A HUNGRY WORLD: LESSONS FROM A LAND-GRANT SCHOOL PERSPECTIVE*

By Harold O. Carter**

It is ironic to meet in one of our most productive farm states to address the chronic problems of underproduction, hunger, malnutrition, and poverty. The irony is even more acute with the realization that U.S. farmers are facing their worst financial crisis in half a century, due in no small part to their success in production, while millions of farmers in other regions of the world can't produce enough to feed even their own families. This disparity between the industrialized and developing nations not only emphasizes the complexity of the global food problem but also is an everpresent reminder of the long-term nature of the development process.

My comments relate mainly to the role of land-grant universities in development assistance. I contend that aid and assistance for building and strengthening national or indigenous agricultural research and teaching institutions in developing countries have the highest potential, long-run payoff for the world community; yet this vital link in the international research/educational system has received low priority for at least 15 years, and there is little hard evidence of any serious commitment from the international aid agencies in the near future.

Further, I contend that U.S. land-grant universities can help developing countries to establish viable agricultural research and education systems, but not in the mode of the 1950s and 1960s. In formulating a new approach we need

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to recognize that: (1) The needs of low income countries are different now; requiring more and a wider range of research, teaching and organizational skills than what any one or group of American universities can provide while still maintaining quality programs at home. (2) An expanded and significantly improved global agricultural research and extension system operating today must be mobilized and coordinated for this important task. Our agricultural universities should become an integral part of this larger network. (3) Building human capital and institutions is a long-term investment where progress isn't measured on a project-by-project basis.

For the remainder of my presentation: First, I will give a current assessment of the world food problem(s). Second, I will discuss the changing philosophic and programmatic emphasis of aid agencies, including the role of land-grant universities since World War II. Third, I will consider the changing global dimensions of the agricultural research environment. Finally, I will offer some suggestions for redefining the role of American universities and the international community for future involvement. I don't deem it necessary to restate the case for the importance of human capital formation in development (Schultz 1971) nor to review the extensive literature showing high economic returns to public research investment (Arndt et al. 1977, Evenson 1979).

Current Assessment of the World Food Problem(s)

Even the most casual observers are aware of the persistence of world food problems. The extreme disparity in living standards between industrialized and developing nations has been brought to the attention of everyone by the news media in the post-World War II era. All in the developed world are reminded periodically of the precariousness of the food/population balance in some poor areas of the world. The monsoon failures in Asia are memories only

two decades old. A spate of events in the early 1970s adversely affecting international commodity prices and world food supplies, led to convening a World Food Conference in 1974. Both the concern and the rhetoric were unforgettable as U.S. Secretary of State Henry Kissinger enunciated the goal of the conference:

> ". . . that within a decade no child will go to bed hungry, that no family will fear for its next day's bread, and that no human being's future and capacities will be stunted by malnutrition." [United Nations 1974].

In the Wake of the World Food Conference

No one contends that the Conference's goal has been realized, particularly after the tragic events still unfolding in Sub-Sahara Africa--nor did anyone seriously expect it to be. The Conference, itself, as well as the prodigious number of books, reports, and articles that emerged just before and for several years after, helped identify the complexity and enormity of the problems to be solved but did not lead to consensus about a worldwide food strategy.[1] But several lessons can be gleaned from this vast literature.

Lesson One. A first lesson is that there has been a propensity by some to oversimplify in their attempt to explain "the global food problem." Even the familiar term "LDCs" conjures up an image in the minds of many that poor countries are all alike. Then some tend to generalize from a single tragic, well-publicized event in one country to the "LDCs." In this context, lifeboat theories get more credence from the public then they deserve. Also, demands for quick-fixes to complex problems get disproportionate attention from policy

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[1]See, for example, Falcon 1984, Resources for the Future 1984, Hanrahan et al. 1984, Johnson, D. G. 1984, Mellor 1985, U.S. Congress, October 1984. For an extensive bibliography see Ball 1981.

makers and detract from more substantive longer run efforts to deal with underlying causes rather than symptoms.

Lesson Two. A second lesson is that hunger is an elusive concept to define and agree upon. Poleman [1981], a long time critic of nutrition assessment studies, contends that while extreme statements about hunger (e.g., . . . the world is teetering on the brink of mass starvation) are more than just unbridled lust for personal recognition, for they reflect our inability to accurately measure many of the parameters that enter the food equation.

The food equation contains several crucial components, including food availability, nutritional levels, and population growth. Measurement of food availabilities requires a considerable investment in reporting systems not generally available in poor countries; the resulting bias, Poleman argues, tends to be in the direction of understatement of food availability. Conversely, food requirements which are a function of age, sex, body size, activity, health status to mention a few, have been biased upward. For example, recommended daily allowances of protein and calories have been revised downward over the years by official nutrition agencies.

Poleman [1982] also questions whether general nutritional levels have deteriorated, as some contend, when life expectancy in poor countries has increased from 40 to 55 years in the last three decades. (Life expectancy in developed countries, however, still exceeds that in developing countries by 10 to 20 years.)

Population growth is influenced by changing social attitudes, economic factors, new developments in human fertility control, improved health care, disease prevention, public sanitation, and education; all of these are difficult to assess. In 1974, the UN world population projections for the year 2000 ranged from a low of about 6 billion to a high of over 7 billion.

The current median projection for 2000 is near the low variant. Estimates have been revised downward by the equivalent of almost four Bangladesh's--a reduction of about 400 million people. Still, even this represents a 40 percent gain in world population over 1980 levels.

Researchers are generally cognizant of the assumptions and deficiencies of such food evaluations but the footnotes and caveats tend to be overlooked when the data fit predilections or when editors are looking for a gripping lead for a story. Eberstadt [1976, p. 32] writing in the New York Review of Books calls this the Catch-22 of food reporting, "If you read prognostications, they are probably not worth taking seriously for the very reason that got them in the paper."

Lesson Three. A third lesson is to distinguish between temporary and permanent structural changes, preferably without a crystal ball. Regional food studies require a number of crucial assumptions about the present and future regional population, the extent of the people's well-being, their ability and likelihood to purchase food, the resources and productive capacity of the regions to provide food, the will and incentive of its people to do so--to mention only a few. Then, after careful analysis of all these factors and more, come empirical estimates of the ominious food gap.

Most of the world food studies conducted in the 1960s and 1970s project growing deficits in production relative to consumption in most developing countries for 10 to 30 years into the future. Many of these studies also conjectured increasing real food prices. But Fox and Ruttan [1984], D. G. Johnson [1984] and others suggest that most of these projections are not consistent with postwar trends nor even with trends after the studies were conducted. They contend that these apparent inconsistencies arise from insufficient attention to more transitory demand-side influences, while being

preoccupied with negative supply factors. The shock of grain shortfalls in the early 1970s, for example, seems to be indelibly printed in the minds of researchers and policy makers--i.e., what Paarlberg calls the scarcity syndrome [1982]. While models have become increasingly sophisticated, and less aggregated, we still have much to learn about modeling the complexity and the dynamics of the food system.[2] And quality of the data for many countries is an obvious handicap. Having had some experience in these endeavors leads me to advise projecting for the long term sometime after one's retirement date.

Has There Been Any Progress?

What can we conclude about progress toward solving food problems in developing countries after more than three decades of individual country effort and global assistance?

First. In spite of occasional statements to the contrary, worldwide there has been a relatively steady upward trend in food production both on an absolute and per capita basis. Total food production doubled between 1950 and 1982 yielding a yearly compound growth rate of about 2.6 percent [Hanrahan 1984, pp. 2-3]. The comparable growth rate for developing countries was 3 percent, slightly higher than the rate for developed countries.[3] However, the rate of growth in per capita food production was lower for developing countries, gaining only at a 0.6 percent yearly rate because of rapid population growth.

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[2]A review of 15 major food studies over the last 20 years is in Schertz 1984.

[3]This comparison is somewhat misleading because domestic policies in many developed countries were constraining output to maintain higher prices.

While overall gains have been realized, there are wide differences between regions. East Asia (excluding Japan and China) has shown the most rapid gains in per capita food production. Rural reforms in China are producing favorable agricultural results. Even some of the traditional trouble spots in Southeast Asia have managed to increase per capita food production in the last decade. Similarly, some major countries in Latin America have recently increased per capita food production, but declines were experienced in a few of the smaller Latin American countries. In fact, one sign of progress is that nations are now classified as low-income, middle income, and high-income developing countries, and we even have "graduates" to the higher categories. Sub-Saharan Africa is the only region in the world that persistently shows declines in per capita food production over the last two decades. The current tragedy is the result of several factors including drought, strife, and government mismanagement. Countries of North Africa face an uncertain future as they continue to rely on heavy shipments of food imports, on both commercial and concessional terms. Thus, the record overall just since the World Food Conference in 1974 is mixed for developing countries: Some areas have exhibited vast improvement while others, particularly regions in Africa, give rise to increasing concerns.

Second. Events that have unfolded since 1974 provide additional evidence that expanded production for meeting global nutrition goals is a necessary but not a sufficient condition. Better distribution of food within and among nations and the wherewithal of people to purchase the food remain for many of the poor countries as elusive as they were a long time before the Conference. The crises of shortfalls in world grain stocks that emerged in the 1960s and again in the early 1970s is in sharp contrast to the situation in the last decade. Now the United States and other exporting nations, including some new

members of the "club," ponder whether markets and acceptable prices can be found for rapidly growing surpluses. The answer to the question of the early 1970s about whether the era of rising real grain prices had arrived, seems to be a resounding "No"--at least for now. The longer-run answer depends on the priority that the United States and other countries give to investment in agricultural research.

Third. The growth in trade among nations is now considered to be more closely tied to world economic developments. By the year 2000, only 19 percent of the world's population will live in the most developed regions--a decline from 23 percent in 1980 [Resources for the Future 1984, p. 4]. In spite of the current grain surplus, Mellor [1984] and others [Thomas 1983] contend that all food exporters must, in their own best interest, recognize that their major potential markets are in developing nations, particularly the middle-income countries. These markets will be enhanced if lower income people whose income elasticities for food are higher share in growth [Yotopoulos 1985]. If indeed this is the case, there is a compelling self-interest argument for industrialized countries to accelerate technical assistance to poorer countries and to remove obstacles to more liberalized international trade.

The Changing Role of Aid Agencies in Development Assistance

The Land-Grant School's Role in the 1950s and 1960s

In the post-World War II era, the United States emerged as one of the superpowers with acknowledged superiority in industrial, agricultural and scientific capacity. American agriculture which had helped feed much of the world during and immediately after the war was clearly the envy of the world

and considered by many to be the model to be emulated in agricultural development.

Spectacular success with the Marshall Plan in rebuilding Western Europe seemed to indicate to some that transferring American agricultural know-how and technology to poor countries would work equally well. The United States as a nation was formally committed to agricultural development assistance when on January 20, 1949, President Harry S. Truman delivered the now famous "Point Four" of his inaugural address. Early emphasis in Point Four programs was on assistance to extension services and training institutions, mainly universities [U.S. Congress 1981].

Government-sponsored university involvement began in the 1950s when a number of agricultural colleges were asked by Henry G. Bennett, first administrator of the Technical Cooperation Administration (TCA), to establish and strengthen research and educational institutions in developing countries. Bennett, a former land-grant school president, was a firm believer in the land grant concept. He was well aware that the process was more than simply cloning our schools in foreign countries. After his appointment, he went on to state, "We should not try to transplant our own institutions intact to foreign soil, but rather to help other people develop the kind of institutions that suit their own particular needs."[4]

Lack of formal experience in institution building by college administrators and faculty did not hamper their enthusiasm nor commitment. The approach used extensively in the 1950s and 1960s was a simple contractual arrangement creating a "sister" relationship between a university or consortium of universities in the United States with a university in a developing country.

4Cited in Eddy, Jr. 1956, p. 252.

Beginning in 1952 and extending into the early 1970s, following the lead of the University of Illinois, a consortium of six land-grant universities helped nine states in India build new agricultural universities. Read [1974] records this fascinating and largely successful institutional building effort in his Partners With India: Building Agricultural Universities. Methods and approaches varied with each university but common elements included American university advisors assigned to India, training in the United States for Indian students and faculty, and upgrading of equipment and libraries to improve teaching, research, and extension. From this beginning, by 1978 a total of 21 agricultural colleges were established in India, some with several campuses [Ruttan 1982, p. 94]. Most would agree that some of India's agricultural successes in the 1970s must be credited to these early efforts in the nine Indian states.

During the same period, Cornell University worked closely with the College of Agriculture of the University of the Philippines in Los Banos in a similar institution building venture that has been widely acclaimed. Wharton [1982, p. 28] credits some of the early success of the International Rice Research Institute (IRRI) to its location adjacent to the College of Agriculture in Los Banos.

Brazil's national research and extension system has benefited immensely from its relationship beginning in the 1960s with a host of U.S. universities including Purdue, Wisconsin, Michigan State, Ohio State, and Arizona. Other university involvement in Latin America during these early years includes the California Convenio with Chile, North Carolina State with Peru, Iowa State in Mexico, just to mention a few. It can be noted that the research institute model that emerged in the late 1950s in Latin America with its decentralized administrative control bears striking resemblence to the land-grant research

system [Pineiro 1985, p. 6]. Similar work in Nigeria by Kansas State, Colorado State, Michigan State, and Wisconsin also is well known.

The emphasis of AID assistance shifted somewhat in the 1960s as it became apparent that western technology was not generally adaptable to local conditions. Fewer AID resources were devoted to extension and increased attention was given to strengthening national and regional research institutions. University faculty also became involved on an individual basis, or as part of a team, as they were recruited by aid agencies, foreign governments, and private foundations to supply scientific expertise either as consultants or in an advisory role for national governments and research agencies.

The investment in human capital made by our universities on their home campuses is another important, if not the most important, dimension of our continuing involvement in development. Just before Point Four (1946-47), about 15,000 foreign students were studying in the United States [Parsons 1957, p. 236]. Ten years later the number was about 36,000 with about 21 percent enrolled in land-grant universities. Almost one-half of all foreign students came from Africa, the Middle East, and Asia; about one-fourth from Latin America; and the remainder from other developed countries. According to Parsons [1957, p. 237], over half of the foreign land-grant students were studying for advanced degrees in 1955-56. In the 1960s almost 1,500 American doctorates (Table 1) were awarded to foreign students studying agricultural sciences and agricultural economics. This number doubled in the 1970s. The total since 1960 is 6,320.

Table 1. Agricultural Science and Agricultural Economics Doctorates (Temporary Residents in the United States)

	Year of Doctorate (numbers)			
	1960-1969	1970-79	1980-84	1960-1984
Agricultural Sciences	1,447	2,473	1,500	5,420
Agricultural Economics	26	553	321	900
TOTAL	1,473	3,026	1,821	6,320

Source: National Research Council, Office of Scientific and Engineering Personnel, Doctorate Records File.

These examples of university involvement and institution building were accomplished mostly in the 1950s and 1960s and included at various times the cooperative efforts of AID, Agricultural Development Council, and the Ford and Rockefeller Foundations. How successful were these efforts? The answers are mixed. The contract university "success stories" that are usually cited were long-term arrangements with continuity provided mostly by dedicated regular faculty members. A considerable amount of research entrepreneurship seems to be a factor as well.

Graduate and post-doctoral training were generally an important part of the effective programs. Here the concerns were less about the quality or rigor of the training received in our institutions than of its applicability to handle the kinds of problems encountered in developing countries [G. Johnson 1983, Fienup 1974]. The neglect of nondegree training by our universities is of particular concern. Another concern has been the "brain drain" where students, after receiving their training, sought employment outside of their home countries. The long-run goal, of course, is to establish reputable indigenous institutions which would eliminate the need for large numbers of students to leave home to obtain training. Some progress is evident. Fienup [1974, p. 1185] reported even more than ten years ago that

Asia and Latin America generally have or are approaching the capacity to train professionals in agricultural economics through the masters level but only a select few can offer a U.S. type Ph.D. degree.

Some have criticized the university contract arrangement as an ineffective instrument for research either for the discovery of new knowledge or technology [Ruttan 1982, p. 123], while the short-term advisor-counterpart or consultant model for transfering temperate zone technology was generally viewed even less favorably. In retrospect, it was "learning by doing" since faculties had no previous experience in building departments in another culture, much less entire universities. Expectations on both sides were unrealistically high about what could be accomplished in a relative short period. Hill [1964, p. 1093], then with the Ford Foundation, cautioned over 20 years ago that progress even at home was not always fast. Of the 43 land-grant colleges started between 1862 and 1879, only five were rated "great American universities" in 1910, over 30 years later. Willard Cochrane, in his illuminating book on the Development of American Agriculture [1979, p, 245], notes that perhaps only a dozen agricultural experiment stations were successful in forging highly professional work in the agricultural sciences by 1900.

The lessons of our first two decades of agricultural development assistance were a humbling experience for all involved. Agricultural development was recognized as a complex dynamic process requiring both dedicated effort and patience.

New Directions in Assistance

By the early 1970s, the philosophy of aiding developing countries made an abrupt shift. "Modernization" or transfer of developed countries' techniques fell from favor, and small became beautiful in international circles as well

as in the United States. Growth with equity came in vogue; small farm project were "in" as the best means to reach the rural and near landless poor. Quoting from an AID position paper: "Building institutions at the national level went out of fashion, even though AID continued to work largely through government organizations to carry out its new mandate. The focus, therefore, shifted away from building colleges and universities, away from national planning organizations, and toward encouraging local self-help . . ."[6] Similarly, in a 1973 speech, World Bank President Robert S. McNamara announced the bank's development strategy shift towards helping small farms, but also toward supporting the development of new rural institutions.[7]

The Role of the International Research Centers

By the early 1970s aid-agency institution-building support shifted to the international agricultural research centers, in what has been termed "shortcuts" to deal with inadequate national agricultural research systems [Mellor 1980, p. 22]. The research emphasis of the international centers on food crops for domestic consumption rather than export crops was also more in line with the new small farm policy orientation of bilateral and multilateral aid agencies.

From the beginning in 1960 when the International Rice Research Institute (IRRI) was established by the Ford Foundation, the system has evolved to its present 13 geographically-dispersed centers.[8] The Consultative Group on

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[6]Quoted in Wharton 1982, p. 12.

[7]Robert S. McNamara, Speech to the Joint World Bank IMF annual meeting at Nairobi, September 1973. Cited in U.S. Congress, October 1984, p. 269.

[8]Other international centers outside of CGIAR include, for example, The International Fertilizer Development Center in the United States, The Asian Vegetable Research and Development Center in Taiwan, and the International Center for Insect Physiology and Ecology in Kenya.

International Agricultural Research (CGIAR), formed in 1971, coordinates the centers. Funding for the international agricultural research centers grew dramatically from $20 million in 1972 to now over $180 million. Support for CGIAR comes from about 40 donors including countries, development banks, international organizations and foundations. The United States, a charter member, provides about one-fourth of the total funding.

While currently there are no formal links between the centers and land-grant universities, cooperative arrangements are being made with a number of developed country institutions for backup research at home institutions and graduate dissertation work at centers. The potential is great for linking centers and universities around the world considering that about half of the senior staff of the centers received advanced training from American universities and about another 40 percent from other developed country institutions.[9]

The reversal in AID support to the international centers can be clearly seen in the preciptious decline in AID-financed university contracts and grants (food and nutrition, health, education and others). In 1970, AID grants totaled $189 million for 119 contracts among 66 universities. By 1974, grant funds had fallen to $60 million for 47 contracts among only 32 universities. Funding and participation remained through the rest of the 1970s at about this same reduced level [U.S. Comptroller General 1981, p. 4]. In 1981, AID spent about 20 percent of its total appropriation for

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[9]Currently, of the 625 senior scientists in the international research centers, 40 percent received their highest degree from U.S. land-grant universities, 12 percent from other American universities, 39 percent from other developed country institutions, and 9 percent from developing country institutions. A significant proportion of these scientists received their first degree from a developing country institution.

agriculture, rural development, and nutrition on agricultural research (including funding for international research centers) and in the last few years the research shares has been in the 13 to 19 percent range [U.S. Agency for International Development 1983, p. 4]. Some are concerned that if U.S. support for the international research centers remains fixed at the 25 percent level, eventually this commitment will absorb AID's entire research budget [Wharton 1983, p. 11].

Almost as soon as CGIAR was established it was recognized that international research centers are more complements than substitutes for national research systems within the developing countries. By the mid-1970s only a few national research systems, e.g., India, Brazil, and the Philippines, had the institutional capacity to effectively use the information and technology becoming available through the international centers, from developed countries and from the more advanced developing country institutes [Ruttan 1982, p. 126].

This recognition of the need to strengthen national research systems prompted, in part, work in the centers on what is now referred to as Farming Systems Research (FSR). FSR, a holistic systems approach, also kept the focus on small farmers [CIMMYT, p. 363]. Also to strengthen national research systems, in 1980, CGIAR established yet another center: the International Service for National Agricultural Research (ISNAR). ISNAR's purpose is to provide more of a consultative or outreach role to assist national governments in identifying their institutional research needs. This assistance is a necessary first step for building and maintaining strong national research systems in the poor countries but follow-up support is needed.

Redefining the Role for University Involvement Under Title XII

Congress expressed concern about the quality of AID's agricultural technical assistance and reacted to the downgrading of land-grant university participation in the AID development plan by passing in 1975 Title XII: Famine Prevention and Freedom From Hunger Amendment [U.S. Comptroller 1982, p. 1]. Title XII provided for the establishment of a Board for International Food and Agricultural Development (BIFAD) which was given broad and significant policy responsibility for revitalizing U.S. agricultural universities for development assistance. The especially appealing new elements of Title XII called for universities' participation with host countries in the design and definition of the scope of the work, and gave them the management and organizational responsibilities to carry it out. This significantly departed from the old contracting model in which various universities competed for contracts where the scope of work was already specified by the contracting agency. A most serious flaw in the Act was the failure of Congress to provide separate funding sources for Title XII activities and to give BIFAD autonomy with operational authority of the program. Thus, funding must compete with existing projects in the AID budget, and operational authority remains with AID.

Nine years have elapsed since BIFAD was formed under Title XII. After six years the General Accounting Office (GAO) review concluded "AID and the Title XII community have yet to forge a partnership to fight world food problems" [U.S. Comptroller 1981, p. 33]. That the same thing could be said today does not mean the effort is without merit. Given the administrative and funding constraints, much has been accomplished [Wharton 1983]. I will return to this topic in the final section.

The Changing Global Dimensions of Agricultural Research

At the beginning of this century only a few advanced countries had viable and productive agricultural research systems. In the post-World War II period, however, many developing countries had just begun to establish research and extension institutions. Now in the developing countries after 30 years of bilateral and multilateral aid and national investment, we see emerging a vast network of national and international institutions with a primary focus of increasing food production. And the developed countries have invested in large and sophisticated public and private institutions, many of which are at the forefront of scientific agricultural research. In addition, the private sector is devoting increasing amounts of research and development capital to basic agricultural research which was once thought to be the domain of public institutions.

Agricultural Research and Extension Worldwide

Judd, Boyce, and Evenson [1983] provide the most recent data on public investment in agricultural research and extension (by major regions of the world for selected years between 1959 and 1980 in constant 1980 dollars). Public expenditures worldwide on agricultural research, which account for about two-thirds of the total agricultural R&D expenditures, were estimated for 1980 at about $7.4 billion or roughly 3.6 times, in constant dollars, that spent in 1959, and over six times that spent in 1951[10] (Table 2).

For the developing countries, the biggest increase in public research expenditures (in constant dollars) between 1959 and 1980 came in China with a

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[10]Boyce and Evenson [1975, p. 31], in an earlier study, show a 169 percent gain in 1959 over 1951 in constant dollars. Thus, 3.6 x 1.69 equals 6.08 which is rounded to 6.

Table 2. Public Expenditures on Agricultural Research, Major World Regions, 1959, 1970, and 1980

Region/Country	Expenditures Constant U.S. 1980 $ (millions of dollars) 1959	1970*	1980	Change 1959 to 1980 (percent)
Asia (excluding Japan and China)	71.5(3.5)	204.9	470.0(6.4)	657
Japan	135.4(6.5)	497.7	684.3(9.3)	505
China	54.2(2.6)	502.5	643.6(8.7)	1,187
Western Europe	275.0(13.3)	918.6	1,489.6(20.2)	542
Latin America	79.6(3.9)	216.0	463.6(6.3)	581
Canada, Australia and New Zealand	196.2(9.5)	486.1	628.1(8.5)	320
U.S.S.R.	372.4(18.0)	846.1	939.4(12.7)	252
Eastern Europe	195.9(9.5)	436.1	553.4(7.5)	282
Africa	119.1(5.8)	251.6	424.8(5.7)	357
United States	564.2(27.3)	997.9	1,094.3(14.8)	194
World Total	2,063.6(100.0)	5,358.6	7,390.0(100.0)	358

( ) percentage share of world total
* Average of 1968 and 1971

Source: Derived from Appendix Table 1 [Judd, Boyce, and Evenson 1983].

twelvefold gain; Latin America increased almost sixfold; Asia (excluding Japan and China) increased fivefold; and Africa well over threefold. The smallest increase among major countries was in the United States, which showed a gain of 194 percent over the 21-year period. The United States share in global public agricultural research expenditures fell from about one-half in 1951, to about one-fourth in 1959 to less than 15 percent by 1980. After an almost sixfold jump from 1959, public annual expenditures in Western Europe on agricultural research now exceed U.S. expenditures by $300 million. The United States and Western Europe expenditures were about equal in 1974. The Japanese government increased annual expenditures over these two decades almost fivefold. While almost three-fourths of agricultural research investment still remains in the industrialized countries, the developing countries increased their relative share of the research system from less than 16 percent in 1959 to 27 percent by 1980.

The level and expenditure pattern for extension were somewhat different than for research (Table 3). World expenditures for extension activities amounted to $3.4 billion in 1980 (less than one-half of the agricultural research budget), an increase of 240 percent over 1959. The developed countries spend slightly more than the lower-income countries, but the relative differences in expenditure levels are less significant than for research.

As one might expect, the research and extension capacity is not evenly distributed among developing nations. For example, Brazil and Mexico account for over one-half the research expenditures in Latin America in 1980, and Brazil alone represented over 60 percent of the extension expenditures there. In Africa, Nigeria now accounts for almost 30 percent of the total research expenditures. In Asia (excluding Japan), China and India clearly dominate,

Table 3. Public Expenditures on Agricultural Extension, Major World Regions, 1959, 1970, and 1980

	Expenditures Constant 1980 U.S. $ (millions of dollars)			Change 1959 to 1980 (percent)
	1959	1970	1980	
Asia (excluding China)	143.9(10.2)	412.9	507.1(13.5)	352
Western Europe	234.0(16.4)	457.7	514.3(15.6)	220
Latin America	61.5(4.3)	206.0	396.9(12.6)	645
Canada, Australia, and New Zealand	101.2(7.1)	170.5	234.9(6.8)	232
U.S.S.R.	240.7(16.8)	371.5	472.1(13.2)	196
Eastern Europe	126.6(8.9)	191.5	278.1(7.8)	220
Africa	237.9(16.7)	481.1	514.7(14.8)	216
United States	282.1(19.8)	430.5	567.4(16.5)	201
World Total	1,427.9(100.0)	2,722.6	3,443.5(100.0)	

( ) percentage share of world total
* Average of 1968 and 1971

Source: Derived from Appendix Table 2 [Judd, Boyce, and Evenson 1983].

but Bangladesh, Indonesia, Malaysia, Pakistan, and Thailand have shown significant gains.

The Private Research Sector

Until recent times there has been a relatively firm dividing line between research undertaken by the public sector and the private sector. The private sector pursued research where there was an expectation of sustained profit, generally related to the input industries (e.g., hybrid seed, fertilizer, pesticides, feed additives, machinery) and postharvest technology. The Office of Technology Assessment indicates in a recent study that the magnitude of private sector research in the United States alone may approach $3 billion [U.S. Congress 1985, p. 69]. About one-half of the amount is spent on production agriculture and the other half on production or postharvest technology research. Research in the biological sciences and technology has been mainly in the realm of the public sector [Ruttan 1982, p. 186]. But recent court decisions regarding patent rights to plant varieties and biological organisms provide new interest for private sector research, as well as for joint public-private research.

Harl [1984, p. 9] suggests that prospects for breakthroughs in the biotechnologies hold both threat and promise for developing countries. Concern is expressed for the limited research capabilities of third world nations, their lack of industry capability to exploit new developments, and their need to gain legal access to new technologies developed in the industrialized countries. But, the potential benefits to low-income countries could include quantum leaps in food production and cost-saving disease and weed control. Since the new privately and publicly developed biotechnologies will need to be applied to indigenous crops and livestock in the developing

countries to realize the potential benefits, it is imperative that their national research capacities be sufficient to undertake this work.

The Future Role of the Land-Grant University in Development

The UC-Egypt Experience

Since the University of California, Davis, implemented the first Host Country contract which was a prototype for Title XII, a brief review may provide some insights on the constraints, in my opinion, that still remain in forging an effective university commitment to international development.

The five-year $18 million project was jointly designed by the Ministry of Agriculture of Egypt and the University of California, Davis. In all phases of the project responsiblity was shared jointly between Egyptian and American scientists and administrators. Two major areas of work were identified by Egyptians as needing improvement: agricultural economics and horticulture. A major objective of the project was to develop Egyptian capability for sustained effective agricultural research and extension. For the total activity, collaborative arrangements involved over 650 Egyptian university and ministry investigators and more than 130 U.S. scientists. Almost 200 Egyptians came to the United States for training and upgrading of skills and more than 50 seminars and workshops were held in Egypt to discuss policy and research findings. The U.C. participants were mostly faculty members (some from other American universities) who concentrated on teaching, research and policy analysis with Egyptian ministry and university professionals. The program was admittedly overly ambitious. It was slow to put in operation and premature budgetary restrictions in the fifth year prevented an orderly closing of work underway.

The accomplishments are a matter of record [University of California 1984]. I will refrain from expressing what some might consider a biased view on their merits. However, I will share what I consider are some lessons to be gained from this undertaking in context of what has been previously discussed, and offer some recommendations for a different approach.

Much of the difficulty came from trying to match what the Egyptian Ministry of Agriculture perceived as Egypt's needs with what the University of California, Davis, could realistically provide on a sustained basis and still maintain our own programs. The diversity of expertise required was often not available on the campus, or at least available when needed. These deficiencies involved seeking help from other universities and/or consulting firms--the latter an activity for which most universities are not well equipped--at least for short-term arrangements. Many of these administrative and organizational problems could have been resolved over a longer term. A commitment of 15 to 20 years is probably necessary for universities to properly internalize costs to plan, implement and close a large international project as well as to begin to expect positive benefits for all parties involved.

Even if such monumental changes in host country contracts could be realized, I conclude that there are deeper more fundamental flaws in the way affluent members of the world community have tried to help developing countries to build and enhance their research and extension capabilities. Basically, the United States and other donor countries and organizations have been and are still using a "shotgun" approach to deal with a large and complex problem that requires in-depth planning and organization.

The extent of the task is known. The World Bank determined that nearly half of all developing countries are large enough to justify and support a

balanced national research system but lack essential research infrastructure. These countries need help in developing an effective organization for research, in assembling the research facilities, and in acquiring the scientific staff to conduct research. The major need for another 30 percent of the countries is to develop specialized capabilities for research of an adaptive nature for a small number of crops. The other 20 percent have good-to-adequate research capabilities but need to develop stronger links to the international research network. Related programs for extension are needed as well.

We are aware that a vast amount of professional expertise is actively involved in institution building at the country level, not only from our own universities but also from the international centers, bilateral and multilateral agencies, institutes and universities outside of the United States. Unfortunately, there is almost no coordination and planning among these institutions and agencies. Moreover, from my observations in Egypt which is fairly representative of the situation in other countries, there is an embarrassing amount of proliferation and even competition among and even within various donor organizations in providing support.

A Suggested Approach

One possible way to achieve better use of our limited aid resources is to establish an institutional arrangement not unlike what we have for the international centers; that is, we should organize a Consultive Group on National Agricultural Research (CGNAR). The Consultive Group for the international centers has been described as an informal association of independent donors who bilaterally fund independent centers who are responsible only to their independent board of directors [McCalla, 1984].

Accordingly, for the parallel organization, individual donor countries, development banks, foundations and other organizations would be represented and could earmark their support for particular recipient countries. The counterpart of international centers would be international consortiums, some with American universities participating, each focusing on individual countries. A direct link with the international centers could be developed probably through ISNAR. Obviously, many organizational, administrative, and financial details would need to be resolved.

As a start, I propose that the AAEA sponsor, perhaps jointly with Ford and Rockefeller Foundations, and Winrock International Institute, an international conference to present the concept to the heads of the world's assistance agencies and discuss basic principles and operating procedures. It could provide, also, the basis for a worldwide linking of national and international scientific agricultural institutions. The task is great but so are the possible benefits.

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