WORKSHOP ON AGRICULTURAL UNIVERSITIES AND RURAL DEVELOPMENT

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Submitted to:
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INTRODUCTION

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On July 22 and 23, 1985 a workshop, sponsored by AID and coordinated by the Academy for Educational Development, was held in Rosslyn, Virginia, on "The Role of Agricultural Universities in Rural Development." The workshop was designed to discuss issues and themes which will be examined in a forthcoming AID study of Third World agricultural universities/faculties who were former recipients of long-term AID assistance.

During a 20-year period from the mid-1950s to the mid-1970s, AID provided assistance in the development of a large number of Third World agricultural faculties and universities. Most of these institutional development projects were implemented with U.S. land grant universities serving as the primary contractors in providing long-term resident advisors and U.S.-based, advanced degree training for host country faculty development. It has been a decade or more since many of these projects were terminated, and AID is now undertaking a study of several of these universities to identify issues relevant to their evolution and impact on the rural sector and to acquire an understanding of potentials and constraints on the future growth of these institutions.

The objective of the workshop was to help to define guidelines for the forthcoming field studies. Four papers were commissioned for the workshop. They included:

- "Lessons from the U.S. Land Grant Experience for Creating Agricultural Colleges" by Cornelia Flora, Kansas State University;
- "Evaluating Agricultural Research Institutions" by Lawrence Busch, University of Kentucky;
- "The Role of the University in Improving National Food Policies" by Charles Mann, Harvard University; and
- "Evaluating Institution Building Projects" by Mel Blase, University of Missouri.

The workshop discussions addressed a number of issues including an examination of the appropriate roles of agricultural universities in rural development, how these roles will vary in accordance with different national settings, factors which account for university effectiveness in training, research, and national policy making, and donor strategies for improving institutional performance. Participants at the workshop included representatives from AID, ISNAR, and several U.S. land grant universities.

WORKSHOP SCHEDULE

MONDAY - July 22

8:30 - 9:00	Introduction:	Gary Hansen	Study Coordinator
		W. Haven North	Associate Assistant Administrator
		Center for Development Information and Evaluation (CDIE) Agency for International Development	
9:00	"Lessons from the U.S. Land Grant Experience for Creating Agricultural Colleges." Cornelia Flora		
10:15	Coffee Break		
12:00	LUNCH		
1:30	"Evaluating Agricultural Research Institutions in Developing Countries." Lawrence Busch		
3:00	Coffee Break		
4:30	Closing		

TUESDAY - July 23

9:00	"The Role of the University in Improving National Food Policies." Charles Mann
10:30	Coffee Break
12:00	LUNCH
1:00	"Evaluating Institution Building Projects." Melvin Blase
3:00	Coffee Break
4:30	Closing

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LESSONS FROM THE U.S. LAND GRANT EXPERIENCE FOR CREATING AGRICULTURAL COLLEGES

Dr. Cornelia Flora
Kansas State University

Aug85

Lessons from the U.S. Land Grant Experience for Creating Agricultural Colleges

Prepared for the workshop, "Role of Agricultural Universities in Rural Development", Center for Development Information and Evaluation, Agency for International Development, July 22, 1985.

by Cornelia Butler Flora
Kansas State University

Institutional transfer from one situation to another is always difficult. Excellent intensions generally inspire the decision to recreate an institution in a developing country, when that instutition has proven efficient and effective in reaching a multiplicity of goals considered socially desirable in its original settings. Yet by not understanding the institutional constraints of the new setting, creation of the "model" institution will have the same fate as a sorghum bred for irrigated conditions planted in a drought-prone rainfed area. The institution may be "planted" in the alien environment but not germinate at all. Or, if it does, the result may be unrecognizable to those who had hoped it would be the solution to hunger in that part of the world.

Swanberg (1984) conceptualizes the institutional constraints to developing an effective agricultural research and development system, based on the analogy of environmental constraints which impede species adaptation. The lack of success in transferring such systems, he argues, is due in part to a lack of understanding of the system's necessary conditions.

Part of the continued lack of explicitness about which contexts further or retard the development of agricultural colleges -- and the resulting inappropriate expectations and ineffective institutional designs -- comes from our lack of experience in recognizing the contextual settings in which institutions develop. Once key contextual variables are recognized, that understanding could be used to adapt the structures developed and the expectations for those structures. This paper is an attempt to inform the design and evaluation of agricultural colleges in developing countries by sociologically examining key elements in the development of agricultural colleges and the associated research and development institutions in the United States. Only if we understand the long, complex process through which the Land Grant System of agricultural colleges emerged in this country can we understand the strengths, weaknesses and possibilities of using them as a model in different contexts at different historical moments.

Key elements that existed in the United States during the establishment of agricultural colleges related to the value structure surrounding the proper role of the state (particularly the federal government), the belief in social mobility, and the important role of the private sector, both as partner and antogonist of the public sector.

The Morrill Act and Demand for Agricultural Colleges

Agricultural colleges in the United States resulted from a domestic political process that involved different class factions as well as different regional interests. Farmers were part of that process, both as individual politicians and through their local and national organizations. Commercial and industrial interests were also important in the initial legislation that provided the funding for agricultural colleges through the provision of federal government land (land grants, which could then be sold to finance the establishment and operation of the agricultural colleges). The negotiations between the different interest groups resulted in a purposefully vaguely worded mandate, accompanied by what at the time was a mechanism for adequate, long term funding. That mandate, which stated that colleges should provide for "the liberal and practical education of the industrial classes in the several pursuits and professions of life" stemmed from valuing mechanisms of social mobility for those that worked with their hands. It did not stem from a desire to increase agricultural productivity.

By the mid-nineteenth century in the United States, the farmers' role in the national economy was becoming increasingly subordinated to the needs of the urban industrial system. Indeed, many scholars attribute the great internal conflict in the United States that culminated in the Civil War as the contradictory political needs of a landed southern export agriculture and a nothern industrial complex. Labor and land relations figured prominently in that struggle, typifying the major, if often understated, issues that drove agricultural and educational policy. Expansion westward was fueled by a coming together of the needs of established industries for new supplies and markets and of the drive of unestablished men and women for land and an independent way of making a living. The growth of agricultural colleges and the land grant system is a reflection of these two sets of needs.

The impetus for agricultural colleges in the United States was local and national, not extra-national, and although there was by some the desire to emulate the German experiment stations and agricultural chemistry (in part to avoid being cheated by fertilizer manufacturers and merchants), there were no foreign donors to impose assumptions or models. A lot of mistakes were made, but rectification of them was negotiated using national and local terms. Furtner, the vagueness of the legislation allowed for the various states to establish and evolve very different agricultural educational and research institutions. Such institutions developed out of differing local political structures, different types of agriculture, diverse land tenure systems and varying degrees of labor availability in different parts of the U.S. following the Civil War.

As we look at developing countries, where regional and tribal differences are often very strong, it helps if we

recognize that the national development of land grant colleges in the United States were delayed at least twenty years by the political divisions -- and their implications for the structure and function of agriculture -- that existed between north and south and the working out of those divisions in the newer midwestern states. The export-oriented, slave based agriculture of the south fought a number of measures that would have increased the yeoman emphasis of U.S. farming. Only with the secession of the south and the beginning of the Civil War was it possible to pass the two key acts that made the democratization of U.S. agriculture possible. It is not simply coincidence that the Homestead Act and the Morrill Act, which established the Land Grant agricultural colleges in each state, were both passed in 1862. The Department of Agriculture was established in 1862 as well. That year marked formal collective recognition on the part of the northern states that agricultural was an important basis for the country's commercial and industrial development. It also made clear that agriculture was to serve both rural and urban interests.

The push for education in agricultural areas was not new. There had been a constant push for rural schools, particularly in the northeast. These schools provided the first students for the Land Grant Colleges, and provided the rural youth whose desires for a life different from that of their fathers and mothers led them to seek further education. The value structure that stressed provision of equal access to social mobility was coupled with deep distrust of government, particularly national government. Thus, during the period of westward expansion, there was a constant push to have the federal government divest itself of land it acquired through battle, treaty or purchase. The Northwest Ordinances, one of the major accomplishments of the Congress under the Articles of Confederation, established the prototype for development of all subsequently acquired territory. Land was surveyed and sold, with land (as land grants to the local administrative unit) set aside for public schooling in each township. This mechanisms of federal land diverstiture and provision of basic education as an institution for strengthening rural communities established federal land grants as mechanisms for funding basic rural education. Even though the federal government might provide the seed money for rural schools, the control was local. The correct role for the federal government was expected to be minimal, always deferring to local and state governments. The best government was felt to be the most immediate government, and the state was to turn over all possible resources, including the huge amounts of land it acquired during the first 100 years of nationhood, to the private sector.

This is quite different from developing countries, where education is highly centralized, and it is considered appropriate, even desirable for the state to be both a landlord and a major industrialist. Further, the dispersed locally based and funded school systems have not emerged in many places, in part due to the lack of local surplus to invest locally in education, in part because education is assumed to be the

province of the federal government.

Regional differences in local circumstances and private sector development were further accomodated in the development of the experiment stations, supported by the Hatch Act of 1887. In the northern and midwestern states, the New York state model stressed scientific agriculture, based on the notion of discovering the natural laws which controlled agricultural processes in order for agricultural scientists to be able to explain them to farmers to improve their practice. In the south, such a science-base model was rejected. Instead, they choose a systems approach, based on adapting existing species and determining scientifically the better and more profitable of several cultivars, cultural practices, and species.

Agriculture and the Larger Economy

Unlike many parts of Africa, agriculture in the United States was almost always primarily market oriented. Thus even when early agricultural scientists attempted to determine what farmers wanted and why they wanted it in order to guide their teaching, research and extension, they felt they could provide the answer without even directly asking the farmers. The American farmer was assumed to want increased profit, as farming was the primary business on which the family depended. Thus the link between costs, production and profit could be relatively easily calculated within the relatively determined system of the U.S. farmer.

Because of their market orientation, U.S. farmers early defined their problems less in terms of production and more in term of price and costs. Thus there has been a continuing tension between U.S. agricultural colleges and U.S. farmers concerning the relative amount of resources to be spent on science/production goals vs. business/profit goals. This tension was evident from the initial establishment of these colleges. The colleges and experiment stations initially were not able to legitimize themselves through developing new technology. The major innovations that changed agriculture in the 19th century occurred before the establishment of experiment stations and were located in the private sector, including both the mechanization of the production process and the introduction of chemical fertilizers. Most of the activity that influenced farmers involved the U.S. patent office, rather than the USDA. The commercial nature of farming and the strong interest of the private sector in influencing farm innovation greatly aided the early development of U.S. agriculture and greatly simplified the work of public institutions, which entered agriculture to adjust production systems rather than to introduce totally new ones.

Early research demanded by farmers was to use the collective mechanism of the state to defend them against the unbridled profit seeking of the providers of agricultural

inputs. Although the early demands for chemical analysis of fertilizer were based in part on the German model of experiment stations and agricultural chemistry, they should be viewed as similar to the demands made by farm organizations and the agricultural press to control the railroads and others who were able to influence the price of agricultural products. Both control of railroads and warehouses and chemical analysis and control of fertilizer began at the state level, championed by local and state-wide farmers' organizations, and only later became national in scope and jurisdiction. Farm groups demanded control of the railroads during the difficult years of the 1870s in order to increase their profit. They were also concerned that the quality of the products that they used on their crops to increase their production was as advertised.

Just as peasants in developing countries today feel cheated and exploited by intermediaries and attempt to organize to replace or go around them, so the the many farm organizations in the United States lobbied fiercely for an independent chemical laboratory that could evaluate the quality of fertilizer and relate it to the needs of the soil on which it was to be applied, without the self-interest that they felt prevaded the results of the private sector. In a similar vein, livestock producers, particularly dairy farmers, were concerned about the quality of the feed they bought and the fairness of evaluating the quality of the milk they sold. One of the first research results that came agricultural colleges was the development by Stephen M. Babcock of a test for measuring butterfat content in milk, which "rewarded the more efficient dairymen and punished the laggards in the marketplace" (Rothstein, 1978: 124). This process, which was viewed as protecting the good farmers in marketing of their products, was not perfected until 1890, nearly 30 years after the colleges' establishment.

Farmers were motivated to support agricultural science for business reasons, to provide a buffer against a rapicious private sector. They did not seek science for its own sake, or even science as a contributor to increased production. While farmers flocked to the farmers institutes (the first held in Manhattan, Kansas in 1868), which offered them short courses on how to improve their businesses and later, their homes, they were not particularly sanguine about the appropriateness of the knowledge foisted on them by the agricultural colleges as a whole. Indeed, they greatly resented the attempts on the part of agricultural colleges to focus on the laboratory rather than the field, and the attempts by college faculty to substitute time in manual labor in the fields (a requirement in many states) in favor of more esoteric pursuits in library or lab.

Agricultural colleges evolved as a separate entity in the United States at a time when agricultural provided both the dream of independence and a reality of low profit drugery. At the same time land was being offered through the Homestead Act, there was concern about the exodus of farmers from the land, a concern that culminated in the formation of the Country Life

Commission in 1908. Agriculture itself was seeking legitimacy, as farm organizations, the agricultural press, and agricultural scientists helped lobby to make the head of the U.S.D.A. (United States Department of Agriculture) a cabinet level position, which finally happened in 1889. The recognition of the importance of agriculture and effective political action by agriculturalists occurred in the United States only after agriculture was a minority occupation, a fact first monitored in 1880, when for the first time in United States history less than 50% of the persons gainfully employed were engaged in agriculture.

Agricultural colleges developed in the United States at the same time that the USDA was developing a strong basic research arm that provided species, basic principles and techniques that could be adapted to local conditions. Both the USDA and the agricultural scientists at the colleges sought legitimation for agriculture as a scientific enterprise (Marcus, 1985). The tacit division of labor that decentralization of agricultural education and research implied gave the experiment stations the ability to be responsive to local needs. This assured the dominace of applied rather than basic agricultural research at the state level for the next century (Knoblauch, 1962; Busch and Lacy, 1983: 10). The scientists, unlike in developing countries today, did not have dual sets of significant others, with the push to do exoteric basic research for publication rather than applied research that met the local demand. While science was therefore relegated to departments of botany and biology, application was systematic in colleges of agriculture.

As a result, the basic technology that allowed for the transformation of farming from a craft to a science (and thus legitimizing the need for agricultural education) were not associated with the land grant institutions of education and research. Science applied to agriculture and animal husbandry served to regularize production and avert major disaster, not cause two blades to grow where one did before. However, the concern with the day to day practical problems of farmers, even if it involved endless chemical tests of soils and fertilizers, served to legitimate the agricultural colleges to their obvious constituency at a time of farmer unrest and protest that accompanied the highly variable market conditions at the end of the nineteenth century.

Most of the major innovations that transformed U.S. agriculture came not from teaching traditional farmers new technologies, but replacing traditional farmers with more innovative ones. In the best of cases, this occurred generationally. In many others, however, it meant that new types of farmers migrated to new areas, bought or otherwise acquired the land, water, and other means of production, and made the spectacular innovations. Rice on the Grand Prairie of Arkansas is an illustrative crop where a radically new farming system was introduced because German-midwestern farmers brought their basic orientations to new areas. Once there, over the

years they demanded new technology in order to increase their profit.

The U.S. system has few incidences where the traditional farmers used the agricultural colleges to increase their productivity and make use of improved technology. In the case of U.S. agriculture, the blacks who were displaced, along with the poor whites, were absorbed into the larger economy through migration at times of economic expansion, particularly of the industrial sector. That alternative for traditional farmers is not often present in developing country settings.

The original market orientation and general land-extensive farming that evolved in most of the United States, coupled with relative shortages of labor, particularly in the midwest and the northeast, meant that farming was a family enterprise. Economic necessity, coupled with strong patriarchal ideologies brought from Europe, meant that men were assumed to be the farmers, with major labor inputs and decision-making power. Even though many women attended the agricultural short courses provided by the first farmer institutes, it was assumed by those who developed the agricultural college system that women's place was in the home, and both the agricultural colleges and the farmers' institutes introduced separate, less well-financed courses for women, which replicated the attempts of the agricultural scientists to make rural life a science rather than an art. Domestic science, or home economics, became an appendage of colleges of agriculture, providing a profession for women trained in chemistry and other sciences, but with considerably less prestige and less funding than the male-oriented colleges of agriculture (Knowles, 1985).

Social Function and Guiding Ideology

Concern about inequities between rural and urban life and a basic belief that each American (meaning white male) youth deserved a chance to reach his potential were twin concerns which influenced the development of the U.S. agricultural colleges, both at the state level and with the national legitimization and funding of them through the Morrill Act. The early agricultural colleges were developed less to serve agriculture than agriculturalists. The first such institutions outside the northeast were little more than glorified high schools until the end of the century (Geiger, 1978). In part this was because there was as yet little scientific agriculture to put into an agricultural curriculum. But more importantly, such colleges were designed to help counteract the intellectual disadvantages of rural areas (although the containing society, still influenced by the Jeffersonian democratic ideal, acknowledged their moral advantages). Rural educational opportunies up to that point had been limited to the one room country schools, which in themselves represented a value of universal education. The land grant colleges gave rural youth outside New England a chance for the advancement education represented. Youth that went to agricultural colleges as often

went to them to escape agriculture as to better it. Thus, on the part of some, at least, there was a demand for a traditional college course that would lead to general professional development, as well as a pressure to professionalize the agricultural enterprise.

Despite an ever-decreasing number of farms in the United States since the 1890s (with a slight upturn during the depression of the 1930s), the graduates of agricultural colleges found employment. Some returned to the farm, much more predisposed to try scientific agriculture than their fathers. Other joined the large bureaucracies that evolved in the peculiar local, state, and federal partnerships organized to meet farmers' needs, particularly the extension service. Other graduates found ready employment in the agribusinesses that supported and profited from U.S. farming, including private companies providing inputs, such as seed, fertilizer, and machinery, as well as marketing and processing companies. These agricultural graduates in combination with the private sector's potential for profits in the rural areas were often as effective as extension agents in spreading agricultural innovations to rural America. However, their success as change agents depended upon the acquisitive power of the farm population, which assumed that the farm enterprise would generate a surplus to be reinvested. Finally, farm organizations, particularly those organized to compete with the marketing monopoly of the private sector, provided another range of employment opportunies for the graduates of agricultural colleges, again providing a role for the scientific agriculturalist.

The problems of North American agriculture have tended to be problems of over production, rather than production deficits. Farmers organizations as result tended to demand price, rather than technology, and be more political than educational during their initial period. As such, they were often in opposition to industrialists, who sought cheap food as well as markets for their products from the rural areas of the United States.

The subordination of agriculture to the industrial system is also illustated by the Country Life movement (strongest in the period 1909-1919) , which was led by what Danbom (1979) calls urban agrarians and social scientists. There was only one farmers' representative on President Theodore Roosevelt's Country Life Commission, and few rural people were involved in the subsequent Country Life movement. Although the two component groups differed in their assessment of the positive aspects of rural life, they were in agreement that agriculture was technically backward and that this backwardness had a deleterious effect on urban America, resulting in high food prices for the growing industrial and urban middle classes. The Country Life movement proposed the strengthening and transformation of agrarian institutions as a means of promoting scientific agriculture. Secondary school consolidation where vocational agriculture and other "enriched" studies could be taught, and adult education (which became the extension service) were both promoted. These

schools could then feed the best students into the agricultural colleges.

The concern for cheap food for a growing urban population is one which is currently felt in most developing countries as well. A major difference between the United States in the 1910s is that the productive potential was there, as more land was being brought into production. Further, the concern for production came during the "golden age" of agriculture, where there was felt to be a reasonable balance between the cost of production and the price received by farmers.

Clientele Served

When the agricultural colleges were established and when the experiement stations were founded, there were clear delineations between farmer goals and the goals of the teachers and scientists who staffed the institutions. Yet it is important to realize that farmers in the United States were not a homogeneous group, but varied greatly among themselves in terms of economic circumstances, goals, and politics. As the land grant system sought to more nearly meet the needs of farmers by establishing an extension service, it is important to realize which farmers became its major clientele and the reasons for the dominance of that kind of farmer in the land grant teaching-research-extension calculus.

The American Federation of Labor, the railroads, and various business organizations, such as the National Soil Fertility League, as well as the Country Life movement were in many areas more supportive of the extension service than farmers, who felt that science had little to offer agriculture (Danbom, 1979: 71-72). Although many established farmers resented young professionally trained and citified agents who came to teach them how to farm, many others eagerly flocked to see exhibits on agricultural trains and to attend institute lectures and farmer short courses. Farm families generally wanted to eliminate drudgery and lack of amenities in their life (Scott, 1970). However, farm families differed in the degree to which they could follow the recommended practices, due either to limited capital, limited access to land, or limited labor because of their need to work for cash in order to supplement their farming earnings.

The establishment of the cooperative extension service involved an ingeneous method of national, state and local funding and control. Local farm agents were paid through a combination of federal, state, and local government monies, as well as private funds. The agents organized farm bureaus, which served as both as a means of multiplying the information imparted by the agent, and as a local pressure group to insure local financing for the agent from private donations, membership dues and county government appropriations. It was no wonder that the agents would find it more convenient to organize the larger, more affluent farmers who were also those most likely to be the first to adopt new practices and to serve as demonstrators of them to their neighbors in the county.

These bureaus, which in 1919 were organized into the national Farm Bureau Federation, played and in many states continue to play the role of an organized constituency for the extension, research, and land grant system in general --particularly vis-a-vis state legislatures. Early local farm bureau-extension efforts focused on economic issues, particularly organizing input and marketing cooperatives. However, strenuous objection from competing business people led to a stepping away from economic efforts and focusing on education -- and later, national level farm policy, on which it tended to a take a much more conservative stand than did the other farm organizations. Indeed, in Iowa, the farm bureau was specifically organized to oppose the more radical Non-Partisan League, which was sweeping down from the north, spurred by farmers organizing in the face of "intolerable abuses" and pressing for state ownership of grain elevators, flour mills, packing plants, banks and other facilities (Kline, 1948: 62). These political decisions gave specific parameters to the farmers most closely integrated with the extension service, not by design but by convenience.

The organization of the farm bureaus, and subsequently, county extension councils when the Farm Bureau was formally divorced from the extension service, brought for the first time the active participation of farmers--the more prosperous and politically conservative farmers--in the movement for scientific agriculture. The institutionalization of these organizations as governmentally based educational groups tended to diffuse their redistributive oriented political demands and offer a further legitimation of scientific agriculture and the agricultural colleges which promoted it. That scientific agriculture might be oriented toward the upper strata of the farm population was not a concern, as there was expansion of the general economy and a constant demand for labor in the nation's cities.

Price and Productivity

The politically popular argument that farmers would share in the prosperity brought about by their embracing of scientific agriculture failed to take into account the inelasticity of demand for food crops. Underproduction rather than overproduction was generally in the farmerers' interest. Cyclical rises and falls of farm prices responded to the interaction of national economic trends and production cycles.

Expansion of the urban population through massive in-migration and the demand created by World War I and the immediate postwar period brought about the Golden Age of agriculture for farmers in the mid-teens. Although agricultural production increased slowly during that period, it was far outstripped by demand. Prices of farm products rose steeply. Then in the 1920s, with the contraction of foreign demand, overproduction brought about a prolonged agricultural recession and depression.

Curiously, the low prices of the 1920s stimulated farmers to try new farming methods and set them on the path of scientific

agriculture. Since no collective mechanisms existed to reduce total production and thus increasing price by limiting supply, each farmer sought to maximize his/her own production and make up for a low price by increasing the number of units produced. Farmers purchased tractors in record numbers in order to be able to cultivate more land and to remain competitive. The economic rationale for mechanization was strong in the 1920s. Still, by 1930, there were fewer than one million tractors on the six million farms, compared to four million automobiles on farms in that year. Improved roads, rural free delivery postal service, and community telephone companies all subsidized completely or partly by the federal government, served to break the isolation of rural areas and make them profitable areas for machinery to be utilized in agriculture. Thus, even in times of economic difficulty, continued investment by the public sector in rural infrastructure laid the basis for linkages which could be profitable to the private sector.

As Ruttan points out illustrating his theory of induced innovation, innovations in U.S. agriculture have been largely labor saving, i.e., promoting of labor productivity through mechanization (1982: 29-31), which enabled the farmer-businessman to retain profits, especially in areas of relatively low labor availability such as the Midwest (Pfeffer, 1983). Only since the advent of World War II, begun in the 1930s in part in response to acreage limitations imposed in under the New Deal, has land saving research (biological improvement for increased yield and gain, fertilization, and irrigation) borne fruit. In this period, land and labor saving policies have complemented each other.

Rapid adoption of technology has characterized the period of WWII to the present, at the same time the number of farms has dramatically decreased. Although most of the technology adopted between 1945 and 1960 had been developed before 1945, the higher postwar prices favored the acceptance of technology to enhance productivity. Growth in agricultural production based on scientific farming has been unprecedented. In U.S. agriculture, research responded to perceived contraints, and adoption responded to the potential profitability of doing so.

The farm programs of the 1930s and the post-WWII period emphasized acreage limitation as a means of avoiding agricultural surpluses. Farmers responded to that challenge in the postwar period by adopting land saving techniques, such as genetic improvement, animal confinement, and use of chemical fertilizers, which had previously been the subject of basic research. In the areas of hybrids and chemical fertilizers, in particular, private companies joined the adaptive research and extension process, as they profited considerably from these inputs which had to be purchased each year. The graduates of agricultural colleges were able to professionalize to perform these innovative, scientifc roles, reinforcing a scientific, rather than a business orientation of those colleges.

The land grant system has been very successful in ensuring

cheap food (see Ruttan, 1982: Chapter 10, for data on returns to agricultural research in the United States). In the "export" era, it has been called upon to assist in expansion of production to assist the nation in decreasing a negative balance of trade. In addition to improvements in genetic productivity of plants and animals (and the potential for genetic engineering to speed this process), the land grant university is also involved in understanding and documenting patterns of international trade, and in some instances, in cooperating with the private sector, particularly commodity organizations, in the promotion of foreign sales of agricultural products. As was true in the progressive era, during the great depression, and in the period of postwar prosperity and massive migration from farm to city (see Geiger, 1978: 32), the client is predominately the large family farm, except in the industrial agricultural states of California, Arizona, and Florida, where larger than family farms are the principal clients. Only the predominately black land grant colleges have developed systematic programs aimed at limited resource U.S. farmers.

The Limits of the Model

The USDA-land grant system is the embodiment of public policy toward agriculture in the United States. It has influenced not only farmers, input suppliers, marketers, and processers, but also has provided the principal model available to Americans working overseas in the area of agricultural and rural development. Following is a summary of those elements of this model that are relevant (either because they are or are not appropriate) to overseas development processes. (See Flora, 1983, for an expansion of these issues and their implications).

1) The provision of cheap food to urban residents has become an important goal of the land grant system. Improvement of farmers' welfare, although espoused as a result of such innovations, is a secondary objective. In the short term, improving farmers welfare and the cheap-food objective were antagonistic. The welfare of farmers as a whole did improve substantially in the long run as a result of the implementation of scientific agriculture. In part, such improvement stemmed from reduced competition, because of the attendant weeding out of those farmers who were late adopters, nonadopters, or implemented new techniques inappropriately, especially by overcapitalizing.

In developing countries, cheap food policies have even greater political importance than in the United States. Most countries subsidize staple foods to the consumer. Attempts to raise food prices often precipitate riots. Almost invariably, low food prices mean lack of incentives for the producer, and, therefore, a continuance of traditional production methods and a tendency toward subsistence production. Agricultural development programs that fail to address these policy questions have limited effectiveness.

2) An expanding urban industrial complex and a rapidly

expanding need for industrial labor, and, more recently for urban service sector labor, allowed for labor saving techniques to be applied in agriculture without creation of massive unemployment in the United States. The ability of the larger economy to absorb the noncompetitive farmers in other sectors meant that research and extension efforts have been able to focus on the more successful, larger family farms. While this has contributed to massive rural-to-urban migration and attendant adjustment problems, as well as to the persistence of poverty among limited-resource farmers who refused to migrate, these problems are in no way comparable in magnitude to those experienced by rural people in developing countries.

Developing countries today, with even more rapidly growing populations, access to more labor-saving industrial technology, and peasantries that are more subsistence oriented than American frontier farmers ever were, require more land saving approaches to agricultural development than were developed in the United States. The selection process whereby those less prone to adopt scientific agriculture have to leave farming is not an acceptable solution in developing countries. New approaches to agricultural development appropriate to a variety of farmer circumstances, as well as extension efforts designed for limited resource farmers are needed to reach a broader spectrum of farmers than did U.S. extension programs, which were aimed at progressive farmers with adequate resources.

To the degree that the concern is with increasing food production, as it was in the U.S., it does no good to target the larger farmers with access to resources, for generally they are not the farmers who produce food for the domestic market. Further, in many developing countries, they have access to private research and extension services, either through international seed and chemical companies or through their own vertically integrated research units, such as that of the sugar growers in Colombia or United Brands in Costa Rica. These producers making most use of the private sector research and extension efforts tend to be export oriented, addressing national priorities of generating foreign exchange, but not of producing food.

Because of price and other incentive structures aimed at increasing foreign exchange, food production in developing countries is generally carried out by limited-resource farmers, whereas large modern farmers are engaged in export agriculture. The resultant need to reach a clientele that is less educated, more oriented toward traditional farming methods, and with fewer resources than U.S. farmers had in the nineteenth century suggests that the time lines established for research and extension programs in developing countries are much too short. Although it took over a half century for our land grant system to become firmly established, we expect major results in a five year project span in Third World countries.

3) In spite of the inequalities created within the agrarian sector of this country, our history was one of abundant land,

comparatively egalitarian land distribution policies, and for all regions of the country except the South and the Southwest, absence of large numbers of persons of a subordinated racial or ethnic group who could form a socially distinct permanent labor force in agriculture. Hence, except for the cotton South, a dualized agriculture in which large plantations produced industrial crops and a subordinate group of small farmers produced subsistence and food crops did not develop in this country.

Norms that stress the relative equality within the agrarian sector has meant that farmers value a combination of mental and manual work. A reason that the farming lifestyle has been valued in the United States is that the farm family controls the means of production. Farmers generally own their own land, or at least have title to it, even if still paying off family debts. In the U.S., we see nothing intrinsically wrong with people getting their hands dirty and sweating in the fields, because it is understood that the same people who do the dirty manual work also make decisions about planting, harvesting, purchasing, and marketing. They also keep any profits generated. Due to shortages of labor in the Northeast and Midwest of the United States, men and women had to work hard for their food. This practical reality was reinforced by the philosophic trends of this 18th century clearly expounded in the writings of Thomas Jefferson.

In contrast, land in many developing countries is much less equally divided. A few landowners have a lot of land, which often is farmed by sharecroppers. Even in places in Africa where land is more evenly divided, the people who make the final decisions about production often live in urban areas, and do not do the manual farm work (Clarke, 1980; Bernstein, 1977). The idea that getting your hands dirty and sweating is inappropriate for gentlemen and ladies was introduced by colonial masters, who were able to hire or coerce the local population to do the manual work, defining it as inappropriate for those in command. Education in such a hierarchical setting is a tool for getting away from manual work, not for doing it better.

4) As a result of our comparatively egalitarian agrarian social structure, we implicitly assume the unity of goals between researchers and farmers. In the United States, land grant researchers knew what the objectives and problems of the farming household were. One reason was that researchers and extension agents--the employees of the land grant system--came from farming backgrounds (Busch and Lacy, 1983). At least in the early days, the researchers and extension agents themselves continued to farm; Seaman Knapp is an example. The farmer's goals never needed to be discussed, because they were implicit in the frame of reference and upbringing of the researchers, the extension agents, and the users of research--all of whom shared the same social background and the same experience in practical agriculture.

This contrasts sharply with developing countries. Limited-resource farmers often are not able to send their sons and daughters to grade school--much less to college or graduate

school -- to learn agricultural technology. those who get into the formal agricultural research and extension system tend to be people of urban backgrounds, often from upper class origins. Further, agriculture is studied by default, because they cannot get into more pretigious curriculums, rather than by choice. Such student have never engaged in the hard physical labor of agricultural production.

Through training in leading U.S. universities, the goals of researchers from developing countries tend to be defined by their scientific interests, not farmers' needs. Their reference group will more likely be fellow scientists, rather than limited resource farmers. This tendency is furthered by the precarious state of many research institutions in developing countries, making them risky employers. Thus even researchers highly motivated to help local limited resource farmers will feel obligated to publish in pretigious journals and otherwise maintain their professional identity in order to be able to secure employment elsewhere. As a result, the kind of research undertaken will not necessarily correspond to the food production needs of the country, nor relate to the more marginal farmers who produce most of them food for their countrymen.

5) Over time, a strong constituency for agricultural research and extension developed in the U.S. Although the masses of farmers were indifferent to the legislation structuring the Department of Agriculture and establishing the land grant teaching, research and extension system, a handful of agricultural scientists, urban agrarians and businessmen, many with agricultural backgrounds and economoic interests in the prosperity of agriculture, perceived the importance of a productive agriculture for the growing industrial system. Often prosperous, white, male farmers were elected to the legislatures and to Congress, enabling them to articulate their funding needs directly to those bodies. The organization of the bipartisan farm block in Congress in 1921 (Rasmussen, 1960: 223-226) continued congressional support for farm-related legislation until the 1970s. The farmer constituency came to be organized as pressure groups, first in the Grange, which, after a period as a highly political and activist organization in the late 1860s and 1870s, then sought educational goals for farmers, and later as the Farm Bureau, which served as the grassroots linkage to the extension system and promoted agricultural research and extension through the land grant system.

Operators of large farms in developing countries, who produce industrial agricultural products largely for export, have considerable political power and are often able to obtain favorable prices, exchange rates, export subsidies, and preferrential imports of their inputs. However, limited resource farmers, who produce most of the food for domestic consumption, are often marginal to the political process. Such farmers generally lack organizational presence at the national level. In those instances where they are organized, theri pincipal concerns are with prices and access to resources such as land, credit and inputs; entension and reserch are of

secondary concern to them. Indeed, it is difficult for such farmers to express their problems in a way that leads directly to a researchable problem. The mandate for reserch and extension programs for these farmers often comes from outside donors concerned about macro problems of food production. Although such outsiders from either international agencies or the national capital city try to understand the food-producing limited resource farmers, their understanding is often incomplete because of the "top-down" nature of the programs.

6) The assumptions that farmers' goal is profit and that productivity is key to that profit in the U.S. has major implications for the relevance of North American agricultural expertise to developing countries. Family farming is characterized by the union of the productive unit with the household. Hence, a family farm can never be completely given over to what Weber (1978, 161-164) calls capital accounting, the reduction of all activities to measurement in dollars and cents, never completely conform to the rules of formal rationality. The family farm can be said to operate under substantive rationality, in which economic activity may be carried out for reasons other than profit maximization The standard for substantive rationality might be the preservation of the farm for the next generation (including conservation practices that are economical only in the long run), a strongly positive valuation on raising one's children in the country, or providing employment for family members. Such a perspective is sometimes referred to as farming as a way of life. Among limited-resource farmers in developing countries, other substantive goals may be added to those already mentioned: risk reduction through limitation of purchased inputs and a balance between production for home consumption and for the market, diversification of on-farm and off-farm economic activities of the family, and expenditure of resources on ritual social events to ensure the family's integration into a larger community of mutual aid.

Although the move toward formal rationality in U.S. agriculture has brought about great increases in food production, it means that land grant university scientists, administrators, and extensionists have less and less to transfer directly from the U.S. experience to developing countries--except the large-scale, export-oriented sector. Assistance to that sector, which already has access to the latest technology and cultural practices, often through overseas presence of multinational agribusiness firms, is to a considerable degree superfluous.

That does not mean that land grant personnel cannot make any contribution to improving food production and rural welfare in developing countries. The growing sophistication and access to resources that characterize the land grant system mean that it now has the institutional capability of working explicitly on new approaches, which utilize knowledge that can appropriately be translated to developing country conditions. Two major barriers exist to the effective translation and application of

land grant expertise to developing countries:

a) The unique funding mechanism instituted through the Hatch and Smith-Lever Acts, which has been so effective in bringing agricultural technical and administrative innovations to American agriculture, poses a problem to the effective translation of those innovations overseas. Land grant extension services and experiment stations are quite dependent on state legislatures for funding. It is difficult to demonstrate that overseas results can directly benefit any individual state. Indeed, if the overseas work is designed to increase production of a commodity that is also produced in that state, as is often the case since scientists have knowledge specific to the commodities produced in the states where they work, there can be legislative oppositon to overseas work. Although funding for overseas projects comes from Federal or private sources, legislators and land grant administrators often view overseas projects as taking human resources away from the "real" mission of the land grant university. Creative administrators in a few instances, as at the University of Florida and at Cornell University, have been able to convince state legislators of the value to the state of overseas work, and have actually obtained modest state appropriations for such activities.

b) If the differences in agricultural structure and farmer rationality between states such as Nebraska and New York, on the one hand, and Botswana and Malawi, on the other, are not clearly understood by the land grant scientists, administrators, and extensionists working overseas, their impact will be nil or even harmful. The more explicit those differences can be made for land grant personnel, the more effective their overseas work can be.

Given the temptation to transfer unaltered the U.S. model of agricultural colleges to developing countries, and the implicit hazards and difficulties of doing so, what should evaluators and planners look for in the environment of an agricultural college that will indicate the goals which it can realistically seek and the potential road blocks in reaching them? Based on the above discussion, the following characterstics can help serve as a basis for evaluation and analysis.

Contextual Factors Which Need to be Determined

1. To what degree is there long term, secure funding?

2. To what degree is there a diversity of sources of funding? Is there local, as well as national and international support for the agricultural college and its mission?

3. To what degree are there organized constituencies in both rural and urban areas? Is there in place a mechanism for these constituencies to have direct input into the agricultural college, particularly in setting the long-term goals of the

college?

4. To what degree is the basic rural education system in place to feed those with agricultural experience into the agricultural college? If the college students have not had practical agricultural experience, is it provided in the course of study?

5. What is the value placed on mobility within the society? To what degree is agriculture contributing to it or is viewed as a blockage to individual and family progress?

6. What are the expectations for government intervention in the agricultural sector?

7. To what degree is agriculture a primary means of making a living for the farmers who are viewed as the clientele of the agricultural college?

8. To what degree do livestock production and agriculture complement or conflict with each other? Even if crop and livestock operations are carried out by the same family, are they carried out by the same individuals within the family? Does the curriculum reflect this complex interaction between stock and crops?

9. What are the mechanisms by which farmers have access to land? What is the variability of land tenure situations, and how does that variability reflect different farming systems and different access to other resources, including the products of the agricultural university?

10. What is the availability of labor for agriculture? At what periods in the agricultural cycle is it a constraint?

11. To what degree is mechanization available, including fuel (feed, if animal traction is considered) and parts? Is mechanization offered as a solution without consideration of farmer-defined constraints?

12. What is the balance between subsistence and commercial farming? How are each intergrated into the mission of the agricultural college?

13. Is agriculture a primary economic activity of a majority of the rural-based families, or is it a residual survival strategy? Is the technology and process taught relevant to the local goals of farming?

14. Is farming a family enterprise, or are women in charge of farming, while men do off-farm labor or livestock production?

15. To what degree do farm groups have power to influence commercial interests, in both the provision of inputs and in marketing?

16. Do what degree does the society value universal education? Is it important for both males and females? Does the agricultural college provide training for women concomitant with their farming activity?

17. To what degree does the agricultural college have access to basic research? Is it as an institution tied into regional research and extension networks?

18. What are the potentials for employment of agricultural college graduates in both the private and public sector?

19. Has agriculture reached the point of generating a surplus to be reinvested? Is there a market for private purveyors of agricultural inputs? When a surplus is generated in agriculture, where is it invested or absorbed?

20. Is there rural infrastructure in place that can support agricultural innovation? To what degree and by what entities is that infrastructure constructed and maintained?

21. To what degree do farmers define their problems in terms of business (low prices, high costs of production) versus science (lack of appropriate technology to overcome the environmental constraints)?

22. If labor saving technology is taught and introduced, are there non-agricultural employment opportunities within the society?

In addition, contradictions that may surround the education offered at agricultural colleges that result from differential goals of different sectors of society, by region and class should be noted.

A. Is there an emphasis on cheap food, which tends to lend a scientific approach to agricultural education, or on maintaining farmers on the land, which lends a systems approach?

B. Are there conflicts between production and employment goals for the agricultural sector?

C. To what degree is agricultural education aimed at adapting, rather than transforming agricultural? Is there recognition of human dimensions of radical agricultural change?

D. Is there a vision of what will happen to traditional farmers, if transferal of a version of a U.S. model results in fewer farmers doing the job of agricultural production better?

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EVALUATING AGRICULTURAL RESEARCH INSTITUTIONS

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Evaluating Agricultural Research Institutions in Developing Countries

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Introduction

Historical Background

Agricultural research, as an organized, state-sponsored activity, had its beginnings with the development of botanical gardens in the seventeenth century (Brockway, 1979). These gardens were established by the colonial powers to select desirable plant materials and to transfer them to those colonies where they might be successfully introduced. For example, as a result of the work of Kew Gardens in Britain, rubber was introduced into southeast Asia, tea to Ceylon (now Sri Lanka), and Cinchona (quinine) to India.

As a result of Liebig's pioneering work on plant nutrition in the 1840s, agricultural research moved from the trial and error approach of the gardens to the experimental phase. Starting in the 1850s, the various German states began to develop experiment stations. France soon followed the German lead while the British preferred to expand the role of the already extant botanical gardens. During the first quarter of the century, the United States, Russia, and Japan each established their own system of experiment stations. By 1900, there were over 800 agricultural experiment stations to be found around the world. By 1930, the number had increased to over 1400 (Busch and Sachs, 1981).

Given the needs of the European powers and Japan, it is not surprising, that the stations located in Europe and Japan tended to focus on food crops while those in the colonies emphasized export crops that would provide exotic foods (e.g., bananas, sugar, coconuts), exotic drinks (e.g., coffee, tea), or raw materials for european industries (e.g., cotton, palm nuts, groundnuts, rubber). Only after the end of World War II, and especially since independence of the former colonies, has food crop research become a significant part of the research agendas of most third world nations. Even

today the colonial legacy continues to distort research priorities in much of the Third World. Indeed, Janzen could observe as late as 1975 that "it is repeatedly stated that tropical staples are ignored in research programs, while export crops are studied extensively" (1975:107).

The so-called Green Revolution of the 1960s signaled the first successes in increasing yields of the newly emergent system of international agricultural research centers. Of particular importance is that its successes were accomplished by (1) drawing upon a substantial worldwide research literature for the crops involved (wheat, rice), (2) the heavy dependence upon both irrigation and chemical fertilizers, and (3) the development of significant national research competence in the countries affected that complemented the work of the international centers. Though expenditures for international research rose markedly through the late 1970s, and many new centers were established, no breakthroughs similar to those of the 1960s have occured. This has been due in part to (1) the lack of a research tradition of comparable size for the crops of concern to the new centers,* (2) the lack of or infeasibility of irrigation for these crops, and (3) the weakness of national research systems, particularly in Africa. Thus, the "easy" problems of research have been solved; those that lie ahead present even greater challenges.

The Land-grant model in the Third World

U.S. assistance to other nations wishing to create or improve their research institutions is not a recent phenomenon. While there was no U.S. presence in former European colonies until their independence, Land-grant

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*Busch and Sachs (1981) note that in 1977 over 3000 articles in scientific journals were published relating to wheat, while only 500 articles related to sorghum and 70 relating to millet were published.

universities were active in the independent nations of Asia and Latin America as early as the turn of the century. Dean Harry L. Russell, of the University of Wisconsin, was able to present an address to a Japanese audience of agricultural scientists in 1925. The address required no translation for those in the audience had all received part of their higher education in the United States. Moreover, Russell noted that the campus itself physically resembled those of American Land-grant universities, even to the elm trees and quadrangles (Russell, 1927)!

After the nations of Asia and Africa received their independence, American aid in establishing agricultural universities became an important, if not central feature of USAID and its forerunner agencies. It is worth noting briefly, and in somewhat stylized form, the stages that this aid took:

1. Early aid consisted in an extension of the Marshall Plan. Given the success of the Marshall Plan in reviving post-war Europe, it appeared reasonable to attempt to provide similar forms of technical assistance to the nations of the Third World. Thus, the emphasis was upon the transfer of already existing American technology. No one seemed to notice that the skilled labor and administrative personnel necessary to carry out this transfer task already existed in Europe but was largely lacking in the Third World. Equally unnoticed was the inappropriateness of direct transfer of agricultural products and practices from the U.S. to the Third World. The limits of this approach were rapidly reached, leading to the second stage.

2. It was argued that without effective extension services exhorting farmers to adopt new practices and innovations and teaching them how to use them, American technology never reached its intended audience. At this time, many studies of the diffusion of agricultural innovations were launched, some of them eventually suggesting that what was being diffused was ineffective under third world conditions. The emphasis on diffusion coincided with the

entry of social scientists into the international agricultural development arena, especially the entry of agricultural economists and rural sociologists. Three major issues dominated the rural social science agenda: (1)improving farm management, (2) better marketing information, and (3) improving the diffusion of agricultural innovations. Of particular note was that these social scientists largely accepted the products developed by technical scientists as undiluted goods. Indeed, they shared the view held by many of their colleagues in technical fields that scientific knowledge was always superior to tradition. Moreover, as a result of the peculiar politics of American agriculture, and especially the hegemony of the farm bloc, studies critical of the research process, or of agricultural structure, were avoided (Friedland, 1979; Kirkendall, 1966; Hardin, 1955).

3. Reasoning that climatic and soil differences might hinder the direct use of American technology, emphasis began to be placed upon "adaptive research." This research was designed on the assumption that relatively few changes were needed, and that they could be relatively easily achieved. Diffusion studies began to reveal that innovations were more often adopted by larger, higher-status, better-capitalized farmers (Rogers and Shoemaker, 1971). Some began to reflect on the nature of the innovations themselves. They reasoned that under certain conditions non-adoption might be the rational strategy for a farmer to take.

4. Eventually, it became apparent to both administrators and field staff that simple adaptation of American technology would not do the job. A full-scale effort was launched to develop research institutions and agricultural universities that had the full complement of teaching, research, and extension functions, usually under the auspices of one or more Land-grant schools. The approach was formalized under the rubric, "Institution Building." It was

avowedly top-down in its approach, reasoning that a well-trained cadre of scientists could turn around Third World agriculture:

> The IB model is an elitist theory with an explicit social engineering bias. Changes occur from the top down, not from the bottom up, and they are guided by persons enjoying a measure of official authority or sanction (Esman, 1972:66).

In short, peasants would be made to abandon outmoded traditions by a massive organizational campaign (Cochrane, 1972), conducted by "modernized" elites. This position assumed, of course that elites were genuinely interested in develpment and not in merely perpetuating their own elite status. It also assumed that the natural and social sciences would be able to provide all the right answers within a relatively short time if they had the proper institutions within which to work.

5. While the Green Revolution at first appeared to validate the idea of Institution Building, a chorus of critics emerged who began to point out that in some areas increased productivity went hand in hand with increased immiseration of at least some farmers and tenants (e.g., Pearse, 1980). While reaction to the critics was defensive at first-- it should be noted that the critics were mostly social scientists, while the defenders were mostly agricultural scientists-- the eventual result was the incorporation of some of these social scientists into the research programs themselves. While the Institution Building approach was not abandoned, the thrust began to move away from commodity research by disciplinary specialists, to the creation of multidisciplinary teams. This was especially true of the newer International Agricultural Research Centers.

6. With the expansion of international research in the 1970s and the incorporation of social scientists into the IARCs, the farming systems

approach emerged. This approach advocated greater attention to constraints on farmers, treatment of the farm household as a system, and direct contact of researchers with farmers including on-farm trials. Farming Systems Research (FSR) has yet to be fully developed as an approach. Two schools can be discerned presently: those who favor quick reconnaissance methods (the Sondeo approach), and those who favor more detailed analysis and dialogue with farmers. However, both schools share the view that appropriate technology is the key to improving smallholder production and income. Of particular concern is that neither school addresses the technology treadmill problem, of which I shall say more later.

Having provided this synoptic view of the USAID experience with agricultural research, it is also worth noting the major role played by T.W. Schultz, and especially his seminal work, Transforming Traditional Agriculture (1964). In particular, Schultz was responsible for the realization that technically-trained personnel were essential to the development process. This idea was embodied in the now well-known concept of human capital. This suggested that Institution Building programs, modeled on the Land-grant universities were essential. A second issue influenced by Schultz was the decision to establish the international center system along commodity rather than regional lines. Third, whether through intent or oversight, Schultz suggested that the transformation of agriculture could be accomplished without reference to political (and especially distributive) issues. This made research programs appear particularly desirable to Third World elites, especially as compared to programs of land reform or income redistribution. It also made research appear to USAID to be an antidote to political unrest and social revolution. Finally, it suited the apolitical and technical orientation of the various American agricultural colleges.

Subsequent events have shown that this supplanting of politics was an unreachable goal in that (1) research has its own politics and (2) research cannot substitute for political reform. Only recently have the limitations of this approach become apparent.

One final point needs to be made by way of introduction; this concerns the way in which the Land-grant model was exported. It should be remembered that from the late 1930s until the early 1970s, the coalition in the U.S. Congress often referred to as the "farm bloc," insured unquestioned continual incremental growth in research appropriations in return for a strong emphasis upon increasing agricultural productivity. As a result, researchers and administrators lived within an institutional environment in which political relationships were taken for granted. Only with the critiques of the early 1970s (e.g., the Pound Report [National Research Council, 1972], Hightower, 1973) did conflict force reconsideration of those relationships. Therefore, the Land-grant model that was exported reflected not the actual workings of the system but an idealized image of it. This idealized image forms the starting point of my conceptual framework.

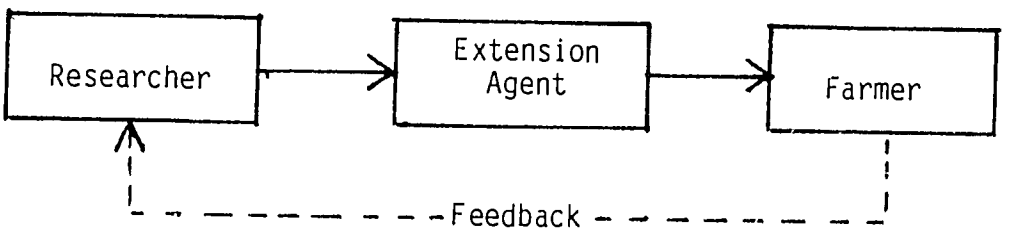
II. Conceptual Framework

A. The Conventional Model

According to the conventional model of agricultural research, borrowed from mechanical models of communications, scientists develop new technologies in their laboratories and fields, and hand them to extension agents who then disseminate them to farmers (Figure 1). In addition, scientists train undergraduates, who become farmers and extension agents, as well as graduate students who become the next generation of scientists. Thus, an apparently complete picture of the system is provided in the three functions of teaching, research, and extension.

This conventional model formed the basis for the diffusion research conducted through the land-grant schools from the 1930s onward. The practical goal of this research was to increase the rate and completeness of adoption of agricultural innovations. While feedback was later added to the model, it

Figure 1. The Conventional Model of the Research and Extension Process



consisted largely in the farmer informing the researcher whether or not he had adopted the innovation developed by the researcher. Thus, though the communication was two-way, it was strongly biased in favor of the researcher. It was assumed that the researcher had the right answer to the right problem and that failure to adopt could be best understood as stubbornness or ignorance on the part of the farmer.

What the conventional model failed to do was to distinguish between scientific or means-ends rationality and everyday rationality. Scientific rationality is the approach generally used in the process of doing science. Consider, for example, the situation depicted in Figure 2. The end of the research is to increase agricultural productivity. Various means, including those listed in the figure, are available for achieving that end. In general, the researcher will choose that (or those) means that are most suitable to his/her disciplinary background. While the choice of means is discussed at length, the end is taken as a given. This is the case even though the end is by no means a final one; it is itself a means to an end.

Figure 2. Scientific Rationality.

End	Means
To increase agricultural productivity	Breed more productive plants Control pests Increase soil nutrients Modify cultural practices Introduce irrigation

A central feature of scientific rationality is that it is instrumental (Idhe, 1979; Busch, 1984). This instrumental character of science is manifested in several ways. First, science involves the use of instruments (e.g., spectrometers, pH meters, microscopes, scales, etc.) to construct knowledge. We need only walk through a modern scientific laboratory to note the profound importance that instruments have for science. Second, science is instrumental in that it is concerned with the choice of means and not of ends. While individual scientists may employ symbolic, analogical, or even literary reasoning in their work (Knorr-Cetina, 1981), the end toward which they strive is not called into question. To return to the example presented in Figure 2, the decision to increase agricultural productivity is the proper subject of philosophy or politics, but not of science.

Now, consider what I shall call everyday rationality. In everyday situations both the ends and the means may be more varied and their interactions more complex. The case depicted in Figure 3 is illustrative. It is immediately apparent that the choice of ends is much broader than in the case of scientific rationality. Moreover, not all of them can be maximized at once. Thus, tradeoffs among them will be essential. The same will be true of the means: The degree to which a given means wil be employed will be directly related to the relative importance attached to attaining the various ends. While an economist might be able to calculate an optimal solution given a

Figure 3. Everyday Rationality.

Ends	Means
To Make a profit	Grow high productivity crops
To Demonstrate success to one's neighbors	Mechanize production
To Minimize heavy toil	Minimize cost of purchased inputs
To Spread one's work evenly over the year	Increase farm size
To minimize soil erosion	Find nearby markets
To maintain a certain degree of independence	Construct terraces
To insure a minimal harvest even in poor years	

particular set of weights for the ends, by virtue of the complexity of the decisions and the press of time on the farmer, no rational calculation of an optimal solution is possible for him. He will be forced to accept the solution that appears most appropriate to him. Finally, science and technology will only aid in attaining some of the desired ends.

In short, scientists not only control for those factors that might directly intervene in an experiment; they also 'control' on the larger political and socioeconomic environment, by limiting their research to the service of one or two relatively well-defined ends. Farmers, especially those in Third World Countries, rarely have this option. As I shall make clear below, this difference between scientific and means-ends rationality has profound effects on communications.

Other assumptions incorporated into traditional diffusion models are discussed at length in Busch (1978). They include:

1. Ontological Monism. Diffusion theory assumes that there is a single, objective social and physical world in which we all live. Ethnographic research in non-Western societies challenges this assumption by arguing that knowledge of aspects of the world is only attained through participating in

it; those who participate in the world differently, in a very real sense live in a different world.

2. Language as an object. Diffusion theory gives little or no concern to the problem of language. Translation of scientific to lay language or from one ordinary language to another is seen as a relatively straightforward task. In contrast continental philosophers and sociologists argue that language is a fundamental aspect of how we put the world together. For example, the categories of scientific botany and those of the ethnobotany of an African society reflect the different concerns of the two groups.

3. Communication as monologue. This aspect of the diffusion perspective is apparent in Figure 1. Feedback in no way directs the research or tells the researcher that a particular innovation is unsuitable or in need of modification. Hence, no dialogue is possible.

4. The sharp contrast of tradition and modernity. From within the diffusion perspective, it is always "us" moderns against "them" traditionals. This perspective, first developed in the self-conscious modernism of Descartes ([1637] 1956), denigrates tradition as inherently erroneous. Tragically, it is often manifested most extremely by members of Third World societies who have received scientific training in the West. Ironically, this position ignores the important, perhaps pivotal, role that tradition plays in science. It is not accidental that scientific journal articles begin with a review of the literature; like all traditions, those of science have withstood the test of time. They have been declared to contain the truth, verified by a (fallible) scientific community. This disregard for tradition has often led scientists to jettison the experience peoples of the Third World have in their particular agroclimatic zones.

In sum, the diffusion approach has been limited by a lack of

understanding of the difference between scientific and everyday rationality as well as a failure to recognize its own underlying assumptions. In retrospect, this is understandable for diffusion models could build on neither the early sociology of science literature nor that of neoclassical economics.

The sociology of science owes its origins largely to the pioneering work of Robert K. Merton (1938, 1973). Merton was among the first sociologists to call attention to the possibility of the scholarly study of science. However, Merton's work was limited in several ways: First, he and his followers have tended to confuse the norms of science (e.g., universalism, communism, disinterestedness, organized skepticism) with its actual practice (Mulkay, 1976). Second, they have confined their studies largely to physics on the essentially untested assumption that physics was in fact the model for all other sciences. Finally, studies were confined to the structure and not the content of science. Only within the last few years have the agricultural sciences been the subject of systematic study (Busch and Lacy, 1983; Hadwiger, 1982; Ruttan, 1982).

A similar situation has existed within economics. Mainstream economics has tended to treat science and technology as essentially residual categories. Indeed, one of the early studies of the contribution of research and development to increased productivity, attributed to R&D the unexplained variance remaining after the effects of land, labor, and capital were accounted for (Solow, 1957). Only with the recent development of the induced innovation thesis-- about which more below-- has R&D been seriously considered by economists.*

One explanation for the scant attention paid to science and technology

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*Schumpeter is an important exception. See Elster (1983) for a review of his position.

has been voiced by Mulkay (1979). He argues that both conventional sociology and economics rest upon a long unchallenged assumption that scientific knowledge is somehow unique in that it is independent of circumstance. Since this is assumed to be the case, the conditions under which scientific knowledge is generated can have no effect upon its contents. Recent studies, however, have shown that this special claim for scientific knowledge is at best too strong and perhaps unjustified (e.g., Latour and Woolgar, 1979; Schafer, 1983). In any case, it is clear that the diffusion approach was hampered by the virtual lack of models in either sociology or economics that would have revealed its limitations.

B. The Induced Innovation Model

The induced innovation hypothesis was initially mentioned in passing by Hicks (1935), but has only recently been developed into an articulated theoretical perspective (Binswanger and Ruttan, 1978; Ruttan, 1982). The argument put forth by its proponents is fairly straightforward: Agricultural scientific and technical innovations are said to be developed in response to relative factor scarcities. Thus, in nations where labor is scarce, innovations will tend to be labor-saving while in nations where land is scarce, innovations will tend to be land-saving. The United States and Japan, respectively, are frequently used as examples of this marked difference in research trajectories. (In contrast, Elster [1983] notes that some have argued that entrepreneurs, including farmers, will accept any cost reducing innovation, not merely those that reduce the cost of the scarcest factor.)

One key assumption of the model is that returns to research will accrue to the firm conducting the R&D. In most countries this occurs as a result of patent laws. Patents grant exclusive license to market a given innovation to a given firm for a given period of time. However, other government policies

may also change the rate and direction of technical change. Binswanger explains:

> If the rate of technical change in an industry is responsive to the price of that industry's output, then policies that alter prices of the output of one sector of the economy will affect the rate of technical change of that sector and of the sectors that produce substitutes (1978:18).

Such policies might include subsidies, high import or export taxes, regulation of use of certain technologies, etc. For example, Sanders and Ruttan note that "government resources used to subsidize tractors [in Brazil] and to subsidize domestic industrial capacity to produce tractors must be directed from other uses such as the creation of yield-increasing biological technology" (1978:277). It also served to shift sugar production from small farms in the Brazilian Northeast to large farms in the South.

Since much agricultural research does not yield patentable products, traditionally, there has been little incentive for the private sector to invest in it. Hence, early American agricultural research focused almost exclusively on machinery (Wik, 1966). Only with the development of USDA research capabilities, and the passage of the Hatch Act in 1887 establishing the state agricultural experiment stations, did biological, chemical, and later, social science research in agriculture become established. This same division of labor between the public and private sectors in agricultural research is apparent in virtually all the market economies of the world.

However, public sector research is outside the market:

> When ... research is publicly funded, the research resource allocation process becomes as imperfect as any public allocation mechanism. The latent demand for technical change must be filtered through political institutions, and the outcome depends

heavily on the political influence of various groups whose income position stands to be affected by the technical change.

Efficiency considerations are not the only criteria by which choices will be made (Binswanger, 1978:15).

Nevertheless, Ruttan (1980) argues that, despite the bureaucratic nature of public research, public sector research institutions are quite efficient. He suggests that this may be due to the highly competitive character of farming. In addition, a review of studies of returns to public sector research in a large number of countries using various estimation procedures, shows consistently high returns to research investments (Ruttan, 1982). Moreover, Trigo and Pineiro (1982) note that when the state fails to provide effective research institutions, the powerful interests in the private sector will attempt to provide those services themselves.

Ruttan (1982) has extended the induced innovations approach to induced institutional innovations. He argues that effective institutions innovate in response to changing environments. Such institutional changes include changes related to the conditions of land ownership, developing organizational structures that effectively produce research, and incorporating social science research that identifies bottlenecks and weak links in the agricultural production system and in research institutions themselves. A particularly interesting example of this latter point was a study of the economics of weed control conducted at ICRISAT. The study revealed that chemical control was much more expensive than hand and animal control. In addition it would displace landless laborers. As a result chemical control of weeds was deemphasized at ICRISAT (Binswanger and Ryan, 1979).

While the induced innovations perspective represents a significant step forward in our understanding of agricultural research and our ability to

improve its effectiveness, it has not been without its critics. For example, Pineiro, Trigo, and Fiorentino have argued that Latin American data suggest that inducement mechanisms described by Binswanger and Ruttan have not resulted in innovation. They note that "different social groups, and particularly those directly related to agricultural production, will have different attitudes towards technology depending on their expectations of the effects of the technology and their capacity to appropriate the potential economic benefits derived from its utilization" (1979:172). They go on to note that the state intervenes in creating both the supply of and demand for agricultural innovations. "A central point is that demand and supply are interdependent through the role played by the state in the determination of model components which affect both sides [of the equation]" (Pineiro, Trigo, Fiorentino, 1979:174). Since supply and demand for research can in no sense be considered independent, the usual assumptions of mainstream economics can no longer be considered valid.

DeJanvry and LeVeen pursue the consequences of this line of reasoning: "Technical change conditions the social control of the means of production, the organization of the labor process, the social division of labor, and the social appropriation of the surplus. As such it is a powerful instrument of social change or stasis" (1983:27). Therefore, research directions and appropriations are determined in large part through social conflict rather than by purely technical means (e.g., optimizing agricultural incomes or crop yields). They note that rising labor costs in California were the result of changing social relations rather than any scarcity of labor. In addition, the California experiment station undertook research on mechanization long before any problem was made manifest (Friedland, Barton, and Thomas, 1981).

A related criticism concerns the international dimensions of agricultural research. Much research in the Third World is as capital-intensive as that

conducted in the United States. In addition it has often centered on products of interest to the developed nations and has employed modes of production more appropriate to developed nations than those of the Third World (Trigo and Pineiro, 1983). In short, not only national groups but international groups as well participate in the research resource allocation process. Certain kinds of indigenous research, even in the private sector, may be suppressed or discouraged by more powerful international interests.

A final point concerns the implicit assumption of a democratic society embedded in the induced innovation perspective. Public support for research is seen as the result of an open policy-making process that, though it may favor some interests over others, nevertheless allows all to be heard. In many Third World nations such an open process simply does not exist. Steinberg et al. (1984) and, especially, Burmeister (1985) suggest this to be particularly true of Korea. Burmeister suggests that directed innovation might be a more apt term to describe that nation.

In sum, the induced innovations approach offers a substantial number of insights over and above those of either diffusion theory or mainstream economics. Nevertheless, it tends to adopt a tacit consensus perspective, perhaps appropriate for developed democracies, but of less value for Third World nations. Recent developments in the sociology of science, however, complement the induced innovations perspective well. Two "schools" may be defined, focusing on (1) the role of clients in the broadest sense in creating a demand for science, and (2) the role of scientists and administrators in creating a supply. It is to these schools that I now turn.

C. Client-driven Science

Traditionally sociologists have conceived of science as a largely autonomous activity conducted by scientists with little concern for the larger

social world. Knorr-Cetina (1981), in her recent work, The Manufacture of Knowledge, has challenged that view. After a year observing a food scientist at work in a university laboratory, she coined the term 'transcientific fields.' By this she means to include not only those who work within a given research group but also non-scientists who have more or less interest in the outcome of the research. She begins by noting that scientific journal articles are written to serve a special purpose: "Scientific papers are not designed to promote an understanding of alternatives, but to foster the impression that what has been done is all that could be done" (1981:42; emphasis in original). This, however, conceals the complex negotiations over just exactly what will be done (Busch, 1980). Moreover, it is misleading to consider non-scientists' influence on research problem choice as an external influence:

> To refer to research problems as an 'external' input ignores the fact that the process of defining a problem penetrates to the core of research production through the negotiations of its implications and operationalizations (Knorr-Cetina, 1981:88).

In short, Knorr-Cetina argues that clients cannot be seen as outsiders but form an integral part of each 'transcientific field.'

Wolf Schafer (1983) and his colleagues take a different path but arrive at a similar conclusion. They argue that science has become a social resource which can be aimed at the solution of various social problems. Bohme et al. (1983) argue that scientific fields may pass through three phases: The first is an exploratory or pre-paradigmatic phase where discovery rather than theory is the rule. The second is the paradigmatic phase in which the problems of research are determined by theory (e.g., Kuhn, 1970). The last is the post-

paradigmatic phase. During this phase, theoretical issues have been 'finalized.' That is to say, the methods and exemplars of the research group are well-defined and subject to little debate. Moreover, there is no compelling theoretical reason for pursuing one research trajectory as opposed to another. At this point the practical concerns of the larger social world begin to take a central role in guiding research.

Not surprisingly one of the first examples they use to illustrate their perspective is that of Agricultural Chemistry. Krohn and Schafer (1983) note that agricultural chemistry was developed as a separate field by Justus Liebig in response to Malthus. Liebig reasoned that the only way out of the Malthusian dilemma was to increase agricultural productivity. This would be done through the development of the scientific specialty that came to be known as agricultural chemistry. Liebig's agricultural "chemistry emerged as a science not only to explain the processes of agriculture, but also to shape them in accordance with human purposes" (Krohn and Schafer, 1983:29). In short, for Liebig agricultural chemistry was at once a science of natural cycles and a technology that could be used to alter those cycles for human purpose.

It takes little extrapolation from this approach to realize that agricultural research itself consists largely of 'finalized sciences.' Moreover, the commitment to application, the mission orientation of agricultural research, insures that clients are central in directing it. Hence, while the basic principles of plant and animal physiology and pathology were worked out many years ago, research is conducted to develop special theories that explain bovine physiology or the physiology of corn. This is the case because it is these organisms (commodities) that are of concern to

client groups.*

A third perspective on the role of clients if offered by Busch and Lacy (1983). Their study attempted to answer the question: How are research problems formulated in agricultural research? To answer this question they (1) reviewed the official literature on the State Agricultural Experiment Stations and USDA from their inception to the present, (2) conducted in-depth interviews with scientists at several locations, (3) administered a mail survey to which 1431 scientists responded (a response rate of 76%), and (4) reviewed the recent technical literature for state-of-the-discipline statements.

When scientists were presented with a list of 21 criteria for problem choice they ranked "feedback from extension" as twentieth. In contrast, "demands raised by clientele" ranked 13th and "client needs as assessed by you" ranked 7th. In addition, 36% of the scientists rated "client or potential user" as an influential person in their choice of research problems. In contrast, their colleagues were seen as influential by only 20% of the respondents. In short, extension had little to do with problem choice. Clients did, but not in that client demands were simply responded to in a passive way. To the contrary, scientists were more likely to take their own assessments of choice. The words of one respondent sum it up:

> Researchers in agricultural economics (as in most disciplines, I suppose) have difficulty in determining what research would be most useful. They prefer to research those areas in which a lot of people would appreciate getting the results. The

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*This has often been carried to extremes. Researchers in agriculture have often felt it necessary to confine their activities to crop plants while those in the basic sciences have studiously avoided them (Levins, 1973).

public and their other clients, however, do not communicate their needs well so the researcher has to decide on his own what is important (quoted in Busch and Lacy, 1983:47).

In short, Knorr-Cetina, Schafer, and Busch and Lacy emphasize that science is conducted in response to clientele demands -- demands expressed not through the market mechanism but through negotiation, persuasion, and coercion. Successful science, it would appear, must respond to those demands rather than go off on interesting theoretical paths for which there is no demand. But if there is a demand side to science, then presumably there must be a supply as well. It is to that supply that I now turn.

D. Science-driven Research

Bruno Latour (1984) proceeds by asking whether science can be separated from politics. He answers this rhetorical question with a resounding 'no.' Louis Pasteur is often viewed as one of the great scientific geniuses of the nineteenth century. He is often described as a lone genius who made his contributions to science and medicine through dedication and hard work. While not denying Pasteur's genius, Latour shows that he was also a great organizer: "Pasteur, from the start of his career, was an expert at fostering interest groups and persuading their members that their interests were inseparable from his own" (Latour, 1983:150). Latour shows at great length how the Pasteurians positioned themselves between the social world and the world of microbes. Only the Pasteurians had access to this microworld, and only they seemed to be able to reproduce that microworld in the laboratory. The hygieneists could produce statistical relations between diseases and certain physical phenomena (e.g., raw sewage, standing water, polluted air), but only the Pasteurians could recreate that relationship in the laboratory. Moreover, every time that Pasteur encountered an 'applied' problem, he turned it into a fundamental one

to be resolved by disciplinary methods.

The Pasteurian laboratory, however, has certain very important characteristics: "The laboratory positions itself precisely so as to reproduce inside its walls an event that seems to be happening only outside... and then to extend outside to all farms what seems to be happening only inside laboratories" (Latour, 1983:154). Thus, Pasteur first brought animals into the lab and created an epidemic; he then literally brought his laboratory into the field and prevented anthrax. He accomplished this latter task by convincing French farmers to vaccinate their sheep and to keep their barns clean -- in other words, to make their barns as much as possible resemble his laboratory.

In short, Latour argues that Pasteur's success was due not only to his genius as a scientist but to his ability to organize various interests so as to transform the world. It takes only a few moments reflection to realize that the same may be said for both the successes and failures of the Green Revolution of the 1960s. Scientists and administrators, first in the foundations and later in the International Agricultural Research Centers, identified the need for high-yielding varieties -- not Third World smallholders. They then set about developing those HYVs on experiment station fields and in their laboratories. Yield response under optimal levels of fertilizer, water, light, temperature, etc. was the goal of much Green Revolution research. The HYVs were diffused by convincing farmers to reorganize their fields so they more closely resembled the experimental fields of the researchers. This meant introducing irrigation, fertilizers, pesticides, and various new cultural practices. Only those farmers who had the wherewithal (e.g., capital, access to credit and inputs, etc.) to replicate the research plots on their farms were able to benefit from the Green Revolution bonanza.

The examples of Pasteur and the Green Revolution clearly show that scientists can and do package and sell their products and processes to the larger public. And, they often do this aggressively. Thus, not only clientele but also scientists themselves contribute to both the scientific agenda-setting process and the determination of the products that emerge from scientific research. What remains is to integrate the sociology of science perspectives with the induced innovation approach. That is the subject of the following section.

E. Synthesis: Supply and Demand in Science

An attempt to synthesize the various perspectives described above is depicted (in simplified form) in Figure 4.* Here, the information flow in the research and extension system is expanded to include in addition to farmers, agribusinesses, administrators, government agencies, scientific disciplines, other funding sources, legislators, and others. These various clients/users all impinge upon the choice of research problems that the researcher addresses (Busch and Lacy, 1983). They may do this through funding mechanisms, by lobbying funding organizations, by direct pressure upon the research organization, or by administrative decree. Moreover, each of the client groups will want different things from the researchers. For example, farmers may desire lower production costs, agribusinesses may desire greater use of fertilizers, administrators may desire annual progress reports or large numbers of articles in scientific journals. In contrast, government agencies may desire new seeds that can be multiplied, scientific disciplines may desire major "breakthroughs," and legislators may desire a reduction in urban food

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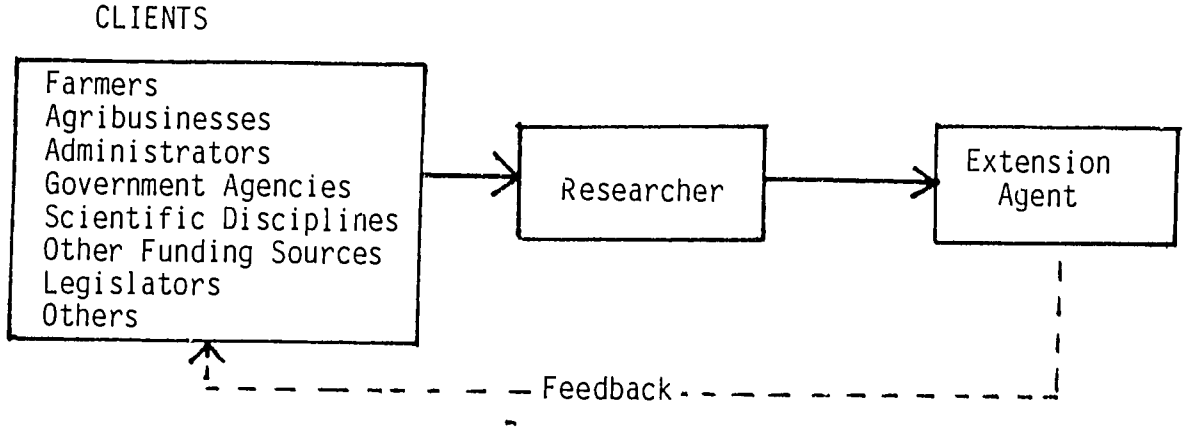
*A much more detailed analysis of the structure of contemporary U.S. agricultural research can be found in Busch (1980).

Figure 4. An Alternative View of the Research and Extension Process



prices. Thus, the variety of groups that create a demand for agricultural research is substantial. However, unlike the demand for a commodity such as beef, which is cumulative and quantitative, the demand for research is, in reality, a set of partially competing and conflicting demands. Thus, the problems finally selected for research arise out of negotiations, persuasion, and coercion involving the full range of clients and the researcher(s) (Busch, 1980).

In addition, the researcher controls the supply of research. The researcher has substantial control in this regard as he or she is one of a very small group -- in small organizations perhaps the only one -- who fully comprehends the ways in which research can be brought to bear upon client demands. Moreover, since research cannot be produced on an assembly line, like automobiles, but instead requires arcane skills and instrumentation, the researcher retains substantial latitude in defining the research even in the most hierarchical research organizations. The practice of doing one thing and calling it something else is so commonplace as to have acquired a clear designation: bootlegging (Greenberg, 1966). Moreover, a competent researcher is likely to have, as a result of training and background, many ideas of his/her own. These ideas will doubtless enter in the

negotiation/persuasion/coercion preceding the research and into the research itself. Finally, if the researcher has been a member of the research organization for very long, he/she will understand the reward system. The research program selected will reflect those rewards, whether they consist of filing annual reports on time, publishing many journal articles, or working in farmers' fields. The outcome of this complex process will, necessarily, set limits on the range of products that are provided to extension agents for diffusion.*

In sum, innovations are induced, in part by the relative scarcity of the factors of production. However, the relative scarcity of the factors of production is only one of many considerations that enter into the public research decision making process. Of necessity many other considerations, some of which are only remotely related to commodity production, impinge upon the research process. This is true even of large private organizations with R&D laboratories. There, too, conflicting pressures from sales and production staff, as well as researchers' own interests, must be taken into account.

If the researcher does his/her homework, then the products created are those that were demanded by (some subset of) clients in the first place. The diffusion process largely involves making those products and how to use them known to the clients that requested them.

Of course, all client groups are not alike. Farmers may be wealthy or poor, may grow different crops and livestock, may or may not hire labor, and may have very different interests. Similarly, as noted above, legislators may be more interested in keeping urban food prices low than in augmenting farmers' incomes. The diffusion literature has often noted the tendency for

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*This is necessarily the case for any research system as a result of limits on financial and other resources.

better capitalized, better educated, higher status farmers to adopt innovations more rapidly than their neighbors (Rogers and Shoemaker, 1971). This is not due to any innate propensity to adopt on the part of these individuals, but because they are more articulate and have greater access to the research system itself. Ruttan explains why:

> Under competitive market conditions the early adopters of the new technology in the agricultural sector tend to gain while the late adopters are forced by the product market "treadmill" to adopt the new technology in order to avoid even greater losses than if they retained the old technology. One effect of the treadmill phenomenon is ... to limit the economic motivation for [farmer] support of agricultural research to a relatively small population of early adopters of new technology. The early adopters also tend to be the most influential and politically articulate farmers (1980:540).

In short, various clients will have differential access to researchers depending upon their wealth, power, status, class, and even their ability to articulate their demands to researchers. And, obviously, in societies in which income, wealth, class, and status differences are already pronounced, the problem of differential access will be proportionately magnified.

The recent move to farming systems research (FSR) represents an attempt to overcome the problem of differential access.* By collecting information about problems directly from smallholders, the probability that research will directly serve their needs is enhanced. However, we should not look to FSR to resolve the technology treadmill problem. That problem is endemic to

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*Key approaches include Hildebrand (1980) and Norman (1978). For a review and critique see Oasa and Swanson (1985).

competitive markets. Simply put, the early adopters capture most of the gains from adoption. If they use those gains to increase the size of their farm operation, as is often the case, then they are in an even better position to be early adopters of the next innovation that is produced. If this process continues for a long period of time, then the distribution of farms by size becomes bimodal irrespective of the scale bias of the innovations. A few large farms grow most of the marketed agricultural produce while a larger number of small farms produce mostly for home consumption. The medium sized farms disappear, their owners migrating to the city in search of more lucrative employment. A recent study examined this problem for the United States for the years 1915-73. It concluded that public agricultural research significantly increased farm size during that period independently of other contributing factors (e.g., debt, taxes, unemployment) (Busch et al., 1984).

In the United States most farmers and farm laborers who have left the farm have been able to find employment in the industrial or service sectors of the economy, though displacement was not without its costs. However, in Third World nations, cities are already overflowing with unemployed and underemployed workers. Clearly, there are good reasons for maintaining a larger percentage of the population on farms until non-farm employment is available. However, with few exceptions, the research system is incapable of accomplishing this task. Only an informed national agricultural policy can mitigate the undesireable effects of a steady stream of innovations into a competitive market. Such policies might include production quotas, elimination of subsidies on machinery, or perhaps taxes on machines.* In any

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*To my knowledge no nation has adequately addressed this problem. Perhaps other policy options need to be invented. However, few social scientists are addressing the issue.

case, agricultural research policy must be integrated into a national agricultural policy if they are not to work at cross-purposes.

In summary, this synthesis adds several dimensions often neglected in evaluating agricultural research systems. First, the importance of client demand and researcher supply is clearly stated. Second, it is noted that the supply of and demand for research are not market functions but must, of necessity, enter into the larger political sphere. Third, it is recognized that some clients have more access to the research system than others. Fourth, diffusion is seen largely as providing certain clients with the innovations that they initially requested. Fifth, the necessary linkage between agricultural research policy and agricultural research is clarified. In short, "while research can provide the required technology improvements, a research program will be more effective if it is not planned in isolation, but as part of the political, social, and economic system that it must serve" (Murphy, 1983:19). Let us now turn to the methodological issues raised in using this conceptual model to evaluate agricultural research.

III. METHODOLOGICAL ISSUES

A. The Need for Comparative Data

One of the difficulties in evaluating a research institution, is that there is often nothing with which to compare it. As such, it is difficult to know if resources are well-allocated, if funding is adequate, if productivity is sufficient, etc. There are several ways of overcoming this problem:

1. Examine evaluations of other research institutions of about the same size, historical background, region, etc. that have already been conducted (White, 1985). In particular during the last decade, large numbers of such studies have been produced, but they are often what librarians call "fugitive literature," hard to find and only occasionally

indexed. (AID may wish to consider sponsoring a project to support collection and indexing of such documents.) Examples of such studies include Lacy, Busch, and Marcotte (1983), Pray et al (1982), Evenson, Waggoner, and Bloom (1981), ISNAR (1983), and Murphy (1983).

2. Examine statistical information collected comparing research systems in developing countries. In particular, Oram and Bindlish (1981) have compiled an enormous range of statistical information on research systems and provide both an analysis and the raw data. Evenson (1974) has produced a similar study of Extension activities; however, data on extension are more spotty. Other studies include Evenson and Kislev (1975), and Arnt, Dalrymple, and Ruttan (1977).

These data can also be useful for historical comparisons of the same research systems. For example, consider the data for Tanzania contained in Table 1. It is apparent that expenditures per scientist declined by half during the decade in question. Moreover, when comparative data from other low-income nations of sub-Saharan Africa are examined, we find that Tanzania had the second highest rate of growth in scientists (11.34% per annum), surpassed only by Togo; at the same time, it had the lowest rate of growth in expenditures (0.66% per annuma). No complex statistical analysis is necessary to conclude that Tanzania has poorly utilized its research resources.

B. The Perils of Quantification

Ever since Descartes and Galileo, scientists have appreciated the importance of mathematical information to the progress of both science and technology. Unfortunately, this mathematical emphasis is often translated into a naive belief that quantified information is more valid, and even more real, than qualitative information. This has had and can have absurd and even tragic consequences. Let us consider some of the perils of quantification:

1. Accuracy. One major reason for quantifying things is to increase accuracy. However, the quantified data analysed are only as good as the procedures used in collecting them. If those procedures are poorly defined or in dispute, then quantification can be misleading. For example, Lele and Candler (1981) note that statistics on maize production collected for Tanzania by the United States Department of Agriculture, the Food and Agriculture Organization of the United Nations, and the Tanzanian Ministry of Agriculture are vastly different. They correlate poorly and do not even show the same trend lines. Especially when statistics refer to Third World countries, they may reflect the inadequacies of the reporting system more than the phenomenon they were intended to measure.

2. Ambiguity. Another reason for quantifying is to remove ambiguity. However, poor collection methods can increase rather than reduce ambiguity. For example, some years ago when Rhodesia unilaterally declared independence, a well-known survey research organization asked respondents whether the U.S. should intervene. Unfortunately they neglected to state on which side the hypothetical intervention was to occur (Lang, 1981). Thus, numbers do not guarantee that ambiguity is eliminated.

3. Relevance. A curious argument often given by researchers fascinated by numbers runs as follows: Certain variables were excluded from consideration due to a lack of (quantified) data. Yet, often those things most relevant to evaluating a project are precisely the things not quantified. For example, changes in cultural practices are often easily identified permitting collection of data on the number of hectares on which improved practices are employed. In contrast, illness caused by chronic exposure to low levels of pesticides is extremely difficult to quantify yet very relevant in certain Third World situations.

Table 1. Expenditures (in thousands of 1975 constant US dollars) and Scientists in Tanzanian Agriculture Research, 1970-1980.

Year	Expenditures	Scientists	Expenditures per Scientist
1970	3,329	90	37.0
1971	4,388	100	43.9
1972	6.564	112	58.6
1973	5,820	130	44.8
1974	6,492	145	44.8
1975	7,074	158	44.8
1976	5,506	184	29.9
1977	4,860	194	25.1
1978	4,847	200	24.2
1979	4,878	256	19.1
1980	4,715	256	18.4

Source: Oram and Bindlish, 1981.

Similarly, surveys can be designed that will obtain answers to irrelevant questions (e.g., Do you, as an American, approve of the current government of the Maldive Islands) while answers to relevant questions may be extremely difficult to obtain (e.g., What is your current income and worth). In short, relevance must take precedence over quantification.

4. Time and cost. Evaluations must be done expeditiously or they cannot be justified. Hence, the collection of quantified information must be weighed against the time and cost involved in the collection. In many cases, responses from a few qualified key informants will be sufficient to answer the question. Random samples are not absolutely essential (White, 1985:37). Moreover, research administrators rarely desire highly detailed reports, but, instead, prefer clear pictures of the current situation and potential payoffs for development (Murphy, 1985).

In sum, while quantified information is useful, its value in evalutions, as in research, should not be overdrawn. A good evaluation employs the best data available within the time and cost limitations imposed upon it, whether that data is quantitative or qualitative.

C. Exogenous factors effecting research effectiveness.

As the conceptual model presented above makes clear, research institutions are ultimately linked to other actors in the agricultural sector. Therefore, there is no way to evaluate them without taking the broader agricultural economy into account. A hypothetical example should make this point clear. Consider an adequately funded research institution that successfully produces agricultural innovations of relevance to smallholders. However, the institution operates in an environment in which producer prices are restricted by government decree. As a result, no one adopts the innovations. Clearly, such an institution would have little impact on agriculture; yet, it would be a mistake to argue that it was an institutional

failure. The problem lies in government policy, not the information. Therefore, it is essential that background information about the agricultural sector be collected as part of the evaluation. It is also helpful that at least one member of the team be familiar with local conditions.

IV. Components of an Evaluation

In this section I discuss some of the kinds of information that an ideal evaluation would include and analyze. No evaluation would be able to document fully each of the many issues described below. However, this should not be necessary as some of the issues raised here will be moot in a given study. In addition, it should be emphasized that the list provided below should not be seen as so many compartments into which all evaluations can be sorted. Effective evaluation of research will require that the evaluators remain flexible and willing to incorporate issues raised by the actors in the research system in the evaluation. Overly rigorous conformity to an evaluation model is likely to produce formal results without an adequate understanding of the underlying dynamics.

A. Background Information

1. Agriculture

a. Changing crop and livestock mix. Even the most traditional agricultural sector changes. Collecting information on the major crops and livestock over the last decade or two will reveal trends in productivity, crop mix, and regional distribution. This will allow matching research projects with the relative importance of various agricultural commodities. For example, Hargrove (1978) found that rice research in several Asian nations gave too much emphasis to irrigated varieties and not enough to upland cultivars.

b. Food and agricultural policy. Has food and agricultural policy

encouraged production? Has it been consistent over the years? How effective are the current polices? Are they enforced or widely ignored? What has been the effect of agricultural policy on farmer prices for key commodities? Understanding these and other country-specific issues is essential for a satisfactory evaluation. In some countries this information will be well-codified and easily accessible, while in others personal interviews with policymakers will be essential.

2. Agricultural Research

a. Budgetary History. As Table 1, above, makes clear, a great deal can be learned from reviewing budgetary histories. This is especially true given the relatively long-term between the inception of a project and its impacts. Evenson (1978) suggests that productivity impacts may average 12 years, while Busch et al. (1984) found that distributive impacts could take as long as 10-12 years to be completed. Of particular import are declining resources per scientist, unstable research budgets, salaries so low as to encourage researchers to take second jobs (e.g., Cardwell, Moomaw, and Ruttan, 1981), inadequate staff or equipment, or lateness in delivering appropriations. These and other fiscal problems may impede the effectiveness of a research organization.

b. Institutional history. While some Third World research systems are of recent origin, many go back to colonial days. Often, research is still biased toward colonial objectives years after independence. Given the need for stability in research institutions, this is not surprising. A case in point is Sudan. The Agricultural Research Corporation of Sudan inherited a strong emphasis on cotton research from the needs of the now-defunct Empire Cotton Growing Corporation. It still reflects that bias (Lacy, Busch, and Marcotte, 1983).

In addition institutional histories offer an opportunity to assess long-term progress as well as policy shifts. Such histories need not be very detailed and can often be gleaned from older records.

c. Initial goals. Related to history are the initial goals of the institution. Have they been regularly examined? Are they formalized? How have they changed over the years? Looking at goals offers an opportunity to determine how self-critical the organization has been.

d. Issues raised at the inception. In some cases research institutions have started as a result of particular issues of local importance. What were these issues? Have they been resolved? Is their lack of resolution problematic for the institution? In the case of institutions established with foreign aid, original project proposal documents may shed some light on these issues. In the case of other institutions, interviews with older staff or public officials may be necessary to clarify these points.

e. Changes in structure. No institution stands unchanged for years at a time. Government reorganizations and administrative styles may alter institutional structure over the years. In some cases a research institution may be shifted from one Ministry to another. In other cases, it may be physically relocated. Functions performed may be combined or separated. Such changes may improve or impede institutional performance. Understanding them gives insight into institutional rivalries and instances of cooperation.

B. Internal Dynamics

1. Formal Structure. Understanding the formal structure of an organization is the first step toward comprehending its internal dynamics. Organizational charts, ubiquitous in most nations, are particularly useful in this regard. Having an administrator use the chart to explain how the institution works can be particularly enlightening.

2. Quality/Quantity of Staff. It goes without saying that no research

institution can function without sufficient numbers of qualified staff. This is the foundation upon which all else is built. Happily, information on quantity and quality of staff is almost always available as it forms a part of the administrative record. Of particular value, if available, are staff records over time illustrating growth or decline of the system. Specific information to be collected includes: (1) percent with PhD or equivalent, (2) schools and nations where PhD received, (3) number of scientists of various ranks, and (5) number of administrators of various ranks.

3. Scientists' Family Background. Even in the United States today, fully 38 percent of Agricultural scientists come from a farm background. As a result many scientists have practical farming experience that helps them in their work. While it cannot be expected that every scientist would come from a farm background, the lack of such persons in Third World countries would suggest a rigid class structure with minimal upward mobility and perhaps a weak link between research and its application.

4. Adequacy of support and infrastructure. Even the most well-qualified staff will be ineffective if the physical facilities, instrumentation, and supporting units (e.g., library, greenhouses, motorpools, experimental fields) are not adequate. Overall adequacy can, of course, be assessed quantitatively by looking at the capital and expense budgets of each scientist. However, a more careful assessment will required asking questions about the quality and relevance of experimental equipment, fields, greenhouses, library, etc. It is not necessary that such equipment be the most up-to-date available but that it be relevant and appropriate to fulfull the mission of the institution. Making such an assessment will usually require someone with substantial technical expertise.

5. Reward Structure. All organizations, whether explicitly or implicitly,

reward their members in a variety of ways. While some rewards are pecuniary, others include promotions, perquisites, access to special facilities, travel, and vacation. In research organizations, of particular significance is the consonance between rewards and organizational goals. For example, in the United States, Busch and Lacy (1983) found that the quantity of journal articles published was perceived by scientists to be most important criterion in promotion and tenure decisions. In contrast, Lacy, Busch, and Marcotte (1984) found that submission of annual reports was perceived by Sudanese scientists to be the most important criterion for obtaining rewards in that system. In both cases questions could be, and were, raised regarding the appropriateness of the reward structure to the voiced goals of the research enterprise.

In evaluating reward structures, it is important to examine both formal documents, and statements by administrators, and scientists' views as related in interviews. This is necessary as scientists do not respond to formal statements or administrators' perceptions but rather to their own perceptions of the reward structure. Also, given the enormous variation in reward structures across organizations, starting with an open-ended question such as "How does one get ahead within the _____?" will be more revealing than a series of closed-ended questions about particular rewards.

6. Disciplinary mix. Traditionally, agricultural research organizations have centered around the disciplines of agronomy and animal science. As time went on, it became apparent that entomology and plant pathology had to be represented as well. More recently, the social sciences as well as nutrition and food science have also become well-established.* Having the full complement of disciplines is particularly important if (a) interdisciplinary teams are to be effective, and (b) the organization is charged with the development of a final product. This is of even greater concern for Third

World countries as a private sector that takes partially developed products from experiment stations and markets them is often lacking. (This was also the case in the early days of the U.S. system. Only as the input industries developed did experiment stations abandon product development. In some areas, e.g., varietal seeds, the stations still develop marketable products.)

Of concern here is the appropriateness of the disciplinary mix to the agricultural problems faced. For example, a research organization may have the agronomic scientists to develop an improved sorghum but lack the food scientists to test its palatability or the social scientists to test its social and economic viability.

7. Appropriateness of projects. By this I mean more than the disciplinary mix described above. Specifically, the question that must be raised is whether the scientific projects underway are well conceived and whether they are likely to lead to positive changes in the agricultural economy. These are two interrelated but distinct issues. For example, the probably apocryphal story of the Indian soil scientist who made a career out of studying New York soils in India, is an illustration of high quality research unrelated to development objectives. On the other hand, research may be related to development objectives but poor conceived and likely to fail (cf., Murphy, 1985).

Clearly no evaluation can examine all the research projects in even a medium-sized organization. Hence, some sort of sampling procedure is essential. While a random sampe might make for a more elegant design, there are likely to be better reasons for sampling. These include (1) the cost of

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*Of course, some agricultural research organizations have been organized along commodity lines and so included only those disciplines concerned with a particular commodity.

reaching the research site, (2) an informed observer's account of areas that are particularly strong or weak, and (3) the centrality of the project to the organization's mission.

In practice the decision as to which projects to evaluate will have to be made with the particular local circumstances in mind.

C. Relations with the Agricultural Sector

As noted in the conceptual framework section above, effective research institutions are in continuous close contact with the clients for and users of their products. Hence, in addition to asking scientists and administrators about their contacts with clients, client perceptions of the institution should help in the evaluation. Among the clients/users to be considered are:

1. Farmers
2. Farmworkers
3. Students
4. Input industries
5. Processing industries
6. Extension agents
7. Other research institutions (including the IARCs)
8. Legislators/Policymakers
9. Ministry officials

Of course, no evaluation of reasonable length can sample persons in each of these categories of clients/users. Hence, some compromises will have to be made as to whom should be contacted. Decisions as to who to contact might be based on mutual discussions with administrators of the research institutions. For example, if certain types of clients (e.g., processors) are said to have no contact with the research institution, interviewing them about their contacts will yield no useful data. On the other hand, lack of contact with

ministry officials might well be worth an inquiry. Finally, it should be noted that some relations may be the subject of printed documents; whenever possible such documentary evidence should be used.

D. Costs, Benefits, and Distributive Issues

A strict, formal cost-benefit analysis of a research institution is likely to yield little of value. Unlike large capital construction projects. research can rarely be evaluated in this manner. However, there are costs and benefits associated with research programs. Two key questions need to be addressed: (1) Do the benefits potentially to be gained from the research outweigh the costs? And, (2) are the benefits and costs distributed fairly and equitably?

The first question is easy to answer in a general way. Though not without methodological problems, most studies show very high positive social returns to investments in agricultural research (Ruttan, 1982). Moreover, returns to effective research are likely to be higher in Third World countries where little research has been done, and major gains are possible, than in countries where there is a long research tradition. However, such returns are always realized over a substantial period of time; research rarely, if ever, pays off within a one to two year period.

Of more importance are the complex distributive issues related to research. These are particularly important in countries in which income, wealth, and power distributions are already highly skewed. It is there that research is likely to have the most serious distributional consequences.

Eide et al. (1985) have suggested that many distributive impacts can be best analyzed and understood by starting from the normative assumption that each person has a right to a nutritionally adequate diet, in short, that everyone has a right to food. This suggests that improved food security-- for

individuals, households, communities, and nations-- must be a central goal for agricultural research (Busch and Lacy, 1984). If this is taken as a starting point, then many distributive issues can be defined as follows: Under no conditions should agricultural research reduce or eliminate access to a nutritionally adequate food supply. Moreover, ideally the products of agricultural research should improve the nutritional status of the most marginal segments of the population. Let us apply this to several of the distributive issues that typically face agricultural research.

1. Economic issues. In areas with landless labor, the introduction of labor-saving technologies may nave little effect on productivity but throw thousands out of work. As unemployment in most Third World countries means a complete loss of income, it it equivalent to being deprived of the means of subsistence. Not surprisingly, when such events have occured, riots and bloodshed have occured as well (e.g., Brass, 1982).

2. Labor issues. Third World farmers often plan their farm activities so as to spread labor out evenly over the year. The introduction of new crops or varieties that radically alter labor needs may interfere with other essential family activities. Such effects can reduce the demand for casual labor, thereby eliminating a traditional method for redistributing wealth (i.e., the smaller producers work occasionally on the farmers of the larger producers), as well as change the labor periods for the various members of the household. Both can contribute to reduced food security. In the former case, casual laborers may need that extra income to provide for their families. In the latter case income may go up while nutritional status (particularly of women and children) declines:

> For example a study from Ghana in a place where migrant labor was common, showed that the women, as a consequence of men's

> participation in cash crop production, would have had their work burden increased should they have continued the cultivation of yams which was the traditional staple food. Because of this they changed to cultivating cassava, for which less labor is needed. However as cassava is less nutritious than yams, this move to counteract an increase in women's work load had the effect of lowering the nutritional value of the staple food available to the household (Eide et al., 1985:7-27).

A similar study conducted in Tanzania found that infant mortality was highest in the area of greatest agricultural productivity. It appears that changes in cropping patterns had reduced women's breast feeding from five to three times daily with a consequent rise in mortality. Finally, Murphy (1983) reports a Tunisian project with detrimental impact on the status of women and overall nutrition.

3. Environmental issues. Certain new varieties or crops may encourage farmers to cultivate marginal lands better left in pasture or forest. Such environment degradation undermines the food security of future generations. At the same time it may shift labor and meal patterns by reducing the availability of firewood and/or potable water (e.g., DeWalt, 1983).

4. Role of Women. It is now commonplace to note the important role played by women in Third World agricultural production. Also of import is that women play a major role in each of the four aspects of household food use: procurement, handling, distribution, and consumption (Eide et al., 1985). Of particular note is that, in most Third World families, these four tasks are fully integrated; all are part of the daily work activities of women. As a result, as noted above, when labor patterns in one area are modified, other areas must be modified as well. Effective agricultural research in the Third World cannot ignore this intrinsic linkage as it is

fundamental to food security.

5. Agricultural research policy issues. Broad issues of agricultural research policy may also effect food security at both the household and national levels. For example, DeWalt (1985) notes that Mexican agricultural productivity has continued to rise since the 1940s, but in the 1960s grain sorghum was introduced from the United States. As the varieties introduced have been suitable only for feed, per capita production of grain has continued to increase while consumption has leveled off. Since only the most affluent segment of the Mexican population can afford meat products, the overall effect of sorghum introduction has been to reduce Mexico's food security.

E. Summary

In short, evaluations of agricultural research programs must include background information on the agricultural situation, an analysis of the internal dynamics of the system, a description of relations with various client groups, and an examination of costs, benefits, and distributive issues. Only a comprehensive analysis of this sort can (1) sort out with some degree of certainty those events traceable to agricultural research and those associated with other factors, and (2) provide information that is relevant to the improvement of the effectiveness of the research enterprise.

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THE ROLE OF THE UNIVERSITY IN IMPROVING NATIONAL FOOD POLICIES

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The Role of the University in Improving National Food Policies

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The Role of the University in Improving National Food Policies

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This paper focusses on the relationship between agricultural universities/ faculties and agricultural growth. While the production and extension of suitable technology obviously is a key aspect of agricultural growth, there is increasing recognition that another important determinant of agricultural growth is the policy environment in a particular country.[1] Does it provide incentives to the farmers to produce? Is there adequate investment in physical and social infrastructure, in research, in human resources? An important dimension of how a university affects agricultural growth is its effect upon the national policy environment.

There are many reasons for the lack of a supportive policy environment for agriculture. Many of these are rooted in the distribution of power and wealth; the political power of urban elites relative to the rural poor; deep-rooted social injustice. In some cases, however, a contributing factor to an adverse policy environment is the failure to understand its importance to agricultural productivity and/or a lack of capacity to create a supportive environment, even given the political will to do so. These two broad reasons for non-supportive policies can be divided into structural problems and capacity problems. In both cases, the university can be an important force in moving the nation toward a more supportive policy environment. In the former this may take the form of political analysis; in some cases direct political action by various elements within the university. In the case of capacity inadequacy, the university is a major source of capacity building through enhancing the capacity of its students, of its own faculty and of those involved in making national policy. The focus of this paper is on the role of the university in addressing capacity problems rather than structural ones.

The starting point is to consider the various ways in which the university can affect capacity as it relates to the policy environment. Most obviously, it provides the training for many of the individuals who staff the institutions that devise, analyze, create and implement the programs and policies that together produce the policy environment. Faculty members in various ways provide direct advisory services to government and quasi-public institutions. In some cases, universities provide various kinds of outreach training to various institutions. Lastly, university faculty and graduate students do research whose results may affect policy.

Thinking about the university's role in building capacity, it is useful to define the term as it relates to the creation of a supportive agricultural policy environment. In attempting such a definition, Malcolm McPherson and I interviewed many individuals with extensive experience in agricultural development. We sought to identify in an operationally useful way just what sort of capacity shortcomings were contributing to ineffective food and agricultural policies.

We developed a long list of specific instances of "capacity failure". The responses can be grouped into four broad areas in which capacity was inadequate.[2] First, there was an inability to place particular agricultural programs and policies in a broad strategic context of national agricultural development: a lack of strategic capacity. For example, there is little appreciation of how such macroeconomic variables such as foreign exchange and interest rates affect food and agriculture. Second, technical aspects of agriculture often are poorly understood. A national program to import phosphorous fertilizer will have limited impact if it is nitrogen which is limiting plant growth. A broadleaf herbicide will not help if grassy weeds are choking the cereal crop. The benefits from irrigation may be lost in the long-run without a drainage system to help prevent salinization. Third, even when wise policy decisions are taken, inadequate capacity to implement the decisions can produce the effect of a poor policy environment. Clearly, capacity has an important administrative dimension. Lastly, relevant knowledge often exists within local institutions but bureaucratic or other barriers to communication hamper access to it. Thus part of the capacity needed is improved communciation skills and a systematic approach to acquiring new knowledge which may lie outside one's own organization or discipline. These four dimensions of capacity can be summed up as Strategic; Technical; Administrative; Communicative.

University programs can be examined for their contributions to these four aspects of capacity which are needed to create and implement the policies and programs which generate a supportive environment for agricultural growth. This can be done with respect to their teaching programs; their research programs and the advisory and other activities of the faculty. At various levels this leads to the examination of the course content; of the subjects and objectives of research; of the nature of faculty advisory activity. Additional insight can be gained, however, by focussing explicitly on the incentive environment of the university itself as it motivates faculty to emphasize certain activities and to give less attention to others. What is the relative importance of teaching, of research, of consulting? What drives the promotion/retention decisions? What sets of pressures establish the research priorities? What is the nature of the government/university relationship? Are faculty members influential in government policy councils? Does university based research find its way into government decision making? If so, by what means? Is the university faculty a source of staff or executive governmental leadership? Over the longer run, are the students such a source? Once in government, do the students view their former teachers as a source of valued advice and counsel?

If capacity at the university is upgraded, how will it produce an increase in capacity within government? Will this come about only through more capable graduates or through the effect of more useful research and/or improved advisory services? Over past years, what changes are apparent? What are the mechanisms for such upgrading? What formal and informal communications channels exist between government and university?

Recognizing that universities are both a source of capacity and that their main purpose is enhancing the capacity of others, many programs seeking to help improve the national policy environment for agricultural growth have sought to link the university more effectively with the policy process. University training and research skills can enhance and enlighten that process. In return, greater exposure to real world problems can enrich and improve university teaching and research programs. In the recent past some donor programs have sought to create mechanisms to facilitate closer collaboration between university and government. Among those were several food policy projects supported by The Rockefeller Foundation, three of which will be examined in this paper: projects in Thailand, Kenya and Tunisia.

The ultimate objective of all three projects was to help by various means these countries create a more supportive policy environment for agricultural development. Some project activities pursued this indirectly, generally in the belief that enhancing the capacity of those working both at the university and in government would lead to greater understanding of the need for an improved policy environment. Improved capacity then would help them make and implement appropriate policies to achieve such an improvement. Other project activities sought to affect policy more directly by producing research leading to policy recommendations. The Kenya project operated more directly on the policy environment through providing a respected advisor working directly with the staff of a key policy maker.

In a brief overview paper it is not possible to attempt an in-depth evaluation of these three projects according to all of the suggested criteria. Rather the purpose of this paper is to suggest a framework within which to see how each of these projects sought to affect the policy environment and to facilitate making some general observations about the outcomes. The framework shown in Figure 1 is intended to serve as a first step in evaluating the impact of selected projects on the agricultural policy environment and thereby, on agricultural growth. Its purpose is to make explicit just how the project was intended to affect the policy environment -- by what mechanism and linkage. Bearing in mind the four dimensions of capacity development, what was the capacity focus of the project? Whose capacity was to be developed? Students? Policy makers? Their staffs? The faculty themselves? Was research a part of the project? If so, what was its objective? To build capacity? To affect policy? To satisfy donor requirements?

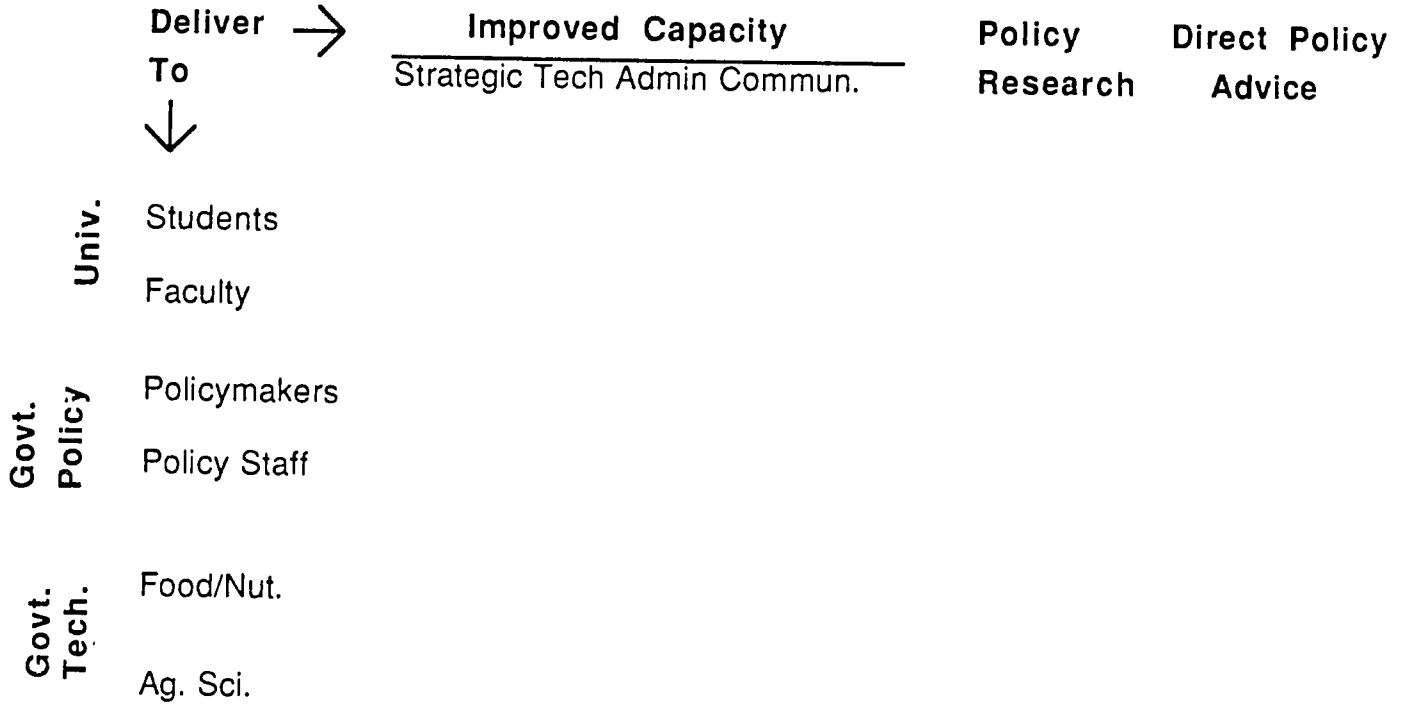
Using the same framework it is also possible to examine the extent to which the intended resul were realized. All three projects were intended as pilots to explore different approaches to helpir developing countries improve their agricultural policy environment. Accordingly, they serve to illustrate the diversity of options by which this goal can be pursued. The use of a common framework highlights their diversity. It also helps to clarify not only what had been indended, bu what actually happened. The comparision makes possible some tentative conclusions on things th seemed to work, some which did not and some which may work with some readjustments.

Some of the activities were intended to affect policy through improving the capacity of policy makers and/or policy staffs. Others were to make an impact through policy research which would clarify policy options and estimate their impacts on various government objectives. There were explicit roles for university faculty in both approaches. Curriculum improvement often was a related objective. In all cases, the projects were a response to specific requests from countries for particular sort of assistance, usually in terms of some input they wanted help in getting -- help in starting a policy research institute; the appointment of a specified individual whose judgement and expertise they valued highly; support for a specific survey or study they believed would help their policy deliberations.

Because projects were shaped collaboratively around country specific problems they came out very differently. It should be clear therefore that this common framework is something created ex-post to try to clarifiy and interpret what happened under a variety of approaches. There was no such common framework imposed on project design at the outset. What did exist were some general principles about how capacity is developed and some ideas about how particular activities might be adapted to embody these principles.[3]

Some project activities focussed on capacity directly. In others capacity improvement was more of a secondary effect of policy research or direct advice. Accordingly, it is useful to identify separately these three aspects, recognizing that the latter two also had a capacity building dimension. To do so, the framework (Figure 1) has three major columns indicating what kind of output the project was intended to deliver; capacity enhancement, policy research, direct policy advice. Capacity is broken down into the four categories described earlier: strategic, technical, administrative, communicative. The rows indicate who is the focus of the project activities: whose capacity is to be improved; who is involved in doing and receiving the policy research; with whom is the advisor working. The rows are grouped into three categories: university; government policy; government technical.

Figure 1: Framework for Food Policy Project Analysis



Of the three Rockefeller Foundation food policy projects, the one most intimately and explicitly involving universities was the Thai Food Policy Analysis Project. The project grew from two broad perceptions. One was recognition of Thailand's long-term food, nutrition and environmental problems. The other was the belief that there were substantial unused research resources in Thailand. Researchers were receiving small disconnected research contracts according to priorities established mainly by donors, not necessarily reflecting Thai government priorities.

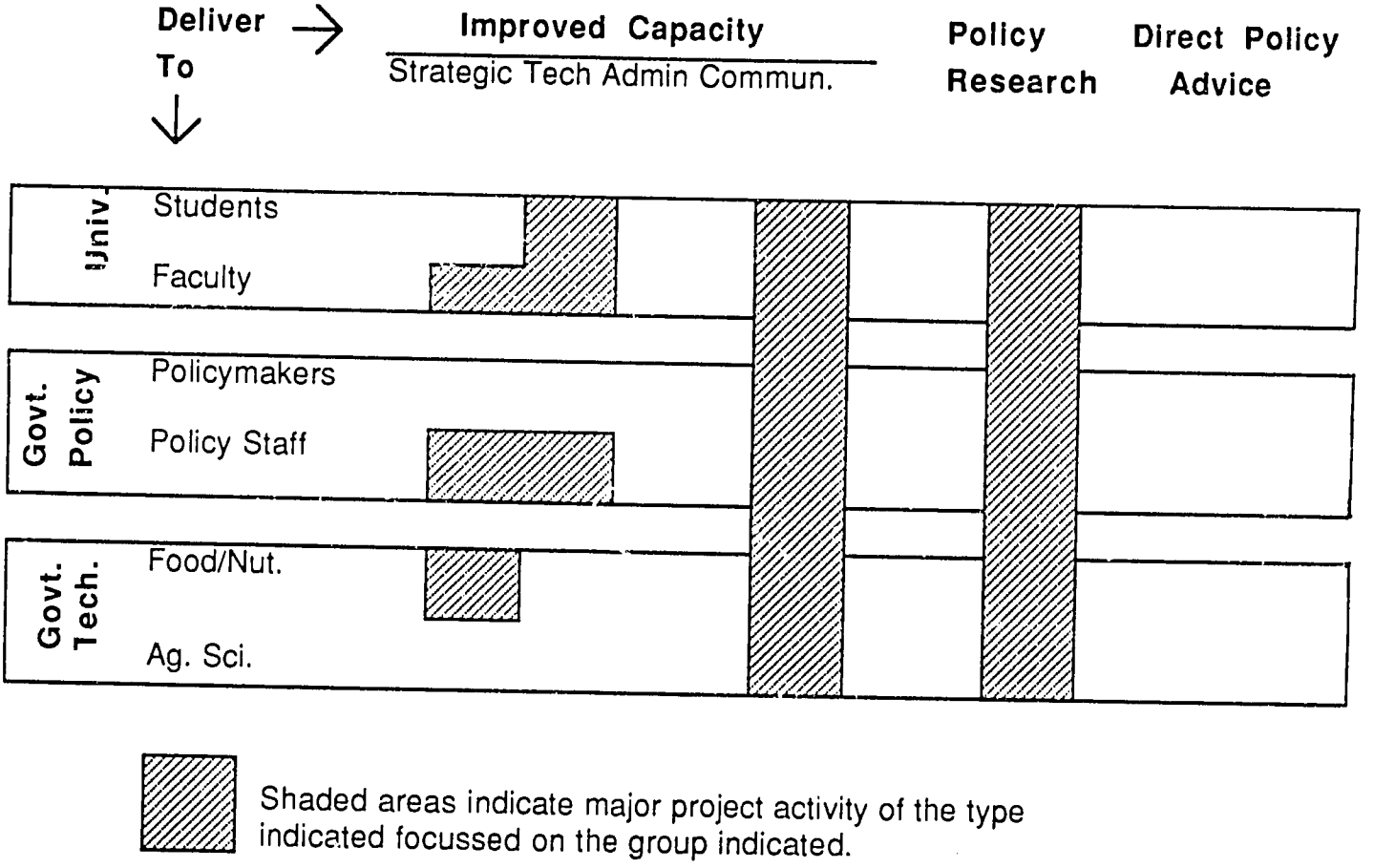
The Government of Thailand sought to assemble a team of researchers, mostly from university faculties, to mount a series of coordinated research projects to illuminate issues upon which the government faced urgent decisions, seeking assistance from The Rockefeller Foundation to carry out this undertaking. If the separate projects could be done within a common framework, the separate pieces could reinforce and draw insights from one another. By working together with such a common analytical framework, the research group could become the nucleus of a research institute something like the Korean Development Institute -- a "Brookings-like" institution as it was described at the time.

The research project was broadly conceived, embracing not only food production (crop and livestock) but its distribution, consumption and the nutritional status of vulnerable groups. Resource depletion issues were also included in the project scope. A key element in the project's ultimate success was the early development of an overarching, integrative framework for the separate parts of the project (described by Panayotou in 4.) Through weekly workshops with all o the research team, this framework was created in a participative fashion. This had not only the effect of improving the quality and usefulness of the research, but made an important contribution to increasing the capacity of the researchers themselves. They learned new analytical skills and techniques through the workshops. Moreover, they discovered how much they could benefit from the close communication with their peers which the workshops stimulated.

At the senior level, the appoint of the project leader, Dr. Snoh Unakul, as Director of the NESDB provided excellent project linkage with the policy process. Moreover, at the working level, one of the researchers was a staff member of the NESDB. Demand for the project's output was assured by the fact that the government's priority concerns were the key element in the conception of the project's work plan. As noted, the explicit intent was to use the research group as the nucleus for the development of Thai Development Research Institute.

Looking at the project design in terms of the comparative framework suggested earlier (Figure 2), the mechanism by which the policy environment was to be improved was primarily by the

Figure 2: Thailand Food Policy Research Group



policy research producing particular recommendations. Capacity improvement was to take place a a by-product of that research effort. An excellent environment for communication was established within the research group and between the group and the government's policy planning process. The capacity focus was in the strategic and technical (economics) dimensions, with little attention t administrative capacity or to implementation issues. As to disciplines, the project linked production, distribution and consumption/nutrition within one ambitious framework.

In evaluating the project's achievements, Delehanty and Stifel called attention to three important characteristics:

> "First, while basically an academic research group, there was clear and strong linkage with the National Economic and Social Development Board through both Dr. Snoh and Mr. Kosit, Director of the NESDB's Development Studies Division at the time. Although the pressures of their duties restricted how much they could interact with the group, this relationship with the policy-making process was important to the project. Among other things it has resulted in some of the project insights being incorporated into the five-year plan.
>
> The second characteristic is the early development of a conceptual framework which provided an important focus for the work. . . . This was a useful analytical and pedagogical device which helped the group to think through the linkages both among the various sub-projects and with the government objectives. . . .
>
> The third key characteristic is the fact that the research agenda was set by Thais. This was a critical point distinguishing this from other research. It had the effect of shifting the intellectual balance from the developed country to the developing country side of the table. . . ."[5]

It is important that this project originated with an individual -- Dr. Snoh -- who had a deep commitment to using more effectively university based research potential. Thinking of capacity in terms of its supply and demand, the initiative came from the demand-side. Dr. Snoh sought a way both to improve the capacity of the universities and to focus this capacity on the government's decision problems. This project history (and the subsequent fortuitous appointment of Dr. Snoh to head the NESDB) assured the project's research findings a good hearing in government councils. In the process, the capacity of university faculty and the project's graduate students improved substantially. Delehanty and Stifel note:

> "the experience of doing analysis has had, for project researchers, tremendous benefits. It is hard to describe this in a single dimension, since the gains were maturity, confidence, subtlety, skepticism, technical skills and many other things, in addition to knowledge. At the final workshop the researchers were scarcely recognizable as the same people who had silently and glumly sat through the early working meetings. Perhaps this development of human capital is the most important result of the project."[6]

The motivation for this project in terms of policy analysis can be characterized as demand-pull with the university seen as the potential source of supply. This made it easy to mount a university

based capacity development project intended to deliver concrete results directly into the government's policy process. The project also could build on a long history of RF assistance to university development in Thailand. Dr. Delehanty, for example, already had been a visiting Professor at Thamasat Univesity for 4 years when the project began and Dr. Panayotou at Kasetsart for 2 years. These antecedents underscore the long-term nature of capacity development activities.

Kenya was the site of another RF food policy project which provides a useful contrast to the Thai experience, particularly *vis a vis* the university. As in Thailand, the project in Kenya began with a request by a senior official responding to a high priority need of government. In this sense it also was demand-side driven: the government seeking a source of policy analysis. Kenya had experienced serious food shortages which focussed attention on food policy issues. However, in contrast to Thailand where the initiator of the request wanted help mobilizing talent at the university for the task, the Kenyans sought an experienced senior expatriate advisor to assist them in policy analysis and implementation, based within the Office of the President. Serving also as a sort of senior mentor, he could help the junior staff members there enhance their own analytical skills.

To build a more formal capacity development dimension into the project, a Visiting Professor position was created at the University of Nairobi's Faculty of Agriculture at Kabete . The objective was to help strengthen both the teaching and research capacity of the faculty in the area of food and agricultural policy. The intent was gradually to develop informal links between the University and government focussing in part on applied research projects on subjects of priority interest to government policy makers. It is important to note, however, that while the government supported this dimension of the project, they were not looking to the university for research output as had been the case in Thailand. Any near term policy analysis from the project clearly was expected to come from the advisor in the President's Office and not from the university.

The project's design notwithstanding, the two parts of the project -- university and government advisory -- never really became integrated. The problems with which the government officials were coping often proved to be more problems of implementation than of policy analysis.[7] Such research as was done aimed more at specific short-term fire-fighting than broad strategic issues. The response time of university research was not fast enough for such chores. Bureaucratic obstacles also impeded close cooperation between the faculty and government officials.

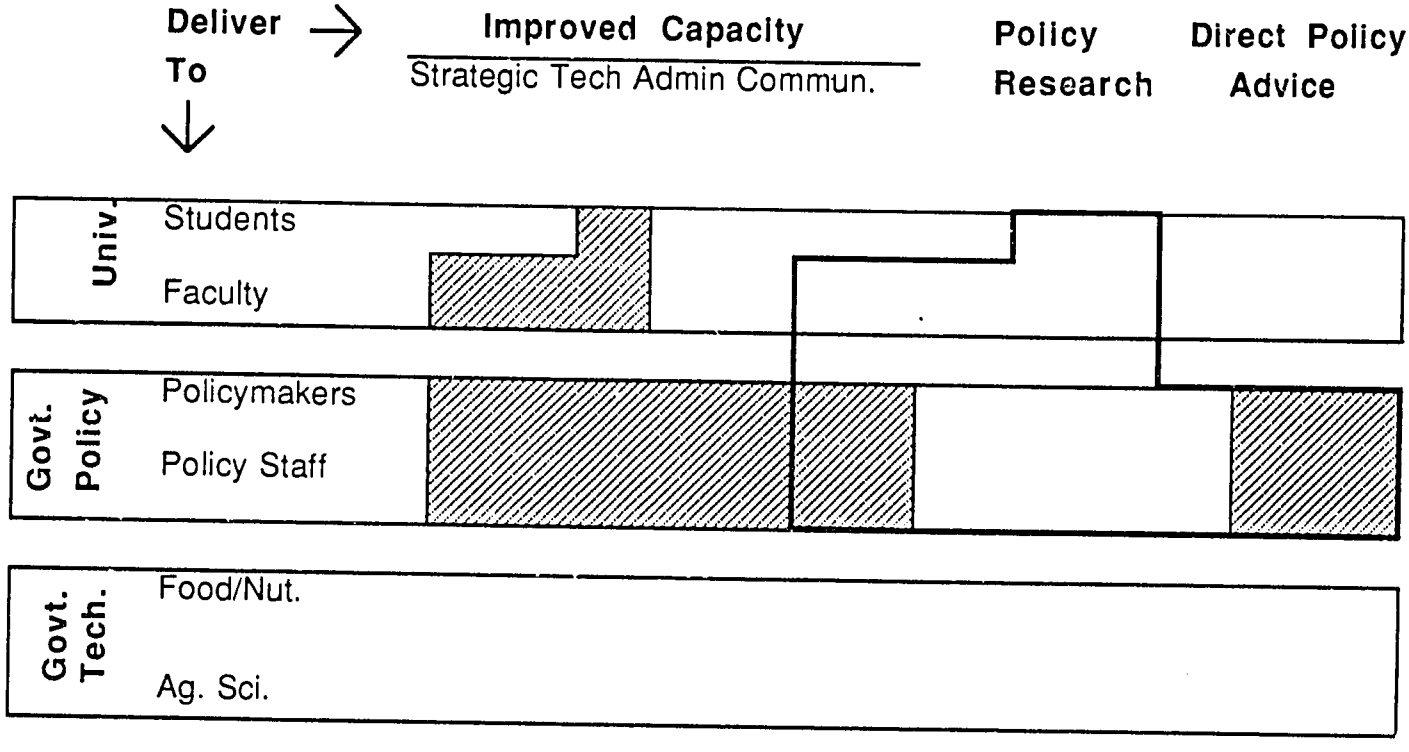
At the university, the formal teaching part of the capacity development objective was relatively successful, although partially compromised by the closure of the university for part of the project period. On the research side, the relatively few faculty members who could have contributed already were overburdened with heavy teaching loads and other outside research projects. The real potential for new capacity development was through working closely with junior faculty members newly returning from foreign doctoral training. An experienced senior faculty colleague with

access to modest funding resources could help them to focus their new skills on high priority research topics and assist them to integrate such research into their teaching program. Before tl dimension of the project could bear fruit, however, the general reduction in the RF field staff le the elimination of the visiting faculty position. Nonetheless some research project funding continues to be available and it remains possible that policy research and training will expand at university. The Harvard group in particular, with their advisory roles in the Ministries of Agriculture, Finance and Planning, is in an excellent position to assist the Faculty to design and carry out useful research; also to help inject into the curriculum some of the issues facing the government policy makers.

Viewing the project in terms of this paper's framework (Figure 3) the intent was to have two components unified through the policy research column. However, this linkage did not develop a hoped, leaving the project without an effective connection between university and government. While the project originated as a demand for analytical capacity, the supply was not seen to come from the university, but in the short-run at least, was seen as something to be imported. Moreove it was more oriented toward multiple short term projects. It lacked the drive behind the Thai projec towards integration of all sub-projects within a common integrating framework. In part, this probably reflects the differences between the perspectives and pressures of the Office of the President as compared to a planning board. In any event, in Kenya the project activites at the university clearly had far less impact on shaping the policy environment towards agricultural growth than did those of the project in Thailand. This is not to suggest, however, that the project led to no changes. The input of the advisor may have had a more important and direct effect on the Kenyan policy environment than did the university based policy research in Thailand.

Yet a third approach to building capacity was the RF food policy project in Tunisia. Like those in Thailand and Kenya, it started with a government request for help with an urgent problem. After years of steady progress, Tunisian cereal production fell precipitiously in 1977 and remained low for three years. The Director of Agricultural Planning asked the RF for assistance in analyzing the reasons for this poor performance and in planning remedial actions. As in Kenya, they did not look to the university as a possible focal point for such an analysis. However, unlike the Kenya case, neither did they seek an advisor. Rather they wished help in mobilizing their own resources to address the problem, a "catalyzeur" as they described it, to help them organize such a review of the sector. In effect, the objective was short-term capacity building: to develop the capacity to diagnose the reasons for the production shortfall and plan the steps needed to restore the former higher levels.

Figure 3: Kenya Food Policy Project



Shaded areas indicate major project activity of the type indicated focussed on the group indicated.

Areas thus outlined indicate activities originally planned to link groups indicated, but which were not implemented.

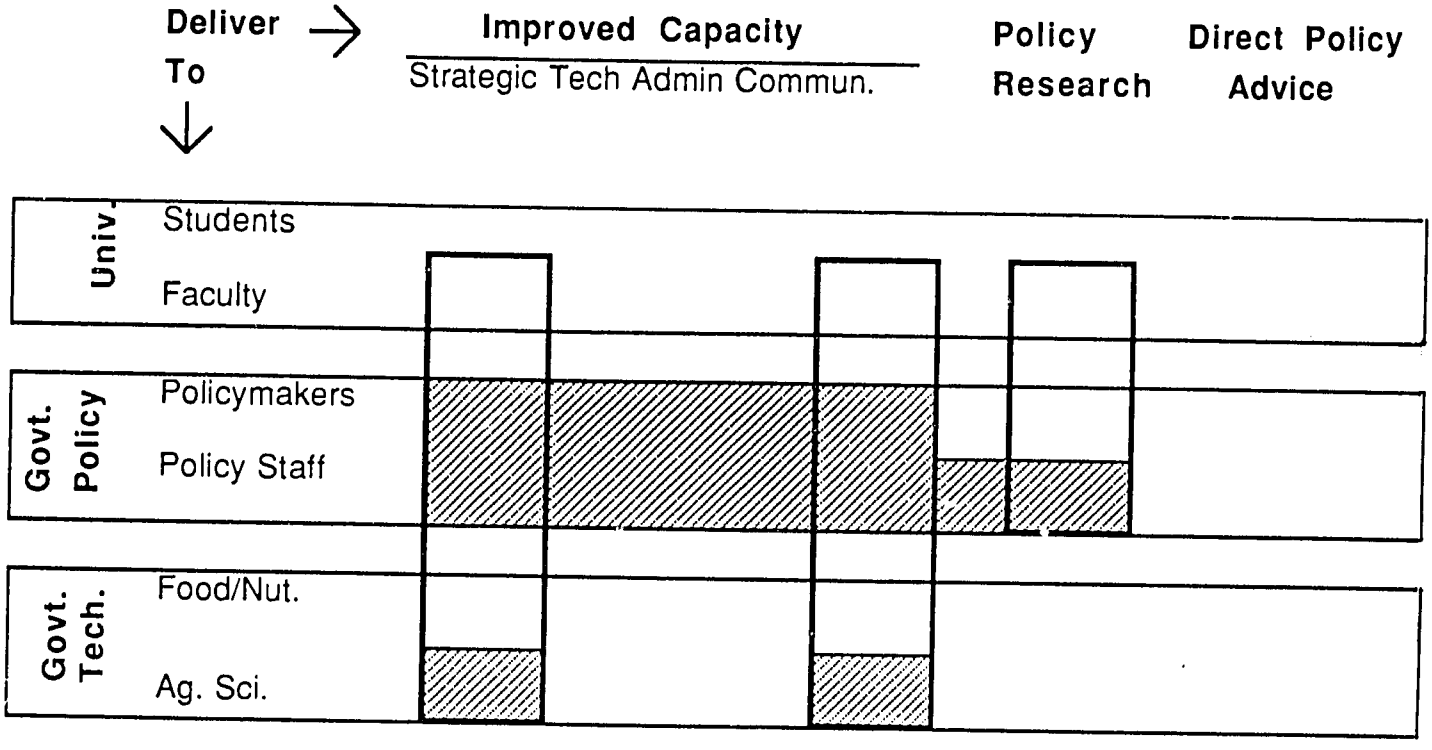
With the assignment of an RF staff member to Tunisia, the first task was to identify and bring together the Tunisian scientists and managers of all aspects of cereal production to think through together the causes of the decline. With the human capital accumulated through a long-term cere research and training program, the Tunisian expertise was considerable.[8] However, because the individuals were working in a variety of agencies and most were unknown to the planners, their expertise had not been enlisted before in such an analytical undertaking. The outside "catalyzeur" served to help mobilize and focus this talent on the problem. As needed, international wheat scientists also were called in to provide additional perspectives on the causes of the production shortfall.

The context within which this outside expertise proved particularly useful was the diagnostic field trip.[9] In this case the purpose was to engage the chief cereals planner in the actual agronomi analysis of the growing wheat crop, guided in a sort of roving crop science tutorial by a CIMMYT plant scientist. Through this experience, the planner became convinced that production was not limited primarily by the shortage of rainfall as he had originally believed. He came to his own understanding from guided field observation that much potential production was being lost by extensive weed infestation and low levels of nitrogen fertilizer. This finding led to a new extensior campaign focussing on fertilizer and herbicide use.

In terms of Figure 4, this is labelled policy research. However, it is more akin to the Hildebrand "Sondeo" or CIMMYT's regional reconnaissance than traditional research. While not very sophisticated, it served to galvanize action to remedy the shortcomings which became apparent to the planner once he was given the vision needed to see analytically what really was limiting the growing crop. Instead of seeing only a satisfying green as far as the eye could see as he had earlier, he came to realize that much of the green was weeds. He learned to see how much darker green and more vigorous were the wheat plants with adequate nitrogen. He even developed the ability to see the track of the farmer hand casting nitrogen by the cresents of deep green in an otherwise nitrogen starved field. His new vision transformed his perception of the cereals problem from one he could do little about ("the rains failed") to one he could do something about ("we must get more fertilizer and herbicide out to the farmers.") Get it out they did and production responded dramatically.

Given the broad objective of long-term capacity development, there was a large potential role for the agricultural university (INAT) with the project. The Ford Foundation had been providing support to INAT and themselves were interested in seeing a closer relationship develop with the

Figure 4: Tunisia Food Policy Project



Shaded areas indicate major project activity of the type indicated focussed on the group indicated.

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agricultural planning office in particular. The intentionally simultaneous visit by officers from b foundations in the same week resulted in a joint meeting with the two donors, INAT and the Planning Office staffs, along with the two donor representatives. This appeared to be the first ti the two Tunisian groups had met together to discuss possibilities for cooperative activities. Whi would be easy to overstate the resulting accomplishments, there was enthusiasm on the Universi side to design field research addressing the problems identified and on the planners' side to tap tl new source of insights. It was clear also that the teaching program would be enriched by involvement of the faculty in such real world problems.

While the communications channels were improved by these joint discussions, it was technolo which facilitated further collaboration. As a tool to facilitate the extensive spreadsheet work done the planning office, the Planning Office ordered through the project two Apple II computers and associated hardware and software. Several INAT faculty members and the Chief of the Planning Office recognized the potential for improved teaching which these machines could facilitate. The machines' presence in the Planning Office provided a powerful attractant for several INAT faculty members. As described elsewhere, the Director of Planning, Mohsen Boujbel, came to see the computers as an important tool to help link his office with other agencies. In his words:

> "The computers serve us as a bridge with other departments because when we went to a meeting, we presented our inputs on the microcomputers. It leaves our department open to other departments and to the University, the College of Agriculture in Tunis, the Institute of Quantitative Economics of the Ministry of Planning. It is really a good bridge for us."[10]

In retrospect, the fact that the Planning Office integrated computers into their own analysis and planning process made them realize the need for more training involving computers within Tunisia generally and at INAT in particular. The effect of the computer in drawing closer together INAT and the Planning Office is evident in the following observation by Mr. Boujbel:

> "My feeling is that for planners, for agro-economists, for statisticians, the use of microcomputers will be the basis in the next few years of their work. In discussion with the people teaching economics in the National Institute of Agronomy, I try to push them to teach how to use these kinds of machines and show how they can help the economists; to teach how the microcomputers can help the students in doing the theories and to have them more familiar with analysis, you see; to introduce these in some courses at INAT especially; INAT is the Institute of Agronomy in Tunisia. They are planning to have more information computer science in the Institute."[11]

In the case of the Tunisia Food Policy project, explicit university linkage and capacity building was not part of the original intent of the Tunisians. However, foundation staff members were able

to provide some encouragement toward greater involvement of the university with the urgent problems the government faced in agriculture. However, in the long run, it may be the computers which provide the most enduring linkage between the ministry and the university. The accessability of this computing power has transformed how the planners define and approach the problems of agriculture.[12] Now that they have experienced the power of the computer both in analysis and in administration, they are pressing the university to produce graduates who know how to use this power, who use it routinely as part of their course work and research projects. If the university incorporates such training, the project's indirect effect upon university research and training through this computer dimension may be the most important long-term impact of the project on human capacity development.

For the purposes of this paper the important lesson is that efforts to develop the universities must attend not only to the supply side of capacity, the university itself, but the demand side; the potential users of its graduates. In terms of the framework (Figure 4), the Tunisia project in the short-run omits students and faculty from the explicit design. However, the heavy line indicates that they may be drawn in eventually through this demand-side effect. Unlike the Thai case where the original request foresaw the university as the source of supply of analysis, in Tunisia the original project did not do so. However, in part as a result of the use of microcomputers, the Planning Office may look more to the University in the future than in the past.

In trying to draw from these three food policy projects some overall conclusions for donor assistance strategies, it is clear from the Thai case that university development efforts can be combined with policy analysis which can help the government to improve the policy environment for agricultural growth. However the experience in Kenya of trying to forge such a goverment-university relationship suggests that the motivation to do so must be strong on the government side to make it work. Some demand-pull for the analysis is an important factor. This is not to rule out the possibility of unsolicited university research having a constructive impact on government policy, but it seems more likely if the demand is there from the outset.

In the case of Tunisia, there was little communication between the planners and the university at the start of the project. While not part of the original project, the introduction of microcomputers appears to have established some common ground and common interests (the application of this technology to agricultural problems) which has facilitated somewhat closer cooperation. Involving individuals from both organizations in the original in-country "Microcomputer workshop" was one specific example of how the equipment could be used to bring together people from several organizations and provide them with a common experience. At least when it is still a relative novelty, a microcomputer can serve somewhat as a campfire at a picnic in drawing people together around a common focal point. This "campfire effect" seems to have facilitated cross organizational communication in the Tunisian project.

In all three cases, it is important that there existed prior to the original request some general principles which the donor used as a sort of a compass to provide a general orientation to the projects' direction. While there was a focus on long-term capacity development, there was a belief that the best way to pursue it was to start with whatever food problem the government proposed as their most urgent. Recognizing that usually there is more local capacity than is being tapped, opening up communication across relevant disciplines and organizations was another overall theme

How could both existing and new capacity be linked more effectively to the policy process? Achieving such linkage was facilitated when this objective was made explicit in the original project request as in Thailand. However, the Tunisia case suggests the usefulness of working towards this end even when it is not a part of the original request.

In project design, the metaphor of a compass is more helpful than the more usual one of a map with the route marked in advance to the destination.[13] If guided by some general principles -- a general idea of which direction to pursue -- it is possible to take advantage of unforeseen opportunities and to make mid-course corrections as needed. Viewed in this light, projects are not condemned as a failure just because they fail to take a particular route.

The RF food policy in Kenya did not work out as planned in respect to the university-government linkage. However, based on the experience in Tunisia, a mid-course correction in Kenya refocussed the project more on making effective use of microcomputers provided to the university under the project. Originally these had been a relatively incidental input. The extensive use now of such equipment in various government offices may provide a common link to bring together faculty and ministry people in ways not originally foreseen when the project was begun. Losing the original path is not so serious if there are some general principles which can serve as a compass. These can keep the project headed generally toward the objective, in this case, the development of human capacity to improve the effectiveness of food and agricultural systems.

FOOTNOTES

*This paper was prepared for the AID Washington Workshop "The Role of Agricultural Universities in Rural Development", Center for Development Information and Evaluation, Rosslyn, Virginia: July, 1985. I am grateful to Joseph Stern and the Workshop participants for comments and suggestions on an earlier draft. Any errors of omission or commission are mine alone.

1. See especially Accelerated Development in Sub-Saharan Africa: An Agenda for Action, The World Bank; Washington, D.C., 1981.

2. I would like to acknowledge in particular the contributions of Prof. Alex McCalla to our diagnosis of capacity shortcomings: See "Food and Agricultural Policy Analysis in the Developing Countries", Alex McCalla, Charles K. Mann, Christopher A. Mock; Mimeo, The Rockefeller Foundation, New York, 1979.

3. These principles are set forth in an essay in the IADS Annual Report for 1981: "Improving Food Policy", Charles K. Mann and Malcolm F. McPherson.

4. Theodore Panayotou, "A Conceptual Framework for Food Policy Analysis", (in) Theodore Panayotou (ed.) Food Policy Analysis in Thailand, Agricultural Development Council; Bangkok, 1985.

5. Ibid., p. 5.

6. Ibid., p. 4.

7. For specifics, see D.R. Campbell, "Bridging the Gap Between Analysis and Action" (in) Food Policy: Frameworks for Analysis and Action, Charles K. Mann and Barbara Huddleston, (eds.): Indiana University Press; Bloomington, 1985, pp. 183-191.

8. For a history and evaluation of this program, see U.S. AID, Tunisia: The Wheat Program, (Project Impact Evaluation Report No. 48): Washington, D.C., 1983.

9. Charles K. Mann and Malcolm F. McPherson, Improving National Food Systems: A Capacity Development Approach, Draft Manuscript.

10. Charles K. Mann "Beyond the Metaphor: Microcomputers in Public Policy Planning", paper delivered at the Annual Meeting of the American Association for the Advancement of Science, Los Angeles, May 1985. To be published as part of a collection of essays on this general subject, edited by Stephen Ruth and Charles K. Mann.

11. Mohsen Boujbel, "A Planner's View of the Microcomputer", Transcript of an interview with Charles K. Mann, The Micro Circle, Mimeo, 1984, p.3.

12. Evidence of this changed perspective and approach is presented in "Beyond the Metaphor".

13. For suggesting the compass metaphor, I am indebted to Prof. Robert Hayes of the Harvard Business School who uses it in a lecture on business strategies.

EVALUATING INSTITUTION BUILDING PROJECTS

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TERMS OF REFERENCE FOR
EVALUATING INSTITUTION BUILDING PROJECTS

By

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August 27, 1985

TERMS OF REFERENCE FOR EVALUATING INSTITUTION BUILDING PROJECTS

For decades AID and its predecessor agencies have been concerned with the sustainability of institutions it has assisted to create or improve. The term "institution building" (IB) has been used by many in this regard. The purpose of this paper is to suggest a framework for viewing that institution building process. Further, the perspective suggested will lend itself to an evaluation, expost, of IB projects to determine their sustainability.

The paper will be divided into three sections. The first will discuss impacts, the role of institutions in sector impacts and methods of measuring impacts. The second will involve the presentation of an organizational framework or paradigm for analyzing an institution, including evaluating changes in it over time. Finally, the third will concern component parts of the framework from a systems point of view.

The third section of the paper is designed to serve as the basic terms of reference for evaluations of IB projects. As such, it focuses on three things. First, consideration will be given to the detailed meaning of component parts of the systems model. Second, there will be a discussion of indicators or proxies that can be used to compare exante and expost situations with regard to each particular component of the IB systems paradigm. Finally, the question of attribution will be addressed. That is to say, procedures for identifying those aspects of the change that can be attributed to the AID sponsored assistance intervention will be discussed. A summary section concludes the paper.

Impacts and Institutions

At best, an institution is a means to an end. It has value because of the contributions it makes to the sector in which it is located. The ultimate beneficiaries of these sectors are indirectly impacted by the institutions involved, in many cases. For example, agricultural universities impact on farmers via trained personnel in credit agencies. Likewise, the outputs of a health sector are frequently not directly obtained from health education institutions in that sector. Similarly, in other sectors the institutions represent merely "one link in the chain,"

that is ultimately anchored to the final beneficiary. Impacts, where they occur, should be measurable on the ultimate beneficiaries. That is to say, farmers increase production, the general public enjoys improved health, etc. Ideally, the impact of an assistance intervention will filter through to the ultimate beneficiary. Identifying the amount of improvement in the status of the ultimate beneficiary that is derived from the institution in question will depend upon many things. One of the most important factors will be the relative importance of the institution as a key component in the sector. Clearly, assistance intervention strategies should select strategic or key institutions as the recipients of their efforts if returns to donors' resources are to be maximized.

With regard to the agricultural sector, the identification of the impact of an institution building (IB) assistance intervention on the ultimate producers can be a difficult task. Analytically, the preferred procedure for tracing the impacts of an IB assistance intervention to the ultimate producer could be via an aggregate production function analysis of the sector. For example, Hayami and Ruttan demonstrate that the investment of Asian agricultural economies in research and extension personnel is a key explanatory variable in an aggregate production function analysis of their agricultural sectors. Likewise, Obermiller identified basic literacy skills as a key variable in explaining variation in the value of crop output per harvested hectare in Latin American agricultural economies. Suffice it to say, an analytical methodology is available to determine impacts of institution building assistance interventions on the ultimate producer.

The operational difficulty that impact evaluation teams must face is the frequent shortage of time and other resources to undertake an aggregate production function analysis.* If resource constraints prohibit an aggregate production function analysis, two alternatives are worthy of consideration. First, the decision can be taken to measure the impacts of the IB assistance intervention only at the level of output of the host institution itself. The assump-

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*An alternative procedure would be to utilize an aggregate linear programming model of a country's agricultural sector to estimate the productivity of human capital in assessing its potential. Unfortunately, the data and other requirements make the task difficult, if not impossible, given the resources usually available for an IB impact evaluation.

tion can be made based upon evidence from other analyses that the outputs of the IB project are valued by the using society. This assumption would be significant but not heroic in the case of the evaluation of agricultural universities assisted by AID contractors in the past. The second alternative is to attempt to provide a descriptive and, if possible, a partial analytical evaluation of the impact of the assisted institution on the ultimate beneficiary in the sector. At minimum, this requires that the complete sector be described, especially the entire institutional infrastructure that is of vital importance in influencing agricultural production. Further, partial evidence can be assembled to indicate the contributions that various components of the sector make to its final performance. Of course, emphasis would be placed on the institution in question, recognizing that its outputs represent a necessary but not sufficient condition for improved sector performance.

Two factors recommend the latter of the above mentioned alternatives. First, many of the institution building projects evaluated will have been assisted during a period of time in AID's history when emphasis was placed on benefiting the "poorest of the poor." Hence, many of the projects were designed in terms of impacting small farmers. Second, the primary thrust of the evaluation of institution building projects is to determine their ultimate impacts on the agricultural sectors. Hence, although not as completely as an aggregate production function analysis would afford, the impact evaluation needs to establish, to the maximum extent possible, the impact of the institution building assistance strategy on the ultimate beneficiaries in the agricultural system, i.e., in most cases the farmers themselves.

Framework for Viewing an Institution

An institution can be perceived as producing one or more products of value to the using society. Further, an institution can be viewed as a multiphased production process. In it "raw" inputs are transformed and the resulting intermediate products, in turn, are further transformed in the production of end products that are injected into the using society. Finally, institutions are resource using organizations. In sum, most institutions can be perceived as multiproduct, multiphased, resource using organizations. In order to more fully understand this

generic perception of an institution, attention can be turned to Figure 1.*

The systems perspective of institutional development and performance as depicted in Figure 1 suggests that there are two subsystems involved for most institutions. The first to be considered here is subsystem B which depicts the final phases of the production process. Subsequently, attention will be turned to Subsystem A.

Subsystem B -- Production of Final Outputs

Three classes of outputs are depicted in the model. The first two of these are injected into the using society while the third is absorbed into the institution itself as it recycles through time. Each of these three categories of outputs -- current services, influence, and institutional reinvestments -- deserves elaboration.

Current services are the outputs which are usually associated with an institution. Universities produce graduates, development banks make loans, research institutions produce findings, etc. This category of outputs is the valued dimension of the institution with regard to the using society. Hence, this is the source from which the value ladened dimension of an institution emanates. Institutions differ from organizations with respect to the extent to which they are valued by the using society. The supply of current services that an institution provides the using society largely determines the relative value with which it is held.

Influence is also an output of an institution. In fact, one measure of institutionalization is the amount of influence that it has on its environment relative to the amount of influence that its environment has on it. The process of deliberately producing influence tends to center on two major foci. The first is an effort to influence the environment with regard to improving the receptivity of it to the current service output of the institution. The other dimension of influence consists of those efforts to expand the base of support of the institution. Merely because an institution produces a flow of current services does not

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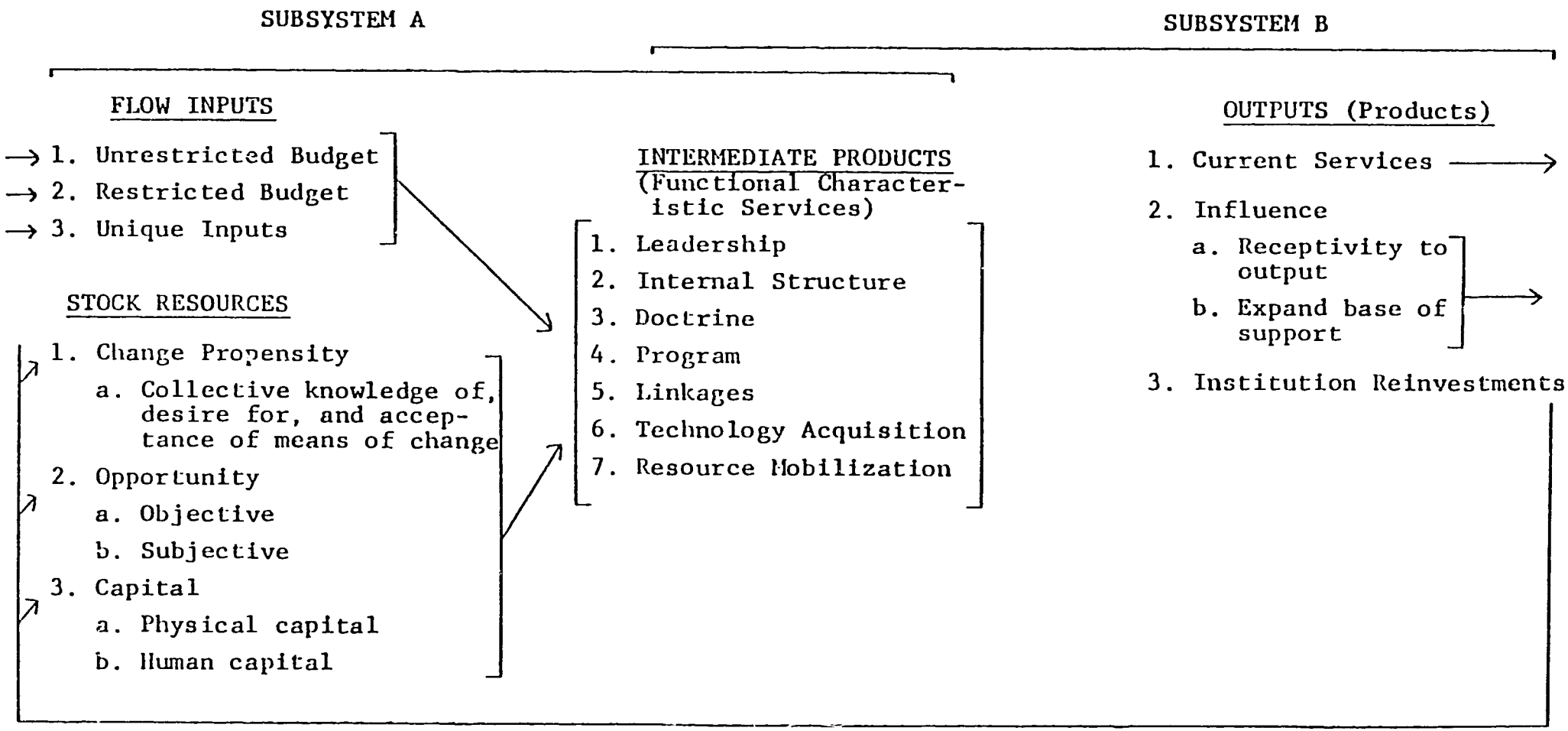
*Numerous definitions of an institution abound. It is defined here as an organization infused with value. Although most often found in the public sector, this definition does not limit them in that regard.

Figure 1

SYSTEMS MODEL OF INSTITUTION BUILDING PROCESS



necessarily guarantee its sustainability. Rather, a planned effort to expand the base of support via exertion of influence by the institution on its environment is necessary in order to capture the full component of value that the society attributes to its current service outputs.*

Institutional reinvestments are analogous to the research and development (R&D) expenditures made by private firms. They represent investments made by the institution at one point in time with a view toward improving the capability of the institution. Minimal reinvestments are needed just to maintain the capacity of an institution. Obviously, a growing, expanding one will require more. Especially in these cases, the opportunity costs of institutional reinvestments become apparent.

Intermediate products. All three categories of outputs share the characteristic of being the product of a transformation of intermediate products within the institution. These intermediate products, frequently referred to as functional characteristic services in the institutional building literature, have value only insofar as they are retransformed into the outputs of the institution discussed above. There are seven categories of intermediate products. These are leadership, internal structure, doctrine, program, linkages, technology acquisition, and resource mobilization. Each deserves elaboration.

Leadership within an institution has two components. These are the formal leaders and the informal ones. The development of leadership of both types is a terribly important part of successful institution building. Past evaluation studies have revealed that successful institution building efforts result from "smart" projects. That is to say, there is enough leadership to perceive the changing circumstances and opportunities so that the institution can adjust over time. Clearly, a profile of both types of

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*In the area of non-market goods this amounts to ascertaining that the "producing" institution is "compensated" for its output. Especially if the production process is initiated by a donor agency, the using society may become accustomed to the current service output being a free good. A valid institution building strategy should provide for use of influence to obtain "compensation" for the institution.

leadership before and after a technical assistance intervention, should provide an indication of significant change if the institution building process has made progress.

The internal structure of an institution has a major impact upon the efficiency with which it operates. The process of adjusting and readjusting the internal structure of an institution, usually through a series of trial and error activities, is important in determining the most effective mode for its structure. In addition, the most effective mode may vary as its program adjusts to changing needs.

Doctrine is one of the most illusive intermediate products of an institution. As its philosophy, or "its philosophical superstructure" that justifies its existence, it can serve as a motivational device as well as a guidance mechanism.* Frequently, doctrine is manifest in the form of slogans. Doctrine changes slowly and is of crucial importance in determining whether the institution exists for the benefit of a few elites or functions in a service capacity for the entire society.

The program of an institution involves the planning and programming functions combined. The program serves as a manifestation of the institution's doctrine or mission that justifies its existence. The program involves combining resources in an effective manner in order to produce outputs valued by the society.

Linkage relationships require effort both for their formation and their maintenance. Any institution exists in a galaxy of other institutions, some of which are supportive and others of which are competitive. The establishment and maintenance of linkages, therefore, is of crucial importance in determining an institution's destiny. Linkages must be managed with normative institutions, enabling entities, functional organizations and diffuse elements in the society.

The acquisition of technology in order for an institution to maintain its currency with regard to the state of the art applies not only to its substantive dimensions but also to the managerial technology. Especially in the Third World, the process of attempting to acquire both types of technology is an expensive and never-ending process.

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*Some authors suggest that it is analogous to genetic coding in plants and animals.

Resource mobilization involves not only acquiring financial resources, but, perhaps more importantly, involves attracting capable personnel to the institution. Resource mobilization finds itself manifest ultimately through the exertion of influence on the using society, as well as determining the human capital (staff) that the institution has at its disposal.

Subsystem A

The intermediate products summarized above have one common characteristic: they all require resources. These resources come from two categories. One is a set of flow inputs, the other is a set of stock resources. These interact in the process of producing the intermediate products. Attention will now be turned to flow inputs. Subsequently, stock resources will be discussed.

Flow Inputs

The budget dimension of flow inputs is in two parts: The restricted, and the unrestricted budget. Clearly, not only the amount of the budget but also the relative flexibility of the budget is indicated by the ratio of restricted to unrestricted budget. This ratio is important in indicating autonomy, an important aspect of any institution being evaluated.

Each institution has a set of flow inputs that are unique to it. For example, universities must have incoming students, development banks must have loan applicants, research institutions must have problems posed for analysis, etc. These inputs are unique to the essential nature of the institution.

Stock Resources

The three dimensions of stock resources are 1) change propensity, 2) opportunity, and 3) capital. Attention will be turned to them in that order.

The change propensity of an institution is its collective knowledge of, desire for, and acceptance of the means of change. Institutions tend to have collective personalities. Some are very averse to change; others are risk-takers with regard to change. Clearly, the relative freedom from rigidity possessed by an institution is

instrumental in determining its responsiveness to the changing needs of the society it serves.

Opportunity can be of two types. Objective opportunities are usually spelled out in the charter of the institution. Perhaps more important, however, is the matter of subjective opportunity. The perceptions of the leadership of the institution with regard to its opportunities to be of service are of crucial importance in determining how dynamic ("smart") an institution will be over time.

Capital is composed of physical capital and human capital. The former is the physical manifestation of the institution and is what frequently is thought of in the using society when the name of the institution is mentioned. Human capital, however, is undoubtedly more important in determining the effectiveness of the institution over time. Technical assistance efforts to augment and strengthen this dimension of capital can be expected to be of crucial importance in determining an institution's sustainability over time.

The Systems Perspective as an Organizational Vehicle for Evaluating Technical Assistance Efforts

An institution has been depicted above as having a set of flow inputs which interact with stock resources to produce a set of intermediate products which, in turn, produce a set of outputs. Two categories of outputs, current services and influence, are injected into the using society while the third, institutional reinvestments, are recycled back into the institution to augment its capability for future production. This perspective of an institution can serve as an organizational vehicle for evaluating the consequences of an assistance intervention designed to make it more sustainable over time. The subsequent parts of this paper deal in detail with these component parts and will discuss them from two perspectives: First, before and after indicators or proxies for each will be discussed. Second, the procedures for attributing that part of the change in the dimensions of the institution that justifiably should be imputed to the technical assistance intervention will be discussed.

Analyzing Components of An Institution by Segments

The four primary component parts of the model -- outputs, intermediate products, flow inputs, and stock

resources -- will now be discussed by component parts. In each case, an amplification of the meaning of the component part, methods of obtaining indicators both before and after the technical assistance intervention, and methods of making attribution determinations will be discussed.

Outputs

Of the three outputs in the generic model, current services, influence, and institutional reinvestments, the first would appear to the most obvious and easiest with which to deal. Attention will now be turned to current services.

Current Services. The primary output of an institution would appear to be relatively easily identified. That is to say, graduates of educational institutions should be quantifiable, numbers of loans made by development banks can be counted, numbers of adult education programs conducted can be determined for extension programs, etc. The apparent importance of current services is something of an overestimate of its importance if the primary objective is to determine the institutionalization of the institution. In most cases, a high correlation will exist between the level of output of current services and the capacity of the institution to continue this production. However, in some cases an institution might be living off of its institutional capital and unable to sustain indefinitely the level of output of current services observed at the time of the evaluation. If, for example, an educational institution reaped the benefits of a major participant training program to educate its faculty and has failed to provide for graduate training for future faculty, the educational institution may be "living on borrowed time." In most instances, however, there will be a strong correlation between the level of current service output and the sustainability of the institution. While this is one indicator of expected sustainability, it is not the sole one, as will become apparent as additional components of the model are discussed.

Quantification before and after the assistance intervention should be relatively easy with regard to current service outputs. In some instances, data problems may exist if inadequate records have been kept. However, with regard to data collection, this should be one of the easiest parts of the evaluation to undertake.

The question of attribution of the portion of the increased output of current services due to the assistance

intervention is much more difficult, however. In fact, much of this question has to be deferred to other components of the model that have been augmented by the assistance effort. That is, the attribution of assistance contributions to other components of the model will help to refine the gross attribution made to the assistance efforts for the change in current services. Regardless, probing questions need to be asked of top administrators with regard to the level of output that would presently exist if there had not been an assistance intervention. Likewise, data can be examined for a period of time prior to the assistance intervention to determine whether there was any significant increase in output.

While the quantity of current service outputs, both before and after the assistance intervention, may be relatively easily quantified, the changes in quality of output are much more difficult to discern. Indicators need to be examined with regard to such things as the relative success ratios of recent products of the institution as contrasted with those pre-assistance. For example, if an educational institution produced graduates who had a low success rate in graduate schools in other countries prior to the intervention, and that rate has markedly improved subsequent to the intervention, some of the difference might be attributed to the assistance intervention. Also, such things as the repayment rate of loans from development banks, value placed upon the outputs of the institution by its clientele groups, etc. need to be considered in examining the change in quality of current service outputs. Clearly, keen perception and wise insight are needed in order to identify not only the change in quality of the current service outputs, but also the extent to which that change in quality can be attributed to the assistance intervention.

Influence. One author describes influence as follows: "....a deliberate effort to change the environment so that the innovative services can be tried and accepted by larger segments of society. It is also a deliberate effort to develop support for the institution. These services must be utilized by broad segments of the economy if development is to occur."*

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*Rigney, J. A., et al. A Guide to Institution Building for Team Leaders of Technical Assistance Projects, Office of International Programs, North Carolina State University, December, 1971, p. 16.

Changes in the influence of the institution with regard to how well the environment accepts its current service outputs are difficult to measure. Nevertheless, some indicators worthy of note can be suggested as illustrations. For example, the involvement of key individuals in government in a reciprocal role with the institution is likely to augment the influence that the institution has with those individuals. In addition, many activities such as senior scholars or professionals in the host institution involving younger personnel via joint authorship of papers and articles, use of widely circulated reports, and widespread listing of good papers which may be published in more obscure media may be methods by which the younger personnel increase their effectiveness vis-a-vis key leaders in the environment.

Measuring the influence of the institution with regard to increasing the receptivity of the environment to its outputs before and after the assistance intervention requires perception of subtle changes that have occurred. Indicators such as the frequency with which key leaders of the host institution are called upon to provide advice with regard to how outputs might be utilized in the society are suggestive of those to be sought. This recognizes influence as being indicated by frequency of communication. In addition, a measure of influence that should be considered is the action taken by the recipient groups in the environment once the information has been communicated to them. This is perhaps best demonstrated by the actual record that has evolved over time with regard to what has happened to the current service outputs of the institution. For example, if the graduates of an educational institution tend to continue to be placed in the same narrow group of positions over time, there is reason to believe that little change has occurred in the influence of the institution. Likewise, if a stagnant pattern seems to exist with regard to what happens to other outputs, there is ample evidence of little or no change in the influence of the institution. The extent to which any changes in the influence of the institution can be attributable to the assistance intervention can only be determined through detailed data gathering, particularly via personal interviews. In some cases, there may be difficulty identifying and finding individuals who were involved in these activities in prior periods of its history. Nevertheless, efforts should be made to attempt to determine the functions that were performed by the technical assistance team that subsequently were found to be helpful in increasing the influence of the host institution leadership in obtaining improved utilization of its current service outputs.

The dimension of influence concerned with expanding the base of support for the host institution is more easily determined and identified. Clearly, changes in budgets over time suggest the possibility of the more effective exertion of influence on the host country environment. Caution needs to be exercised, however, to be certain that the change in financial support is not just due to inflation but exists in real terms. The second aspect of this component of influence is more difficult to deal with. That is, the determination of the impact that the assistance effort had in subsequently increasing the support for the host institution is difficult to determine.

Personal interviews with key leaders inside the institution and key individuals in the environment are necessary to identify the extent to which the assistance effort aided the influence of the institution on its funding agencies.

Throughout the discussion of influence, one point needs to be underscored. It is that ultimately the influence of the institution will be determined by the quantity and quality of the current service outputs of the institution. If, in fact, these are not of sufficient value to constitute a critical mass nor are of sufficient quality to improve the development process, little lasting influence is likely to accrue to the institution.

Institutional Reinvestments. As stated above, the institution's reinvestments in itself for the future is a crucial consideration in determining its sustainability.

Institutional reinvestments are many and varied. They may range from trips designed to broaden the horizons of key leaders in the institution to the investment in physical and human capital to directly increase the institution's capacity for future production. These have been characterized as follows: "Reinvestment outputs of the institution include additional training for its staff members, internal reorganization for greater efficiency, formulation of doctrine that keys the institution to the needs of society, etc. These products are filed back into the institution to increase its capacity to produce 'services' and 'influence' and to keep it innovative and progressive."* Clearly, the amount that an institution reinvests at one point in time will have an impact on its subsequent productivity. Specifically, the reinvestments that occurred during the time of the assistance intervention are

*Rigney, et al.

noteworthy in the evaluation process. Further, the extent to which reinvestments have continued to be made is important in determining the long-term sustainability of the institution. Quantification of these characteristics of the institution should not be difficult. However, the extent to which they can be attributed to the assistance effort must be determined by interviewing key personnel, comparing trends over different time periods, and asking questions in the analysis of a "what if?" nature.

Intermediate Products

The intermediate products of leadership, internal structure, doctrine, program, linkages, technology acquisition, and mobilization, represent services that are produced within the host institution. They have the two characteristics of 1) consuming resources in their production; and, 2) adding value to the using society only after they have been further transformed into the current services and influence outputs of the institution. Further, emphasis needs to be placed on the fact that these are viewed as services within the institution. For example, while the number of both formal and informal leaders is important in an institution, the things that leaders do, i.e. the services that they perform is the really crucial thing. Hence, each of the intermediate products should be viewed in the sense of a flow of services that moves through the institution and that has value only in the recombination of these intermediate products into final outputs of current services and influence. Each of these intermediate product services deserves elaboration.

Leadership Services

Leadership services should be viewed from the dimensions of both formal leadership, that is the things that formal leaders do, and informal leadership services, i.e., those things done by informal leaders within the host institution. Although both are difficult to document, clearly the former is more easily done than the latter because the informal leaders require identification prior to a determination of the functions that they perform within the institution.

Activities of leadership services can be documented best by starting with identification of key formal and informal leaders both prior and subsequent to the assistance intervention. The quality of leadership service provided by

these individuals needs to be further ascertained. In this case, the information can probably be best obtained from staff members within the institution and key individuals in the environment who are the target of the leadership services. Personal interviews are necessary in order to gain a perspective on the effectiveness of the leadership, both before and after the assistance intervention. Of particular importance in this data acquistion process are 1) the allocation of resources effected by the leadership, and 2) the channeling of information flows that have crucial impacts within the institution.

The attribution question is the difficult one in this case, as it is with regard to most of the additional elements of the institutional building assistance model. In this case, an effort should be made to determine the role that the assistance intervention played in training the leaders that subsequently played key roles in the institution. To the extent that discipline training programs were involved in preparing key leaders for their positions, a strong case can be made for the attribution of the change in leadership services to the assistance intervention in some degree.

Internal Structure

"The internal structure is the vehicle through which institutional management is performed... It is likely to be protective of the 'power structure' that installed it. It undoubtedly served many useful purposes in times past.... Internal structure is an institutional variable, and it should vary over time in a manner that will serve the other variables most effectively; i.e., reorganization must take place from time to time."*

Documentation of changes in the internal structure of an institution are probably some of the easiest intermediate products to identify. Clearly, changes in the internal structure of the host institution from the period prior to the assistance intervention to that during and after it should be easily ascertained.

Determination of the extent to which the assistance intervention played a role in modifying the internal structure is more difficult to determine. Again, interviews with key individuals, especially those directly involved in reorganizing an institution, is probably the only way of

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*Rigney, et al.

determining the extent to which the external intervention was responsible for the reorganization. If possible, information concerning this should be obtained from both the former technical assistance personnel and the leadership of the host institution.

Doctrine

Doctrine is the philosophical superstructure that holds an institution together. It is a statement of mission. It is value laden and is frequently controversial. It serves to motivate and cause people to contribute above and beyond the normal call to duty. It may be expressed in the form of slogans.

Articulation of doctrine is frequently difficult to find, especially in an evaluation which requires expost and exante information. In many instances, basic documents such as the project paper and other preassistance intervention documentation can help to establish the doctrine of the institution prior to its being impacted. Further, indicators from the host institution's own records may be obtained in determining "what the institution stood for" prior to its obtaining external assistance. Expost statements of doctrine may be more easily obtained. If not in written form from secondary sources, expressions of doctrine should be able to be solicited from staff members in the host institution and key positions in clientele groups, including government.

If a significant change in doctrine has occurred, the extent to which it can be attributed to the external assistance effort needs to be estimated very carefully. Among other indicators, the background and educational preparation of those responsible for defining and articulating doctrine is important. Finally, determination of why key individuals hold the positions they do with regard to doctrine can best be obtained via personal interviews.

Program

Program provides the framework for transforming resources into final products. It is the operational manifestation of doctrine. It includes both the planning and programming functions. The planning component involves the set of choices about how an organization will utilize the resources it has available and what mix of outputs it

intends to provide. It serves as the embodiment of the technological and social interventions, articulated in the form of doctrine, by which the institution's stands are converted into specific products and services.

The most obvious indicator of changes in a program overtime are of changes in the output capacity of the institution. However, merely comparing numbers concerning the outputs of the institution between time periods does not provide an indication of how well this planning and programming has been institutionalized. In addition to tabulating changes, a narrative explanation of the evolution of the institution's program over time, identifying causal factors wherever possible, is essential to understanding the modifications that have occurred in the programming function.

The determination of the extent of change in program attributable to the assistance intervention is even more difficult. To the greatest extent possible, key decisions need to be identified and the inputs that went into those key decisions determined. In turn, the component parts of these causal factors need to be identified as a consequence or not a consequence of the intervention strategy. Personal interviews, especially with formal institutional leaders, represent the best source of information at this point.

Linkages

The institution building literature identifies the following four types of linkages: enabling linkages, nominative linkages, functional linkages, and diffuse linkages. Regardless of the categories of linkages, they represent interpersonal relationships between representatives of the institution and elements in the greater society. Transactions occur through these relationships. They represent the conduits through which the efforts of the institution's leaders manage its relationships with its environment. These conduits require effort in both their establishment and maintenance. The type of efforts made in these regards differ somewhat according to the type of linkage involved. Time does not permit a discussion of each of the four types. They are extensively covered in the institution building literature, however.*

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*See Blase, Melvin G., Institution Building: A Source Book. First Ed., Beverly Hills, CA: Sage Publications, 1974, 325 pp. Special attention is called to the discussion of Esman's contribution in this regard.

Regardless of the type of linkage involved, the importance attached with establishing and maintaining these relationships cannot be overemphasized. A determination of the extent to which the linkage relationships changed (before and after an assistance intervention) is difficult to quantify. However, such things as frequency of contacts with the host institution initiated by other groups provide an indication of the interface the institution has with others. The mere identification of groups in the environment with which the host institution has some contact is an initial point of departure for determining the before and after linkages.

The attribution of the extent to which the changed linkage relationships can be due to the assistance intervention is another question. The primary means of obtaining this type of information must be via personal interviews with key leaders in the host institution, both before and after the intervention occurred.* Identification of the source of ideas and methods of initiating the change in the linkage relationships is crucial in this interview process.

Technology Acquisition

Isolation is a major enemy of change in institutions in the Third World. This isolation prevents the institution from acquiring two types of technology that are relevant for the institution building process. The first type is directly related to the functions performed by the institution. These technologies are those usually associated with whatever the institution is performing. For example, in the academic world, this would constitute disciplinary technology in the various fields incorporated in the educational institution. However, there is another type of technology also. It concerns the organization and management of the institution itself. This managerial technology is also of strategic importance with regard to the growth and development of the host institution.**

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*If time permitted, the development of an "institutional sociogram" would be instructive at this point. For a discussion of this methodology formulated by Jacobson and applied by Anderson, see Institution Building: A Source Book.

**The new management techniques made possible by the "computer revolution" is a case in point.

Technology acquisition does not happen accidentally. Rather, deliberate efforts have to be made to ensure the flow of both disciplinary technology and management technology. The disciplinary technology impacts the quality of the current service outputs of the institution. Management technology impacts the efficiency with which the institution is run. Clearly, both are extremely important in determining the ultimate sustainability of the host institution.

Gaining insights into the consequences of the assistance intervention into the technology acquisition process is both simple and difficult. On the one hand, the technology that has been acquired via the participant training program and the one-on-one training from technical assistance counterparts is relatively easily identified. On the other hand, actions taken by the assistance intervention to make this technology acquisition process sustainable after the withdrawal of assistance to this technology acquisition process, is more difficult to ascertain. Initially, a mere indication of the changes between the assistance and after it with regard to the technology acquisition process is an indicator of what has happened. More details, however, have to be obtained in order to determine the insights provided into the technology acquisition process via the assistance personnel while they were present. Such things as subscriptions to journals that have been continued, participant training programs that have been both completed and graduate programs that have resulted from the assistance should be ascertained. Determination of the more subtle aspects of this intermediate product, however, with regard to the institutionalized dimension of the technology acquisition process, is dependent upon personal interviews with key leaders in the host institution.

Resource Mobilization

Just as deliberate efforts are required to obtain new technology, so too are specific efforts needed to mobilize resources. Moreover, this process of resource mobilization needs to be institutionalized because it is a crucial element of the whole sustainability question. Used in this sense, resource mobilization involves a wide variety of elements such as money, people, access, etc. Just because a set of current service outputs of admirable quality has resulted from an intervention strategy, a sustained flow of resources into the institution will not necessarily result. In fact, many institution builders have been severely disillusioned to find that this did not occur. Hence,

deliberate efforts are needed to ensure the establishment of a resource mobilization capability within the institution.

In evaluating the change in the resource mobilization dimension of an institution over time, several obvious indicators need to be considered. First, there needs to be some determination of the extent of the resources devoted to this function, both before and after the intervention assistance has occurred. For example, have host institution personnel mastered the "art of grantsmanship"? Second, the specific activities undertaken to mobilize resources need to be enumerated both before and after the intervention occurred. Third, the continuing aspects of the resource mobilization process that have been sustained need to be determined. Fourth, the effectiveness of the resource mobilization program needs to be determined for both the before and after situation.

Via interviews with key leaders from the host institution the role of the technical assistance personnel can be determined with regard to the process of increasing the institution's capability to mobilize resources. The identification of specific caselets of strategy obtained from the technical assistance team is of considerable interest. Likewise, any specific efforts to train institutional leadership in this area are noteworthy. Finally, any additional aspects of this process which can be obtained from reading reports filed by the technical assistance team will be useful in determining the extent to which improvements in the functioning of this dimension of the institution is attributable to the technical assistance effort.

Flow Inputs

Flow Inputs might be considered the essence of the "fuel that keeps the institution running." They can essentially be divided into two categories. The first concerns budget, the other are inputs unique to the class of institution involved. Each deserves elaboration.

Budget Inputs

Budget inputs can usefully be divided into non-restricted budget and restricted budget. Because of the flexibility afforded by the former as contrasted to the latter, this dichotomy is worthy of explanation.

There is both merit and danger associated with an unrestricted budget. While administrators of the host

institution will almost always be pleased with the availability of unrestricted budget because of the greater amount of control it provides them, there is also danger associated with it. Especially in the early years of either the life of the institution itself or of its innovation phase if an existing one, there is a danger in that the lack of restrictions on the budget may make a significant difference with regard to the care with which these funds are expended. Especially during the crucial initial period, wise utilization of resources is important for establishing the credibility of the institution. Restricted budget items significantly limit how administrators can utilize funds. Consequently, restrictions represent a dimension of control of an institution exerted by the funding agency. In some instances, innovations are virtually impossible because of the constraints within which the institution is placed by its funding categories. The dimension of change that is important at this point is the extent to which the proportion of funds has been modified to improve flexibility of their use by the host institution's leadership.

Indicators or proxies of these budget items are clearly easily obtained. The only warning that needs to be expressed at this point is the need to consider inflation in making comparisons in budget amounts over time. After appropriate inflation adjustments have been made, comparisons in budget items by the two categories can be made appropriately.

While the identification of the quantities of budget in the two categories is relatively easily accomplished, the problem of determining the role of the assistance intervention in influencing their changes is much more difficult. Interviews not only with leaders in the host institution but also in the funding agencies are essential to determine the reasons for changes in the funding categories over time. Of course, special interest should be given to the period of assistance as compared to the period thereafter.

Stock Resources

If a snapshot were taken of an institution at one point in time, it would primarily reveal dimensions of the institution's stock resources. These are relatively slow to change, have reasonably clearly identifiable dimensions, and are reasonably available for analysis. The three components of this category -- change propensity, opportunity, and capital -- will be discussed separately.

Change Propensity

Institutions have a collective personality analogous to the personality of individuals. Specifically of interest in this personality is the change proneness of the institution. As a collectivity of individuals, institutions exhibit a given change proneness. That is to say, they exhibit a collective knowledge of, desire for, and acceptance of the means of change. If the assistance intervention has had an impact at this crucial juncture, the institution's change proneness will have changed over time.

Institutions, by virtue of their value infusion, are closely related to the society and its value system. To deviate from this value system represents a traumatic event. Hence, if an institution is in an environment which is very status quo oriented, it too will likely have a value system that abhors change. In that case there must be a change in the orientation of the institution with regard to change itself. That, in turn, means that the institution must divorce itself partially from the value system of the environment and take on one of the crucial dimensions of the value system of the larger world community, i.e. a cognitive orientation to change as the means to development. If the technical assistance intervention has been successful, one of the dimensions that will have been modified will have been this orientation to a change as a vehicle for development.*

Proxies to indicate the inclination of the institution toward change are difficult to identify. Perhaps the best single source of information in this regard is the record of institutional performance with regard to change in its program over time. If prior to the assistance intervention the institution appeared to "be in a rut" and changes have resulted subsequent to the assistance intervention that has resulted in its being willing to undertake new tasks, the question then evolves as to the reason for this change having had occurred.

If the question of measuring the change proneness is difficult, the question of the attribution of the change in change proneness is even more difficult. Again, project

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*See the review of Powelson's discussion of this process in Institution Building: A Source Book for more details.

reports, interviews with key host institutional personnel, and discussions with leaders and clientele groups in the larger society can provide insights as to the extent to which the change in the change proneness of the institution should be attributed to the assistance effort. But more important, the sustainability of the change proneness of the institution needs to be considered. After all, if a change in change proneness occurred that is not likely to be sustainable, the end result will be a regression to an old, stagnant institution.

Opportunity

Closely allied to the concept of change proneness is the concept of opportunities open to the host institution. As stated earlier, these are of two types. First, there are the objective opportunities as manifest in specific statements such as an institution's charter. Second, there are the subjective dimensions of opportunities which get at the leadership's perception of the opportunities the institution is facing. Very frequently, the latter is more constraining than the former. Part of the institution building accomplishments of an intervention strategy should be to broaden the horizons of institutional leadership to enable them to see new opportunities for the institution to be of service.

Quantification of the change in objective opportunities is much more easily accomplished than is the case for subjective opportunities. If there has been a charter revision or if there are new elements of legislation broadening the charge to the institution as part of its funding documents, etc. there is clear evidence of changes in objective opportunity. On the other hand, subjective opportunity represents the difference in insights of institutional leaders. These are probably best manifest in a type of program that the institution evolves over time. If the institution elects to take an aggressive stance, which is manifest in new activities launched, there is considerable evidence that an expansion and broadening of the horizon of the institution's leadership with regard to its opportunities to be of service has taken place. On the other hand, if the institution has not made significant changes in its activities, there is reason to believe that there may have been little change in the perception of opportunities afforded the institution.

Regardless of whether or not the change in perceived opportunities has been small or large, the difficulty of

attributing this to the assistance strategy is apparent. Assuming that interviews with the technical assistance personnel themselves are not possible, this information will have to be gleened from the host institution personnel interviewed on site. The most important dimension of this interviewing process will be the question of the inclusiveness of the interview. Clearly, personnel should be interviewed who have been involved in the institution previous to, during, and subsequent to the assistance intervention.

Capital

The capital stock of the host institution can be divided into two component parts. The first is its physical capital. The second is its human capital.

The physical counting of both physical capital and human capital is relatively easy. The quality dimensions of both require more deliberate data gathering efforts, however. Inventories of both, prior to and subsequent to the assistance intervention, represent beginning points for this analysis.

The attribution of the changes in the capital of the institution is one of the easier tasks confronting the evaluation team. In most instances, project reports will indicate the external assistance for such things as laboratory equipment, computers, participant trainees, etc. However, some of the more subtle continuing, sustainable dimensions of this variable become terribly difficult to associate with the assistance intervention. Via personal interviews and discussions with individuals in both the host institution and recipient clientele groups, the analysts need to obtain the best evidence possible to determine the extent to which this should be attributed to external assistance.

Summary of Systems Model

The above represents a "set of glasses" through which an institution can be viewed. This perspective suggests that there are outputs, intermediate products, flow inputs and stock resources that represent the most obvious focal points of an institution. Further, subdivisions of each of these begin to provide "handles" for analyzing the extent of change over time, in general, and the proportion of that change attributable to the assistance intervention, in particular. Although the framework presents a point of

departure for gathering data and asking questions, its use in the evaluation procedure depends largely upon the ability of skilled analysts to make reasoned judgments concerning the attribution of effects to appropriate causes.

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