Partners Against Hunger

The Consultative Group on International Agricultural Research

Warren C. Baum

With the Collaboration of Michael L. Lejeune

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Published for the CGIAR

THE WORLD BANK
Washington, D.C.

BEN 00797

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for Reconstruction and Development/The World Bank
1818 H Street, N.W., Washington, D.C. 20433, U.S.A.

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First printing October 1986

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Library of Congress Cataloging in Publication Data

Baum, Warren C.
Partners against hunger.

Includes index.
1. Consultative Group on International Agricultural Research—History. 2. Agriculture—Research—International cooperation—History. I. Lejeune, Michael L. II. World Bank. III. Title.
S539.5.C663B38 1986 630'.72 86-45463
ISBN 0-8213-0827-0
ISBN 0-8213-0828-9 (pbk)

Foreword

THE CONSULTATIVE GROUP on International Agricultural Research—the CGIAR—is the result of one of the least known but most successful international development initiatives of the postwar era. With modest resources contributed from many quarters, it has helped developing countries to grow enough food to provide better lives for millions of their people and in the Indian subcontinent and elsewhere to stave off recurrent famine.

To most people such an outcome seemed visionary in the 1960s and 1970s, when agricultural research was first being undertaken on an international scale. Populations in the developing countries were rising rapidly, in large part because the introduction of modern medicine had begun to improve health and reduce infant mortality. There was widespread concern—shared by the rich, well-supplied countries as well as those hard pressed to meet their people's basic needs—that the developing world would not be able to grow enough food to meet the rapidly rising demand. Farmers in earlier times had increased the supply of food to keep pace with growing population by bringing unused land into production. Now, however, the farmers in many developing countries were already cultivating all of the arable land, using for the most part seed varieties and farming methods that were centuries old and offered small prospect of increased yields. There was little hope that this traditional agriculture could meet the growing need for food.

It was against this background that the CGIAR and the thirteen international agricultural research institutions under its aegis came into being, a partnership of scientists, developing countries, and aid-giving countries and institutions. Today the CGIAR system com-

prises over six thousand people—scientists, technicians, and workers on experiment farms—who are developing the new technologies needed to expand agricultural production in the developing world. They have been eminently successful, for today agriculture in many countries has begun to be transformed. Production of rice and wheat, the staple foods in many countries, has already increased, through the introduction of new plant varieties and methods of cultivation, by enough to feed half a billion more people, and the potential exists for increases in other crops.

These gains have been possible because, beginning more than twenty years ago, knowledgeable, creative, farsighted people saw the need for action and devised the means to take it. These were, at the outset, the people in the Rockefeller and Ford Foundations who joined together in the 1960s to design and establish a new kind of agricultural research center, international in scope, independent and multidisciplinary in character; then the people in the United Nations Development Programme, the Food and Agriculture Organization, and the World Bank who in the early 1970s designed, sponsored, and promoted a new kind of international venture—the CGIAR—to oversee and finance a network of these new research centers; the people in the aid ministries of donor countries and the international development finance institutions who came forward to contribute the funds needed; and most of all the scientists in the research centers and their collaborators in the developing countries who have worked with great dedication to develop better crops and better ways of raising them.

Since the CGIAR was founded in 1971, the World Bank has provided the chairman from among its senior officers. Warren C. Baum was the second chairman and held the position for ten years, through 1983. He has written this book about the genesis, development, achievements, problems, and potential of this lively international effort. The World Bank is proud of its involvement in the CGIAR and is pleased to offer this work as a token of respect and encouragement to the CGIAR and to those who have taken part in making it a success or who will guide it in the future. We believe the book will also be of interest to others in the development and scientific communities who wish to learn more about this unique enterprise.

A. W. Clausen
President, The World Bank

June 1986

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Preface

TO WRITE A BOOK about the Consultative Group on International Agricultural Research has been for me a labor of love. Like most of those who have been associated with this remarkable enterprise, I count the time that I have spent with the CGIAR as the most rewarding of my professional career. No doubt this enthusiasm has colored the book, although I have tried—not always successfully I am sure—to present objectively the evidence on which the reader can reach his own conclusions.

The CGIAR is now (in 1986) celebrating its fifteenth birthday. This is not old as international organizations go, but it is old enough that several different books might be written about it. Some might find the scientific activities of the international agricultural research centers, of which those dealing with rice (IRRI) and wheat (CIMMYT) are the best known, to be the subject of greatest interest. I have tried to convey some understanding of the nature and importance of these activities, which are the raison d'etre of the CGIAR, and of what has been accomplished. But I am an economist rather than a natural scientist by training, schooled in the doctrine of comparative advantage. Having served as chairman of the CGIAR during ten of its fifteen years, I have chosen to orient the book primarily around the workings of the CGIAR itself.

I believe, again in common with many of those familiar with it, that the CGIAR is one of the more successful ventures in the art and diplomacy of development assistance. So the lessons of the CGIAR experience, including the occasional mistakes, shortcomings, and failures, may be worth recounting in their own right. This means that aid administrators and other public officials will share the stage with the international scientists who hitherto, and not without justice, have received such public attention as the CGIAR has at-

tracted. This unique partnership of individual scientists, staff and officers of private foundations, and officials of industrial and developing countries and of international organizations has made the CGIAR one of the most effective weapons in the campaign against hunger.

Given the orientation of the book and that it is based in considerable part on my own experiences and observations, I have taken sole responsibility for its authorship. But I hasten to acknowledge the special contribution of Michael L. Lejeune, a former colleague in the World Bank and executive secretary of the CGIAR during the years 1974 to 1982. Mr. Lejeune collaborated with me on much of the book. He provided background material and initial drafts of several of the chapters. He also reviewed and commented on the manuscript as a whole and helped in its editing and revision. Harold Graves, who was executive secretary during the CGIAR's earlier years, drafted background materials, marked with his own sprightly style, for chapter 3.

Other former colleagues in the CGIAR—Ralph W. Cummings, Richard H. Demuth, Lloyd Evans, Curtis Farrar, Lowell Hardin, Robert Herdt, and John Nickel—read and commented on the entire manuscript; Jock Anderson, David Bell, David Hopper, and Donald Plucknett commented on parts of it. While I benefited from their many criticisms and suggestions, I am responsible for the contents of the book, the views and opinions expressed, and the mistakes of commission and omission that undoubtedly remain. The numerous secretarial tasks during the writing and editing were handled very capably by Virginia Acio throughout. Moreen Tolerton also participated in the secretarial work until her reassignment.

A word of explanation may be in order about the paucity of footnotes. Much of the material on which the early history in the first two chapters is based comes from the archives of the Rockefeller and Ford Foundations, including the oral histories of some of the participants. I am very grateful to the foundations for granting me access to this information. (I am also indebted to the Rockefeller Foundation for my period as a resident fellow at its international conference and study center at Bellagio, Italy, where I was able to work on the book at what is, for the CGIAR, a historic site.) For the later chapters dealing with the CGIAR itself, I have relied for the most part on internal documents of the World Bank, the verbatim record and summaries of proceedings of CGIAR meetings, the proceedings of the meetings of the Technical Advisory Committee, and other CGIAR documents that are not in the public domain. There

seemed to be little point in making detailed references to materials to which the public at large does not have access. I believe that the record presented in the book is factually accurate, however much my enthusiasm may have influenced the conclusions I have drawn from it.

The CGIAR Centers

CIAT	Centro Internacional de Agricultura Tropical
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
IBPGR	International Board for Plant Genetic Resources
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Center for Africa
ILRAD	International Laboratory for Research on Animal Diseases
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
WARDA	West Africa Rice Development Association

1

In the Beginning . . .

THIS IS AN ACCOUNT of how the international community organized and is operating a system of scientific research and development to combat hunger in large parts of the developing world. It is, by most standards, a success story. The system's contribution to the Green Revolution—the astounding jump in basic food production that has occurred in the developing world, particularly in Asia, since the mid-1960s—is by now well documented. The institutional cooperation that brought the system into being has been called "a remarkable chapter in the diplomacy of international development assistance."[1]

The system, as well as individuals and organizations within it, has received international recognition and award, and it has been flattered by imitation. Yet some efforts to emulate it in other fields have been abortive or met with limited results, and its success, through a healthy and perhaps inevitable process, has spawned skeptics and critics. How the system came into being, how it works, what issues it faces, what it has—and has not—accomplished, and what lessons can be learned from its experience are the subjects of this book.

The 1960s and early 1970s, when the new research system was being developed and put in place, were a period of widespread scientific and popular concern that rapidly rising population, particularly in developing countries, would soon outstrip the world's capacity to increase food supplies. The Malthusian threat of a world food crisis, if not worldwide famine, seemed real and

1. McGeorge Bundy, "The President's Review," *Ford Foundation Annual Report, 1977* (New York, 1977), p. vii.

was given further credence by the droughts in Asia in the mid-1960s. Articles and books were written, not only about the "limits to growth" but also about the "lifeboat" strategy and the principles of triage: how society should decide which countries or groups of people should survive in the event of a food shortage of global proportions. That this apocalyptic vision has not yet come about is due to many factors—including faulty premises in the reasoning—but the new agricultural research system has played its part.

This was also a period when agriculture was gaining ascendancy in the economic strategies of developing countries. Experience was demonstrating that in many countries industrial development alone could not provide the engine for sustained economic growth. A prosperous agriculture was essential. But in many countries only a limited amount of new arable land could be brought into production. Increasing the productivity of existing land therefore appeared essential both to meeting food needs as population increased and incomes rose and to promoting a thriving agriculture on which the development of the rest of the economy depended. The stage was set to welcome a new approach to agricultural research and development that held out the promise of greatly increasing yields from existing land.

At the heart of the new research and development system is a process of large-scale plant breeding and testing that has produced new, higher-yielding varieties of wheat, rice, and other crops. As it has developed, the system has also come to represent a holistic approach—combining biology with socioeconomics—to raising the production of food of improved quality in the developing world. Thus, scientists within the system investigate plant physiology to maximize yields and plant response to the supply of nutrients, soil and water management and better agronomic practices to deal with varying and often difficult ecological conditions, and plant pathology and entomology to better control the perennial crop pests and diseases that have proved perversely resistant to some of the early genetic improvements. Economists and other social scientists have joined forces with the natural scientists to study how new crop varieties can be combined with existing farming systems, what policies and incentives are necessary for the new technologies to be adopted, and how obstacles to change can best be overcome. Research and development has also focused on strengthening the national agricultural research systems of developing countries—which have become important partners in the process and bear the ultimate

responsibility for adapting the new technology and introducing it to the farmers' fields—and on conserving the developing world's supply of plant genetic resources.

The principal agents in developing and disseminating this new approach are a group of independent, international agricultural research centers, now numbering thirteen. The concept of agricultural research centers that are both international in character and self-administering was a novelty when it was introduced in the 1960s. Also innovative, early in the 1970s, was the concept that the centers, loosely joined together, should come under the aegis of a Consultative Group on International Agricultural Research (CGIAR). The CGIAR was conceived as an informal, voluntary association of donors that reviews the centers' programs and budgets, provides their funding, and sets priorities for future research and action. A small number of representative developing countries (in addition to those that are donors) are also members, and the Consultative Group is advised by a committee of distinguished agricultural scientists. The international centers and the Consultative Group together compose what is called here the CGIAR system, a collaborative effort of scientists, administrators, and donors who together have forged a unique experiment in international cooperation.

Early History of Agricultural Research

The origins of modern agricultural research can be traced to the second half of the nineteenth century, when efforts were first made to find scientific alternatives to traditional agricultural methods. In traditional agriculture, yields depended in large part on the inherent fertility and other qualities of the soil. Agriculture tended to flourish where soils were rich and rainfall was adequate or where irrigation and drainage could be controlled. The principal varieties of crops available to farmers were those that had been planted for centuries because of their ability to produce dependable, although modest, yields. These varieties had also become adapted to the low levels of crop management employed by most traditional farmers.

Among the scientific discoveries and innovations that have revolutionized agriculture, one of the most important is the application of Mendel's laws of genetics to plant breeding, which has made it possible to develop new varieties with predetermined characteristics. J. George Harrar, who will figure promi-

nently in the early portions of this narrative, has described the modern geneticist as "a sort of biologic tailor who fits varieties into a specific environment, using such techniques as induced polyploidy, multiple topcrossing and backcrossing to obtain and fix desirable characteristics and produce blended progenies."[2] Plant breeding offered alternatives to native varieties, which for most crops had proved to be ill suited to the high levels of fertilizer and intensive management used in modern agriculture to obtain higher yields. In particular, the cereal grains tended to develop excessive vegetative growth under modern techniques of cultivation. As a result, the plants became so top-heavy that they "lodged" (fell over) long before harvest or shaded the lower leaves, which reduced overall grain yield.[3]

Particularly dramatic has been the development through plant breeding of new strains of wheat with strong stems and the genetic potential to benefit from increased nutrients. Japan has a long history, going back at least to the 1870s, in the development of a dwarf wheat stalk that would not lodge even on the richest soils and with the heaviest applications of manure. One strain, known as Norin 10, was released to Japanese farmers in 1935. The Japanese varieties were, in turn, used in breeding programs, first in Italy and then in the United States and Mexico. In 1946, a U.S. Department of Agriculture scientist acting as agricultural adviser to the occupation army in Japan brought back varieties of Norin 10 to the United States. Norin 10 was not satisfactory for direct use, but it was crossed in breeding programs with domestic varieties eventually to produce a number of semidwarf lines. One semidwarf winter wheat variety, Gaines, developed by Orville Vogel of the Department of Agriculture and Washington State University, was released in 1961 and spread rapidly through the northwest United States.[4]

2. "Food for the Future," paper presented at the Symposium for Natural Resources: Power, Metals, Food, at the American Association for the Advancement of Science meeting in Berkeley, California, December 27, 1954.

3. See Sterling Wortman, "The Technological Basis for International Agriculture," in Rockefeller Foundation, *Agricultural Development: Proceedings of a Conference* (New York, 1969); and Sterling Wortman and Ralph Cummings, Jr., *To Feed This World: The Challenge and the Strategy* (Baltimore, Md.: Johns Hopkins University Press, 1978). Both references contain an extensive bibliography on the subject.

4. Haldore Hanson, Norman E. Borlaug, and R. Glenn Anderson, *Wheat in the Third World* (New York: International Agricultural Development Service, 1982); and Dana G. Dalrymple, *Development and Spread of High-Yielding Varieties of Wheat*

Research on Wheat: The International Program in Mexico

The pioneering cooperative effort in international agricultural research was a joint program on food crops initiated in Mexico in 1943 by the Rockefeller Foundation and the government of Mexico. The program was the Rockefeller Foundation's first venture into the field of agriculture; theretofore its operations had been confined to public health, a field in which it was already well known in Mexico.

Two men played key roles in bringing about this partnership between the government of Mexico and the Rockefeller Foundation. One was Josephus Daniels, U.S. ambassador to Mexico, who had tried in 1935 to interest the foundation in Mexico's agricultural problems. The other was Henry A. Wallace, who as vice president elect represented the United States at the inauguration of General Manuel Camacho as president of Mexico in December 1940. To the Mexicans, Wallace represented modern, scientific agriculture, both as a former secretary of agriculture and as an Iowa farmer with worldwide recognition as a breeder of corn (maize). Wallace spent a month in Mexico after the inauguration, conferring with Mexican agricultural officials, including Marte R. Gomez, the minister of agriculture, and Alfonso Gallardo, subsecretary of agriculture. Undoubtedly through Wallace's influence, they promptly established a maize-breeding program.[5]

In early 1941, when Wallace and Daniels were both back in the United States, the latter had a chance meeting with a long-time friend, John A. Ferrell, who was regional director of the Rockefeller Foundation for Canada, the United States, and Mexico. Daniels urged Ferrell—who himself had also tried unsuccessfully to interest the foundation in Mexican agriculture—to speak with Wallace. He did so promptly, accompanied by Raymond Fosdick, president of the foundation.

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and Rice in the Less-Developed Nations, Foreign Agricultural Economic Report 95 (Washington, D.C.: U.S. Department of Agriculture, 1974).

5. This discussion and other sections of this and the next chapter are based in part on unpublished materials in the Rockefeller Foundation archives. Some of these materials are referred to in Elvin C. Stakman, Richard Bradfield, and Paul C. Mangelsdorf, *Campaign against Hunger* (Cambridge, Mass.: Harvard University Press, 1967), ch. 1–3. See also J. George Harrar, "A Pattern for International Collaboration in Agriculture," *Advances in Agronomy*, vol. 6 (1954), pp. 103–04.

Wallace told the foundation officials that work in health and in agriculture should go hand in hand. Improved health alone was insufficient: reduced mortality would in fact lead to a decline in per capita food availability. Raising the yields of maize, wheat, and beans (the principal Mexican foods) through modern agricultural methods would have a greater effect on national living standards than anything else that could be done. Fosdick was persuaded and responded quickly. Following a time-honored foundation procedure, he appointed a committee to look into the matter and recommend a course of action. At the committee's recommendation, a survey commission consisting of "three eminent agricultural scientists, tempered by experience and distinguished by achievement," was sent to Mexico.[6] This team consisted of Richard Bradfield, a soil scientist; Paul Mangelsdorf, a geneticist and plant breeder; and Elvin Stakman, a plant pathologist. These men, who later became known as the Three Musketeers of Agriculture, had among them seventy-five years of experience in agriculture.

The survey commission advised a "top-down" approach, relying heavily on research as the first essential step. It proposed that a highly trained research team of Rockefeller-appointed staff work jointly with Mexican scientists, who would be trained under the program, to solve local problems in ways adapted to the physical and cultural requirements of the local environment. (This approach was a precursor of the international centers that would come into being later.) Three priorities were established initially: breeding better varieties of maize, wheat, and beans; improving methods of soil management and crop protection; and increasing the productivity of domestic animals.

Wallace had undoubtedly instilled in his Mexican colleagues a desire to look abroad for help in bringing about an agricultural revolution which, they recognized, was needed to complement and give effect to the agrarian (land reform) revolution begun in 1910. They turned naturally to the Rockefeller Foundation. Not only had the foundation already demonstrated its commitment to public health in Mexico, but at the time there was no official U.S. aid program, nor was there a United Nations or a Food and Agriculture Organization to turn to for assistance.

The first staff member of the joint Mexico-Rockefeller Foundation program, and the leader of the four-man Rockefeller team,

6. Raymond Fosdick in the foreword to Stakman and others, *Campaign against Hunger*.

was J. George Harrar.[7] Edwin Wellhausen arrived in Mexico in September 1943 to head the maize-breeding program. Norman Borlaug arrived in October 1944 and took responsibility for the wheat-breeding program early in 1945. Progress in wheat research was slow, as had been expected; the early breeding efforts ran into a yield plateau because the plants lodged when nitrogen fertilizers were applied, and they were susceptible to stem rust. Borlaug corresponded with Vogel at Washington State University, and in 1953 a few seeds of a Norin 10 cross arrived in Mexico. After a first unsuccessful attempt, a new type of wheat was produced in 1955 with higher-yield potential. It took another seven years of experiment, and frequent failures, before the first Mexican semidwarf varieties, Pitic 62 and Penjamo 62, were released for commercial use.

Some characteristics of the new semidwarf wheats were attributable to Norin 10 genes, and some to careful selection for desirable features from other parent varieties. The principal characteristics of the semidwarf wheat varieties, as compared with the traditional varieties and as they have developed over time, are:

- *Short stature.* The height of semidwarfs in Mexico ranges from 50 to 100 centimeters, compared with 125 to 150 centimeters for traditional varieties.
- *Sturdy straw and strong crown roots.* The plants are more resistant to lodging even with high rates of nitrogen fertilization.
- *More fertile florets.* When properly spaced and adequately fertilized and watered, the semidwarfs can produce more than twice the number of fertile flowers (grains) per head.
- *Higher tillering.* There are more tillers (stems) per plant, and consequently more heads, resulting in higher yields.
- *Better grain-straw ratio.* A higher proportion of the carbohydrates synthesized in the leaves goes into the grain, rather than into vegetative growth.
- *Early maturing.* Semidwarf spring wheats can reach maturity days or even weeks sooner.
- *Better response to fertilizer.* The semidwarf varieties yield twice

7. Before joining the foundation, Harrar was head of the Department of Plant Pathology of Washington State College. In 1951 he moved to New York to become the first deputy director for agriculture in the foundation's Division of Natural Sciences and Agriculture. He later became, in turn, director for agriculture, vice president, acting president, and in 1961 president of the Rockefeller Foundation.

as much additional grain as the traditional ones for each kilogram of added nitrogen fertilizer up to the first 70 kilograms of nitrogen per hectare. (Beyond this level, yields of the traditional varieties do not increase significantly because of lodging, but yields of semidwarfs respond up to 150 kilograms of nitrogen.)

- *Disease resistance*. Breeders have incorporated in the semidwarfs greater resistance to many diseases.
- *Wide adaptability*. Many semidwarfs adjust well to a wide range of temperature, soils, moisture, and day length and hence can be used more widely in different environments and at different planting dates.[8]

In 1944, when wheat yields averaged eleven bushels per acre, Mexico was importing half the wheat it consumed. By 1966, only four years after the new varieties were released, they had taken over 95 percent of the area cultivated to wheat in Mexico. By 1969, wheat yields had increased more than threefold, to thirty-nine bushels per acre, and Mexico had become self-sufficient in wheat.

By the early 1960s, the cooperative program in Mexico had advanced to the stage where Mexican scientists and the national research organization were able to take full command of the research in their own country. The Rockefeller Foundation closed down its formal program in Mexico in 1964; a small staff, including Borlaug, remained to continue work on the international aspects of the program, linking Mexican varieties with other breeding programs around the world. Borlaug won the Nobel Peace Prize in 1970 for his service to agriculture.[9]

Similar Programs in Latin America

As the wheat, maize, and other programs in Mexico developed, other countries in Latin America became interested, and

8. Hanson and others, *Wheat in the Third World*, pp. 18–23.

9. Borlaug has been described as a perfectionist, with a fanatical devotion to wheat. Once, after a hard day's drive, he and a companion arrived at an experiment station. Borlaug said, "How about going over and taking a quick look at the wheat plots?" His companion responded testily, "Tonight? It's way after midnight; we can't see wheat now." Borlaug's response was, "There's a good moon; we could at least see what the plots look like." Quoted in Stakman and others, *Campaign against Hunger*, p. 81.

the Rockefeller Foundation received numerous invitations to establish similar collaborative arrangements elsewhere. One of these, from Colombia, was accepted in 1950, and a cooperative research program in potatoes, wheat, beans, and forage crops was established. The first Rockefeller staff members sent to Colombia were transferred from the Mexican program. They found that the improved materials developed in Mexico could be used immediately in other areas with similar climate, so that rapid progress was possible. As in Mexico, the program was organized as a special office of the Ministry of Agriculture, with Rockefeller and Colombian personnel joining forces to conduct the various research activities. As in Mexico, the objectives were to increase production of basic foods, to help educate young scientists, and to promote the development of educational and research institutions. The results in Colombia were also impressive, with improved wheat making its way faster than maize. Ecuador became linked to the Colombian program and received help from the foundation. A program similar to those of Mexico and Colombia was begun in Chile in 1955. Harrar, after leaving the Mexican program to take positions of increasing responsiblity within the foundation, began to link these national efforts into a mutually supportive international program.

Wheat Research in Pakistan and India

In 1963, the governments of Pakistan and India invited Borlaug to look into their wheat problems. In both instances, the invitations to Borlaug, still relatively unknown on the international scene, were very likely inspired by foundation representatives who were working closely with the governments on their agricultural problems. Ralph Cummings of the Rockefeller Foundation performed this role in the case of India. Haldore Hanson was the representative in Pakistan of the Ford Foundation, which had been active in education, economic planning, population control, and rural development in various parts of Asia since the early 1950s.

In examining the genetic material in Pakistan, Borlaug found a number of lines from Mexico growing at several stations. They had been brought back by two Pakistani trainees who had attended the Mexican training program under the sponsorship of the Food and Agriculture Organization (FAO). Although the Mexican semidwarfs were already outproducing native wheats, the

trainees had hidden them in a far corner of the research station; according to Hanson, they were cautious about the reaction of local government scientists to the introduction of foreign varieties.

The following year, with Ford Foundation support, a program of accelerated wheat improvement was launched in Pakistan. Called the All-Pakistan Wheat Research and Production Program, it was led by the president of Pakistan, Ayub Khan, himself a landowner and farmer. Ignacio Narvaez, director of the Mexican national wheat program, followed Borlaug to Pakistan and took up residence there in 1964 to help with the program.

The results achieved went beyond Borlaug's fondest expectations. Wheat production in Pakistan rose from 3.9 million tons in 1966 (the year before semidwarf varieties were introduced) to 7.3 million tons in 1971. The near doubling of production was achieved partly by increasing the area under cultivation, partly by better weather, but largely by improving yields. The national average yield rose from 760 kilograms a hectare in 1966 to 1,171 kilograms a hectare in 1971 (it reached 1,500 kilograms a hectare during the late 1970s). In 1980, the new wheats, most released under the name Mexipak 66, covered 75 percent or more of Pakistan's wheat land, and the wheat harvest reached 10.8 million tons.[10]

In the early 1960s, Indian agricultural scientists had been working, with the assistance of the Rockefeller Foundation, on the introduction of Mexican wheat and hybrid maize. They were able to build on a tradition of scientific research going back to British rule, which had resulted in the establishment of strong national institutions. Pitic 62 and Penjamo 62 reached India in 1962 among the varieties made available for world testing by the U.S. Department of Agriculture. The Mexican varieties were tested on Indian research stations in 1962 and 1963 and performed well. After his visit, Borlaug arranged for shipment of samples of other Mexican wheat varieties, which were used in the spring trials in 1964. Two of the Mexican semidwarfs outyielded all Indian test varieties by 30 percent. After 1964, the

10. Norman Borlaug, "National Production Campaigns," in *Strategy for the Conquest of Hunger*, Proceedings of a Symposium Convened by the Rockefeller Foundation, April 1 and 2, 1968 (New York: Rockefeller Foundation, 1968); and Hanson and others, *Wheat in the Third World*, pp. 49–50.

Indian government committed itself to a dynamic national wheat production program built around the new semidwarf varieties, together with appropriate adjustments in production technology and market incentives. The campaign, under the leadership of the Indian Agricultural Research Institute and the Indian Council on Agricultural Research, involved a wheat-testing program on research stations, agronomy trials at numerous sites, a speed-up in seed multiplication, a demonstration program in farmers' fields that eventually covered all wheat-producing states, and massive importation of Mexican wheat seed and of the necessary fertilizer. The minister of agriculture, C. Subramanian, played a key role in giving impetus and policy direction to the program.

National demonstrations were organized in 1966, in cooperation with the states and universities, involving hundreds of half-hectare plots in farmers' fields. Each plot had two parts: one "Your Way," using the farmers' traditional seed and cultivation practices; and one "Our Way," using a semidwarf variety and agronomic practices developed by the research service, including heavy applications of nitrogen and phosphorus fertilizers. In the 1967 harvest, "Your Way" yields averaged 1,200 kilograms a hectare and "Our Way" gave 2,000 to 3,000 kilograms a hectare. Much of the semidwarf wheat harvested in 1967 was saved for seeding the next crop. In 1968, the national wheat harvest was 16.5 million tons, almost 50 percent more than in 1967, although weather accounted for part of the difference.

A revolution in wheat growing was under way. When wheat farmers in the Punjab learned of the great yield advantage of the dwarf varieties, their demand for the new seeds quickly exceeded the supply. The seeds commanded a premium price on the open market, and the experimental plots and warehouses had to be protected to prevent the seeds from being stolen.

The dramatic harvest of 1968 had required only six years of intensive research, crop testing, and training of farmers from the time the first semidwarfs arrived from Mexico. India did not rely long on imported wheat varieties, however. Its scientists, by careful breeding of local and Mexican germ plasm, developed new varieties that were as high-yielding and disease resistant as any of the Mexican semidwarfs and were also resistant to some diseases encountered in India that had not been important in Mexico. Two new varieties were released in 1967 under the names of Kalyansona and Sonalika; within a few years they be-

came the most widely grown varieties of spring wheat in the developing world.[11]

Research on Rice: The First International Institute

Rice has been cultivated in Asia since the dawn of history. Improvements took place over many centuries in mainland China and elsewhere, as farmers selected and planted their best varieties. But yields throughout the area remained low and static.

Research to develop new varieties began in Japan shortly after the turn of the century, and by the 1940s work on improved varieties was also taking place in Taiwan, Indonesia, India, the Philippines, and other parts of Asia. Efforts were also made on a number of occasions to introduce into the tropics technology from the United States and Japan, including the importation of Japanese farmers, usually without success. Moreover, the traditional varieties were not responsive to fertilizer applications beyond a low level. As in the case of wheat, the tall, leafy plants that resulted cut down the rate of photosynthesis of the lower leaves and lodged long before harvest. By the late 1950s, some of the national research programs had achieved moderate results in developing short, stiff-strawed varieties that responded better to fertilizer and had a higher yield potential, but there had been no breakthrough of widespread application. Still, Asian rice breeders were acquiring knowledge and experience with rice that would later serve them in good stead.[12]

During the early 1950s, Rockefeller Foundation officials were considering ways in which they could contribute more to improving food prospects in Asia. Rice, as the major food crop of the region, seemed to be a logical target, and improved research the best approach for the foundation.

11. Hanson and others, *Wheat in the Third World*, pp. 43–48, 56; and C. Subramanian, "India's Program for Agricultural Progress," in *Strategy for the Conquest of Hunger*, p. 16 ff. David Hopper also described the Indian wheat experience, from first-hand knowledge, in his comments at the CGIAR's International Centers Week in 1985.

12. Dalrymple, *Development and High-Yielding Varieties*, pp. 15–20; Robert F. Chandler, Jr., *Rice in the Tropics: A Guide to the Development of National Programs* (New York: International Agricultural Development Service, 1979); and Wortman, "The Technological Basis for Intensified Agriculture," pp. 12–14.

Warren Weaver, director of the foundation's Division of Natural Sciences and Agriculture, and Harrar, then the deputy director, visited Asia in 1952 and again in 1953. In the following year, they prepared a paper for the foundation's board of trustees proposing the establishment of an "International Rice Research Institute in Asia."[13] They had concluded that a single center of international scope was the best way to deal with the basic problems of rice growing, which were universal. They argued that "many of the really fundamental physiological, biochemical, and genetic problems are essentially independent of geography, and they are certainly independent of political boundaries . . ." A central institute would be the most economical way to concentrate expensive equipment and, more important, a "high-powered and efficient international team of experts," who would supplement each other and form a more effective team than any one developing country could hope to create. The team members would be able to work together on common problems under optimal conditions. Thus, Weaver and Harrar's reasoning foreshadowed the international agricultural research institutes that would be established over the next twenty-five years.

The original hope was that the Rockefeller Foundation would provide the funds for building and equipping the institute and that the major rice-producing countries of Asia would jointly meet the operating expenses. When the countries were approached, however, each stated that it would gladly support such an institute, but only if it were located in that particular country. On this rock of narrowly conceived national interest the prospect of multiple-country contributions foundered, and the Rockefeller staff concluded that it would be unwise to undertake such a venture on their own. The proposal was shelved, and in its stead the foundation began a program of grants for equipment, books, fellowships, and specific research projects in the region.

This was the state of play when the Ford Foundation entered the picture. The foundation was very much interested in the food problem, but had decided to stay out of science and research. Community development projects were the centerpiece of the foundation's activities at the time, particularly in India.

13. The Weaver and Harrar paper is cited in Robert F. Chandler, Jr., *An Adventure in Applied Science: A History of the International Rice Research Institute* (Los Banos, Philippines: International Rice Research Institute, 1982). Chandler's book contains a detailed account of the events leading up to the founding of IRRI, on which this chapter has drawn heavily.

The central concept was to have one or more "multipurpose" workers assigned to a village or group of villages to help the villagers discuss their development needs and organize themselves to seek and use government assistance. It assumed that the technology required to raise agricultural productivity already existed (through prior research), as did the extension agencies to deliver it. In 1956, when Forrest ("Frosty") Hill, then vice president for overseas development, visited the large, foundation-supported community projects, he became convinced that much more research was needed to develop suitable technologies for traditional farmers, as well as more training of extension workers.[14]

When Hill left his post as provost of Cornell University in 1955 to join the Ford Foundation, he had never been in a developing country. Still, he was attracted by the opportunity, in his words, "to get a ringside seat at the greatest social, economic and political revolution the world has ever seen."[15] Hill became acquainted with Harrar a few years later. By one of those bits of serendipity that played an important part in this story, they commuted together to New York City from time to time on the train from Scarsdale. Hill on various occasions suggested to Harrar that the Rockefeller Foundation become active in rice research in Asia. Another opportunity to press the point was afforded by a meeting of officials of the two foundations on August 18, 1958 to consider a proposal that had been developed for the joint financing of a College of Agriculture in Lyallpur, Pakistan. Toward the close of the meeting, the following conversation took place, as reported by Hill:

> *Hill*: George, when are you guys going to do something about rice?
> *Harrar*: We just don't have the money.
> *Hill*: We've got some money. You have the experience in conducting research. Why don't we get together and see what we can do?[16]

Hill's further comment was that "this seemed like a good idea to both of us." From this casual conversation was forged a re-

14. See Lowell S. Hardin, *The Ford Foundation and Third World Activities: A 25-Year Perspective* (New York: Ford Foundation, 1978).

15. This discussion and other sections of this and the next chapter are based in part on unpublished materials in the archives of the Ford Foundation.

16. See Chandler, *Adventure in Applied Science*, pp. 4–5. Chandler was present at the meeting.

markable partnership between the two foundations that over the next decade laid the basis for the international agricultural research system that is now in place. Staff of the two foundations worked together as a team reporting jointly to their respective heads, and with less dissension than one would expect to find within the confines of even a single organization.

The proposal for an International Rice Research Institute (IRRI) was revived. This time the institute would be supported jointly by the two foundations, with Ford providing the capital funds and Rockefeller providing the scientific staff, meeting the operating expenses, and managing the institute. The proposal was strongly endorsed by the presidents and the boards of trustees of the two foundations. Hill advised his board that agricultural research would have to be supported on a long-term basis (such as fifteen years), an important departure from the foundation's policy of making grants for a maximum of five years. Each of the foundations committed itself to support IRRI for a period of at least seven years.

The proposal put to the Ford Foundation board did not minimize the importance of this undertaking:

> Aside from the possibility of all-out nuclear war, two of the most important problems confronting the world today are the related problems of population and food supply. The so-called "median estimate" of world population made by the United Nations demographic office is 6 billion people by the year 2000, compared with an estimated 2.8 billion at the present time. Added to the prospect of a staggering increase in numbers is the hard fact that millions of people in the world today have never had a nutritionally adequate diet. At best, the world food outlook for the decades ahead is grave; at worst, it is frightening.
>
> Rice is the most important single food crop in the world . . . Rice is the major item in the diets of more than one half of the world's population. It supplies 70 to 80 per cent of the entire calorie intake in many countries.
>
> Over 90 per cent of the world's rice crop is produced in Asia, with South America, Africa, and North America ranking next in order of importance. Small amounts of rice are produced in Europe, the U.S.S.R., and Oceania. As this suggests, most of the world's rice production occurs in the so-called underdeveloped countries, areas that have been largely by-passed by the stream of modern science and

technology. Except for Japan and the United States, production methods in most countries are primitive and inefficient, yields are low, and prices are relatively high.

Although rice research is in progress in various parts of the world, the major advances lie ahead. Great opportunities exist for increasing the quantity and improving the quality of rice for the rapidly growing number of people dependent upon this important crop for food.

There had been previous discussions with the Philippine government on the use of a plot of land adjacent to the experimental rice fields of the College of Agriculture of the University of the Philippines at Los Banos. The Philippines commended itself to the foundations because of its stable and friendly government, its use of the English language, and its good health and education facilities. The formal establishment of the International Rice Research Institute took place in 1960 by an act of the Philippine legislature, which granted it tax immunity.

Work on staffing the institute at Los Banos proceeded apace, with Robert Chandler, Jr., and Sterling Wortman, both of the Rockefeller staff and graduates of the Mexican program, serving as director and assistant director, respectively. Harrar was the first chairman of the institute's board of trustees; he was succeeded in 1963 by Hill. Construction began in January 1961, and only a year later the institute was dedicated with a sizable international staff on hand.[17]

Profiting from the Mexican wheat experience, IRRI staff knew what they were searching for: an improved short-statured variety. In their effort to develop one or more as soon as possible, IRRI plant breeders collected 10,000 of the world's rice varieties and strains; not one met all their requirements. IRRI's scientists then embarked on a major rice-breeding program, including multiple crosses between dwarf and tall varieties. The most successful of these crosses was between Peta, a tall Indonesian variety then being grown extensively in the Philippines, and Dee-geo-woo-

17. IRRI's staff was truly an international, multidisciplinary team. By 1964, the scientific staff included P. R. Jennings (United States) and T. T. Chang (Taiwan) in plant breeding and genetics, S. H. Oh (Taiwan) in plant pathology, Mano Pathak (India) in entomology, F. N. Ponnamperuma (Ceylon) in soil chemistry, James Moomaw (United States) and S. K. De Datta (India) in agronomy, Akira Tanaka (Japan) and Benito Vergara (Philippines) in physiology, Takashi Akazawa (Japan) and Bienvenido Juliano (Philippines) in chemistry, and Vernon Ruttan (United States) in economics. Wortman and Cummings, *To Feed This World*, p. 152.

gen, a Taiwanese dwarf variety thought to have come from southern China several hundred years earlier. From this mixed parentage there emerged one particular variety that performed outstandingly in field trials throughout tropical and subtropical Asia. In variety trials at experiment stations in India, Pakistan, the Philippines, and Malaysia in 1966, yields exceeded those of the best local varieties by amounts ranging from 2.3 to 3.5 metric tons a hectare, or by 60 to 100 percent. In 1966, just four years after the research program got under way, IRRI released it as its first named variety: IR8.

IR8 was a plant of short stature, with thick, sturdy stems that resisted lodging; narrow, erect leaves to allow maximum penetration of light; a high tillering capacity; a high grain-straw ratio; and insensitivity to day length. In West Pakistan, approximately 10,000 acres were planted to IR8 in 1967. By 1968, IR8 covered 1,000,000 acres; in the following year, almost double that amount. Total rice production in West Pakistan, including both old and new varieties, increased from 1.4 million metric tons in 1967 to 2.0 million tons in 1968 and 2.8 million tons in 1969.

Experience in some other countries was similar. The rapid spread of IR8 throughout the rice-growing areas of Asia was the second half of the contribution of foundation-sponsored research to the Green Revolution— "miracle" rice to accompany the "miracle" wheat. The progress of the research program at IRRI exceeded the expectations of both Harrar and Hill. They thought that it would take ten to fifteen years to develop a dwarf rice variety with superior characteristics—in fact, it took only four.[18]

IRRI's capital cost of $7,510,000 was provided entirely by grants from the Ford Foundation, while Rockefeller provided the funds for the operating budget in the first two years. In 1964, the two foundations agreed to become equal partners in supporting IRRI on a continuing basis, with the understanding that Rockefeller's share of the operating cost would include its staff assigned to the institute.

18. IRRI's rice-breeding story, of course, only begins with IR8. Although it is still grown in limited areas, IR8 proved to be very vulnerable to pests in some locations (such as the brown plant hopper in Indonesia) and its chalky flavor did not appeal to some consumers. Moreover, although well adapted to areas where water depths in the rice paddies could be tightly controlled by irrigation, it was less so to rainfed conditions. IRRI has therefore been engaged in a continuous breeding program to produce new varieties, each superior in some important respect to its predecessors. When IRRI won the Third World Prize in 1982, it was for IR36.

Beginning a Research System: Other Institutes

Neither foundation had initially envisaged IRRI as the forerunner of other international institutes, but after IRRI had been in operation only two years the foundations were studying the possibility of creating additional ones, and by the mid-1960s Hill and Harrar had begun to think about a set of international institutes addressed to the major food concerns of the tropics, although neither the number of institutes nor the agenda for each was clear as yet. They and others were aware that such agricultural research as had been conducted in the tropics under colonial governments had been focused on cash crops for export—sugar, coffee, tea, and palm oil, for example; almost none of it had been devoted to food crops. They also knew that little of the research done on food crops in temperate zones was directly transferable to the tropics, although the research methodology, centered around plant breeding, was applicable. So an important research gap existed, which the foundations together, with their financial resources and scientific experience, were well positioned to help fill.

CIMMYT

In 1962 President Lopez Mateos of Mexico visited IRRI, which was rapidly acquiring worldwide recognition. When he returned home, he pressed for the creation of a similar international institute specializing in the problems of maize and wheat, to be located in Mexico. An agreement between the Mexican government and the Rockefeller Foundation of October 25, 1963 led to the establishment of the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT, the International Maize and Wheat Improvement Center).

As initially conceived, CIMMYT was to have a small cooperative program, with Mexico providing facilities and the foundation the services of its staff and the necessary foreign exchange. CIMMYT was to be included in Mexico's national agricultural complex at Chapingo and was to be governed by a board of directors, with the Mexican secretary of agriculture and the president of the Rockefeller Foundation serving as chairman and vice chairman of the board, respectively.

When Wortman became director for agricultural sciences of the Rockefeller Foundation in 1966, he visited CIMMYT and reported that it could not become an international center as effec-

tive as IRRI with the inadequate facilities available at Chapingo and with the limited financial support of one foundation. A new agreement was reached on April 12, 1966, which reconstituted CIMMYT under Mexican law as a private corporation with some of the privileges and characteristics of an international organization. The charter was also amended to provide for a self-perpetuating board of trustees, with the chairman and vice chairman to be elected by the members. The agreement permitted CIMMYT to receive funds from any source and, it was hoped, gave CIMMYT the status required to attract additional support. The Rockefeller Foundation's willingness to proceed was based in part on encouragement from the Ford Foundation, which had informally indicated its willingness to join in support of the new organization.

Additional land was provided by the Mexican government at the institute's present site at El Batan and at two additional sites in the valley of Toluca and on the tropical coast at Vera Cruz. The Rockefeller staff that had remained in Mexico, including Borlaug and E. J. Wellhausen (who had directed the maize program), formed the nucleus of the new international staff. Funds for the new facilities were provided by the Rockefeller Foundation in 1966; the Ford Foundation began its support in the following year. The capital costs of CIMMYT were borne by the Rockefeller Foundation, with the two organizations sharing the operating costs.

CIMMYT's headquarters were dedicated in September 1971. Research on the development of new varieties proceeded rapidly, and CIMMYT and IRRI shared the Unesco science prize in 1970, the same year that Borlaug became a Nobel laureate.[19]

IITA

In October 1963, Harrar and Hill, by then president and vice president for international programs of their respective foundations, visited Nigeria to explore the possibility of establishing an agricultural research institute. They proposed to their boards in the following year that an International Institute of Tropical Agriculture (IITA) be located at Ibadan, the site of one of Nigeria's universities. A Ford Foundation discussion paper on the IITA proposal subsequently set forth the philosophy underlying IITA

19. Based in part on Chandler, *Adventure in Applied Science*, pp. 153–54.

and the other centers: "a first and basic requirement to increase [agricultural] production is the development of improved varieties of crops and cultural practices suited to a wide variety of local conditions. Lacking this, an extension service, even if well organized, has nothing to 'extend' and the organization of farm supply and credit services is likely to yield disappointing results." That the foundation was thinking of a research system in global terms is indicated by a further statement: "a few additional institutions of this kind [like IRRI] located at strategic points in the underdeveloped world, could make major contributions towards helping to solve the world's food problems." Moreover, "large private foundations appear to be the only organizations on the horizon at the present time that are in a position to make the kind of long-term commitments necessary to insure the success of such a venture."

Although patterned on IRRI, IITA represented a significant departure. Its responsibilities were to be for the improvement of agriculture in a specific ecological zone (the low, humid tropics) rather than for the improvement of one or a few specific crops. Management of the tropical, laterite soils for sustained high productivity under continuous tillage was to be its principal focus. It was to do research on a number of food crops: food legumes (cowpeas and pigeon peas), root crops (sweet potatoes, yams, and cassava), and, in cooperation with IRRI and CIMMYT, rice and maize. The institute was also to develop systems of permanent cultivation for the region to replace the existing pattern of shifting cultivation. IITA was viewed as having a pace-setting role in improving the effectiveness of the research, training, and extension activities of other organizations in the region.

The Ford and Rockefeller Foundations shared responsibility for IITA from the outset, but with a formula somewhat different from that adopted initially for IRRI: Ford was to provide all of the capital costs, and the two foundations were to share equally in the operating costs. (The arrangement for IRRI was changed at this time to provide for equal sharing of its operating costs as well.) Rockefeller was to assume responsibility for managing the center, although in practice Ford staff (or staff recruited for the purpose) also played a key role.

Although the Nigerian government gave strong and continuing support to the proposed center, activity proceeded slowly because of civil war in the country and the desire of the foundations to keep a close watch on events. The boards of the two foundations committed themselves initially to providing finan-

cial support for seven years, beginning whenever the institute became operational. A ceiling of $750,000 a year for the contribution of each of the foundations to operating costs was fixed, "if possible."

The legal charter of IITA was promulgated by a decree of the government of Nigeria on July 24, 1967. The decree included the unusual provision that the foundations would support core activities for a minimum of fourteen years, if operation was satisfactory. The government made land adjacent to the University of Ibadan available on a long-term lease with an annual rental of one peppercorn. Rockefeller had appointed Will M. Myers, at the time dean of international programs at the University of Minnesota, as the director designate of IITA in January 1965, but by the time the board of trustees first met in 1968 he had become a vice president of the foundation. Ford then engaged Herbert Albrecht, president of North Dakota State University, in his stead. The research program got under way in 1970, but construction was not completed until 1972, by which time the capital cost had mounted to about double the original estimate of $10 million. As it had done in other cases, the Rockefeller Foundation transferred experienced staff who had worked in other international programs to provide a nucleus for the fledgling institute.

CIAT

The fourth and last of the international agricultural research institutes launched by the two foundations during the 1960s was the Centro Internacional de Agricultura Tropical (CIAT, the International Center for Tropical Agriculture). It grew out of the cooperative agricultural program begun in Colombia by the Rockefeller Foundation in 1950. Encouraged by the early success of IRRI, Lewis Roberts of the Rockefeller Foundation and Lowell Hardin of the Ford Foundation jointly prepared a prospectus for an international institute in Colombia. The report submitted to the two foundations in October 1966 bore the self-explanatory title: "A Proposal for Creating an International Institute for Agricultural Research and Training to Serve the Lowland Tropical Regions of the Americas." The proposal contemplated that, like IITA, the Latin American institute would primarily have a regional, ecological orientation rather than focus on one or two crops. Among the arguments in favor of establishing a center on tropical agricultural research for Latin America was the extent of

underutilized, almost empty land in the region. These were acid, infertile soils, mostly in remote areas, which had the potential for increasing agricultural production if their fragile ecosystems could be mastered.

From 1966 to 1968, the Rockefeller Foundation was the sole supporter of CIAT's capital and operating costs, with the notable exception that the Kellogg Foundation provided the capital for construction of training and conference facilities and the Kresge Foundation gave capital for a library and publications building. The Ford Foundation, although involved at the outset, had reservations about the evolving program. The Rockefeller Foundation's decision to proceed unilaterally was made with the understanding that, should the Ford Foundation later decide to give its support to the institute, that support would be welcome. The Ford Foundation made its first contribution in 1969, when it became an equal partner with the Rockefeller Foundation in sharing the operating costs. It thus turned out that for each of the four institutes a different modus vivendi was worked out between the two foundations for the funding of capital and operating costs, at least initially.

The agreement between the Rockefeller Foundation and the Colombian government was signed on November 7, 1967. Once again the legal agreement was tailor-made to the circumstances of the host country, a fact that would later pose considerable problems when the "international status" of the centers became an issue (see chapter 7). For its part, the Rockefeller Foundation's commitment was "to consider annual grants, not only for the establishment of the center but also for its operating costs." Ulysses J. Grant, who had been head of the Rockefeller program in Colombia, was designated CIAT's first director, and other foundation scientists in Colombia became part of the initial staff complement.

CIAT's research program took a number of years to become stabilized. This was due in part to delays in completing the physical plant at Palmira—adjacent to the Faculty of Agriculture of the National University—which was not inaugurated until October 12, 1973. In the interim, the Colombian Agricultural Research Institute generously offered its Palmira station to the growing nucleus of homeless CIAT staff. There was also a continuing controversy concerning the content of the scientific program. The original Rockefeller Foundation program in Colombia had been very diversified and ambitious, and CIAT's early research program had components in beef, swine, maize (in cooperation

with CIMMYT), beans, and rice (in cooperation with IRRI), as well as studies in agricultural economics and rural sociology. After considerable debate, the CIAT program gradually became more concentrated into the four components that it has today: dry beans, cassava, rice, and, for the infertile soil regions, tropical pastures.[20]

Making Collaboration Work

The two foundations, which historically had somewhat different interests, forged an unusually close and effective collaboration in their creation and support of the original four centers. Establishment of each of the four was dealt with by the two foundations in a manner adapted to the particular circumstances of the case. On the whole, the arrangements between the two foundations worked extraordinarily well. The interests of Ford, better endowed financially, were more socioeconomic, while those of Rockefeller, older and with a wealth of scientific staff, were more educational and scientific. Their shared concern to find a way to boost food production in developing countries eased and cemented their collaboration despite occasional and minor differences.

One source of some misunderstanding arose from the different personnel policies of the two organizations in their field programs. Rockefeller concentrated on developing a cadre of career scientists, some of whom had been on the staff since the 1940s and who were available for assignment to new institutes as needed. Ford, in contrast, had a policy of employing its field staff on contracts of two, three, or five years. Because the IRRI scientists were identified with the Rockefeller Foundation, some newspaper stories and magazine articles incorrectly gave that foundation the principal credit for IRRI's successes. In 1966–67, Ford began to permit longer-term employment of key scientists in a few specific cases. Nonetheless, Ford believed that all institute staff should be direct employees and that deputation of staff from the foundations should be progressively reduced. These and other matters were the subject of procedural guide-

20. Lowell Hardin presented an interesting paper, "CIAT as Originally Conceived and CIAT Today: Mandate, Objectives, and Achievements," at CIAT's tenth anniversary celebration of the completion of its physical plant, Palmira, Colombia, October 1983.

lines for the selection of directors and staff of the institutes that were agreed between the foundations in 1967.

A further difference between the two foundations was that Ford initially was more disposed to recognize the potential contribution of economists and other social scientists as recruits to the multidisciplinary teams of the institutes. This difference also disappeared with time.

The mutual trust between the two institutions is evident in the role assigned to Hill. In 1968, when he reached the mandatory age, Hill stepped aside as vice president and became a program adviser to the Ford Foundation. At that time, he took on, virtually for *both* foundations, the role of principal officer in their work on the centers. Thus, his periodic progress reports were addressed to the heads of both foundations. Hill was succeeded later in 1968 by David Bell, who became executive vice president with responsibility for Ford's international programs.

Finding the Funds

By 1967, the four institutes were in various stages of construction or operation, and costs were beginning to mount rapidly. In their budget requests for 1968 to their boards of trustees, officials of the two foundations committed themselves to a maximum contribution of $750,000 each to each center, at least for the time being. The total of $3 million to be contributed by each foundation was recognized to be arbitrary and probably inadequate for the centers to reach their full potentials. But some ceiling was considered necessary in order to secure financial support from other sources, to induce cost-effectiveness in the management of the centers, and to encourage the center directors to take the initiative in seeking outside financial help. Moreover, the early successes of IRRI and CIMMYT had given rise to various proposals for additional institutes to work on other crops or regions of the world, which gave further impetus to the search for funds. It had been anticipated from the outset that financial support from additional sources might be desirable, if not essential, and provision had been made in the charter of each institute to enable it to receive gifts and grants from any appropriate source for purposes consistent with the institute's mission and responsibilities. The expected life of the institutes had not been explicitly addressed, but some of the founding fathers thought that the institutes might work themselves out of their jobs in twenty or twenty-five years.

In mid-1968, Hill estimated that an additional $5 million to $10 million would be needed annually for the four institutes. Mobilizing funds from other sources proved to take longer than had been expected, or at least hoped, and the foundations each had to provide more than the $750,000 limit—$890,000—to IRRI in 1969.

The time had come, in Hill's words, to "go public." The first source to which the foundations turned was the U.S. Agency for International Development (USAID). In 1965, USAID had made a one-time grant of $350,000 to IRRI for a special project (outside the regular or "core" budget) for the development of agricultural machinery. The five-year project was highly successful, but did not immediately lead to other contributions from USAID. During the first half of the 1960s, USAID was hamstrung by congressional attitudes opposing foreign assistance for the development of crops that might compete with U.S. farm production. These attitudes changed in the mid-1960s at the time of the disastrous harvests in India and Pakistan. USAID made a grant of $400,000 to IRRI in June 1968. Eighty percent of the money was tied to the purchase of goods or services from the United States.

One of USAID's annual program reviews conducted by its senior staff had dealt with the topic of the new varieties and had emphasized their great potential. John Hannah, the agency's administrator, and his staff were receptive to the foundations' solicitation of funds to support the work of the centers. Through some confusion in the aid-seeking process, IRRI did not obtain any core funds from USAID in 1969. But CIMMYT did receive $425,000 from USAID in that year, half of it tied to purchases in the United States. The agency was gearing up to accept the foundations' invitation to become a "full and official" partner in supporting the centers on a long-term basis. It declined the foundations' offer to have an agency-appointed representative serve on the boards of trustees of the centers, but it did send observers to board meetings and participate in the centers' program reviews.

Overtures to the Canadian International Development Agency (CIDA) and its president, Maurice Strong, also fell on receptive ears. CIDA proposed to the Canadian government that it provide core budgetary support to IRRI in 1969, but the government turned down its request: Canadian wheat was piling up in storehouses as a result of bumper harvests, and the government did not find the time opportune to seek funds from Parliament to support food crop research in developing countries. CIDA, nev-

ertheless, proceeded with plans, to be implemented when the moment was ripe, to join as a full and equal partner with the foundations by pledging $750,000 to one of the centers.

The Kellogg Foundation, as noted previously, had been an early supporter of CIAT. In 1968 it indicated its willingness to continue its support of CIAT's outreach and communications programs with grants of up to $250,000 annually.

Discussions were also initiated with other potential sources. There were a number of contacts during 1967 and 1968 with the United Nations Development Programme (UNDP), and formal requests for support were submitted, but no assistance was in sight.

The Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD) had begun in 1967 to express interest in the role that its member countries might play in trengthening agricultural research activities, both national and international, in developing countries. The United States (later supported by Canada) took the lead in stimulating DAC's interest in the subject. Meetings of OECD and of DAC were held in Paris in October and November 1968, respectively, with Rockefeller Foundation officials present. It was anticipated that IITA, because of its African location, might be the first institute to receive support from the individual European donors that were DAC members.

This was the state of play in the early months of 1969. Numerous contacts had been made, and there were encouraging signs of interest. But the process was slow and time-consuming, and, as Hill observed, the centers needed something more concrete than encouragement with which to pay their bills. As costs continued to rise, the need for more outside support became urgent. The establishment of some kind of consortium of international aid agencies and donor countries had been mooted by Hill and others in 1968, but they were skeptical of the possibility of organizing it.

Clearly some kind of more comprehensive approach to raising funds was badly needed. The conference that was held in Bellagio, Italy in April 1969 provided just the opportunity.

2

Mobilizing the Aid Community, 1969–71

THE CONFERENCE on Agricultural Development that took place on April 23–25, 1969 at the Villa Serbelloni in Bellagio, Italy was a landmark in the events leading up to the formation of the Consultative Group on International Agricultural Research.There are differing versions of the genesis of the conference (perhaps illustrating the adage that "success has a thousand fathers; failure is an orphan"). The written record is confusing, and memories are fading, but it would appear that events took place as follows.

The First Bellagio Conference

To promote coordination among the agencies and organizations working on the agricultural problems of the developing world, Addeke Boerma, in one of his first acts as head of the FAO, called a meeting at the United Nations in New York, which was attended by senior representatives of the FAO, the UNDP, the World Bank, and the Rockefeller and Ford Foundations, among others. The meeting considered the merits of convening a conference to discuss and coordinate views on agricultural development. The two foundations wanted to avoid a formal meeting at which the official agencies would have a preponderant weight. Sterling Wortman therefore proposed to hold a small, informal gathering of heads of agencies at the Rockefeller Foundation Conference Center in Bellagio, which was ideally suited to such a purpose. The other participants welcomed the idea. The Rockefeller Foundation issued the invitations and hosted the conference.

For the foundations, the conference was a golden opportunity to bring the work of the international institutes before the heads of aid agencies that were potential financing partners. Forrest Hill was inspired to raise the level of interoffice correspondence to an alliterative high in a memorandum entitled, "Selling the Centers at Serbelloni."

The Bellagio Conference was a unique gathering of top officials of international, regional, national, and private organizations concerned with agriculture. It included the heads of three United Nations agencies (the FAO, the UNDP, and the World Bank), the heads of the U.S., Canadian, Swedish, and British aid organizations, and senior representatives of the Inter-American Development Bank, the Asian Development Bank, and the Japanese Ministry of Foreign Affairs. Both of the foundations were well represented by top officials. A list of the participants is given in the appendix to this chapter.

The conference met against a background of worldwide concern, if not despair, over the problems of static food production and rising population in the developing world, mixed with a new hope that modern technology might offer an answer to this age-old problem. These thoughts were well expressed by Will M. Myers, the chairman of the conference, in his foreword to the published proceedings:

> In recent years we have become increasingly aware that in the underdeveloped nations, most of which are predominantly agrarian, agricultural development must precede or at least be concomitant with industrial and other economic and social development. We now understand, better than in the past, that a modern industrialized society cannot be built on the quicksand of a traditional subsistence agriculture, particularly in nations where 75 to 85 percent of the people are engaged in agriculture . . . If the developing nations are to catch up with the developed nations, they must make massive strides in increasing the productivity and efficiency of their agricultural sector . . .
>
> Meanwhile there has been deepening concern about the food gap in the face of rapidly expanding numbers of people. Increases in food production in the developing countries have hardly kept pace with growth in population, so that in most countries there has been no increase in per capita food production and in several, in fact, there has been a sharp decrease. Since it is in these developing coun-

tries that the most critical food shortages already exist, the decline in per capita food production exacerbates an already serious situation . . .

Some authorities, viewing the lack of success of past efforts to achieve agricultural development in the developing countries, have expressed despair regarding the possibility of increasing agricultural production rapidly enough to keep up with the growth in human population over the years ahead . . .

In the past two or three years there have been, however, strikingly encouraging developments in agricultural productivity increases in a few countries. These results generate optimism regarding the possibility of increasing food production rapidly enough to close the food gap over at least the next two or three decades, and thus buying time for population programs to reduce the rapid rate of population growth . . .[1]

The range of concerns of the participants was reflected in the papers presented:

- "World Needs and Potentials in Agricultural Production," prepared by the FAO
- "High-Yielding Varieties Program," also prepared by the FAO
- "The Technological Basis for Intensified Agriculture," by Sterling Wortman, Rockefeller Foundation
- "Later-Generation Agricultural Development Problems," by Lowell S. Hardin, Ford Foundation
- "Capital Flows and Income Transfers within and between Nations to Sustain the Agricultural Revolution," by Stanley Please, World Bank
- "Priorities in Agricultural Development," by Forrest Hill, Ford Foundation.

Throughout the papers were references to the untapped potential of the new high-yielding varieties and to the significance of the new technology for closing the gap between worldwide food production and rising population. The FAO paper on high-yielding varieties, for example, called them "the most exciting breakthrough in tropical and subtropical agriculture for a great many years," and Wortman's paper began with the promising

1. Rockefeller Foundation, *Agricultural Development: Proceedings of a Conference* (New York, 1969).

statement, "Mankind now has the capability, given the will, to meet food needs for two or three decades . . . " As the informal summary of the proceedings put it: "The importance of vastly superior technologies of production was a thread running through the entire meeting. Such vastly superior technologies are a pervasive force in disrupting traditional agriculture and paving the way to its modernization and to great increases in agricultural production."

The conferees were a disparate group of individuals, some of whom had never met and who had no experience of working together. As one participant (David Bell) saw it, the conference did not begin to coalesce until Hill, in a homespun and persuasive presentation, spoke about how the new varieties were transforming agriculture in places like India's Punjab. Thereafter, a consensus began to form about the importance for the international community to seize the opportunity afforded by the new technology. Later in the discussion, Robert S. McNamara, president of the World Bank, mentioned the possibility of forming a consultative group or consortium for fund raising, and John Hannah of USAID promptly seconded the idea, indicating that the U.S. government would consider providing 25 percent of whatever amount could be raised. The new technology and the new means to fund it were beginning to fit in place.

The summary of proceedings stressed the need for financial assistance from multilateral and bilateral agencies to support a hierarchy of institutions, ranging from the international agricultural research institutes through regional research institutes to national research and extension programs. Within this hierarchy, institutions were to be complementary: the international institutes were to provide shortcuts in developing technologies and in training people that would fill the gap while national institutions and programs were established and strengthened.

The additional financing needs of the four existing institutes were identified. The conferees also mentioned half a dozen other institutes that could be established, if funds were available, to deal with water development and utilization; economic, social, and agricultural policy problems; arid lands; protein-rich crops; animal health and production; and rodent and pest control. This list was considered speculative; the conferees thought that even more institutes might prove necessary after careful study.

There was a consensus on the desirability of additional support for the existing four institutes, up to the levels indicated by

the foundations, and for some of the additional ones mentioned. How to mobilize the additional funds was left vague. The conferees noted that some agencies would have difficulty making grants directly to the institutes, and "various mechanisms and arrangements for overcoming these difficulties" were discussed. The idea of a consultative group or consortium to serve this purpose had not yet crystallized to the point of being referred to in the summary of proceedings.

Participants at the Bellagio Conference had reason to feel that they had attended a meeting of more than ordinary significance. In the course of three days, they had progressed from a general consideration of the broad issues of agricultural development to focus on a highly promising avenue for initiatives to deal with the problem of world hunger: development of new production technologies through internationally supported agricultural research. Perhaps the key to the meeting's success was its particular amalgam of scientists and aid administrators. To Wortman, it was the most important event of his professional life. He remarked, "While those of us who were scientists thought we knew roughly what was needed, we had no idea what might be done to marshal funds and expand the system. It was here that McNamara, Hoffman [of the UNDP], Hannah, Wilson [of the ODM] and others excelled."[2]

From the viewpoint of the foundations, the Bellagio Conference was successful in forging agreement on the need for greatly intensified efforts to develop and introduce new technologies. Wortman thought that "the problem of financing international agricultural activities, particularly the institutes, seems near resolution" as a result of the prospective participation of bilateral donors and international agencies, including the World Bank and the UNDP. Financing seemed sufficiently probable to allow the conferees to turn their attention to additional centers, stimulated by McNamara's urging that at least one new institute be brought into being before the next Bellagio meeting of agency heads, proposed for one year hence.

It was evident to the foundations that the agency heads present at Bellagio looked to them for continuing leadership. They proceeded immediately with various plans to raise funds from potential donors and to develop the new institutes and activities

2. Sterling Wortman, *Beyond the Bottom Line* (New York: Rockefeller Foundation, 1981), foreword. Wortman rose in the ranks of the foundation to become its acting president in 1979.

that had very tentatively been identified. Donor organizations, too, acted quickly to follow up on the enthusiasm generated at Bellagio.

The Development Assistance Committee

First off the mark was the Development Assistance Committee (DAC), whose chairman, Edwin M. Martin, had attended Bellagio. As mentioned in the preceding chapter, DAC had over several years been holding informal meetings to consider ways in which OECD members could assist agricultural research in the developing countries, including the work of the international institutes. Another such informal meeting of experts, which had been scheduled before the Bellagio Conference, was convened by DAC on May 7 and 8, 1969 "to discuss possible support for international agricultural research institutes." The meeting, which was jointly sponsored by the Canadian and U.S. delegations to the OECD, was also attended by representatives of the foundations.

In preparation for the meeting, the sponsoring delegations had circulated notes on the international agricultural research institutes. One note, prepared by the foundations, described in detail the rationale and purposes of the four existing institutes; their on-going programs, organization, and staffing; and the need for greater financial support. The different forms that contributions to the international centers might take were described. It was expected that major and continuing donors would be invited to participate in shaping the programs of the institutes through representation on their boards of trustees, membership on central committees of the boards, or participation in annual budget and program reviews held by the principal donors (presumably a reference to the annual International Centers Week convened by the two foundations). If donors contributed through a third organization, such as an international or regional bank, or through a consortium, the third organization or consortium might be represented on the board or at annual budget and program reviews.

The DAC meeting evoked strong expressions of interest from a number of the country representatives. To follow up on the discussion, Myers was asked to suggest precise forms of assistance to the international institutes. His subsequent note elaborated on the various types of grant aid, contributions of qualified sci-

entific staff, or support of training programs that were possible. In response to the question of how continuing contact might be arranged between the institutes and the national assistance agencies, Myers suggested various means of exchanging visits or proposals. The only suggestion with respect to any kind of "umbrella" organization was that the secretariat of DAC could serve as an intermediary, at least for arranging the initial contacts. At this time, clearly, the foundations were not thinking of any new international framework that might be interposed between them and the institutes.

The United Nations Development Programme

The UNDP also responded quickly, because it too had been considering for some time how to provide financial assistance to the international institutes. In his opening statement to the Eighth Session of the UNDP Governing Council in June 1969, Paul Hoffman, the head of the agency, referred to the Bellagio Conference and attached a brief summary of the discussion. After describing the importance of the new research, Hoffman went on to say:

> I firmly believe that the United Nations Development Programme should devote, in 1970, a small fraction of its resources to global and regional projects in basic agricultural research—something, perhaps, on the order of 2½ to 3 percent. What the percentage should be in later years and to what extent basic research in other fields should be supported would be a matter for later decision. Such international inputs should not, in my opinion, require national counterpart contributions, at least for the initial projects receiving UNDP support.[3] These projects would, however, naturally involve co-operation by Governments of developing countries and participation by their citizens.
>
> I have no specific projects of basic agricultural research that I would wish to propose, at this session, for UNDP support. However, should the Governing Council agree that there should be limited and experimental support by the UNDP of basic research in areas of critical need, I would expect that recommendations for two or three such projects

3. This was a significant departure from the normal UNDP practice of requiring such contributions.

could be ready for inclusion in the January 1970 programme.

Hoffman concluded this part of his statement on a strong note in which enthusiasm ran ahead of syntax:

> May I add my further conviction that—on the basis of what has already been accomplished by basic research in certain agricultural fields—UNDP participation in expanding such research is almost obligatory for our Programme. We have here an opportunity to contribute significantly to progress in a fundamental area of development. We should not allow this opportunity to go by ungrasped.

Hoffman's proposal evoked favorable comment from almost every speaker in the ensuing general debate. A specific proposal for a UNDP grant of $1.6 million to CIMMYT for use over three years to support work on the development of maize types with high nutritive value was quickly prepared and approved by the Governing Council in January 1970. This was the first such grant by the UNDP to an institution that was not a member of the UN family of organizations.[4]

The Food and Agriculture Organization

Of the three UN agencies that would eventually become cosponsors of the CGIAR, the FAO was the one most advanced in its support of agricultural research and development related to the new, high-yielding varieties. The FAO was already assisting a number of small, scattered projects in such areas as field testing of new varieties, development of new seeds, and training of research personnel. It was associated with a regional research institute, the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE, the Center for Research and Training in Tropical Agriculture) at Turrialba, Costa Rica, and had taken the lead in carrying forward an initiative to establish a West African Rice Institute (which later joined the CGIAR as the West Africa Rice Development Association). Based on a 1968 staff paper, the FAO

4. This was the first of numerous occasions on which William Mashler, the director of the newly established Division for Global and Interregional Projects, showed his ingenuity and resourcefulness in finding funds from within the UNDP to support projects or programs of the international centers.

had selected high-yielding varieties of food crops as one of five areas for special concentration of effort. Even before the Bellagio Conference, the FAO was considering ways in which it could assist developing countries in increasing food production with the new varieties and proposed to work more closely with other agencies and the two foundations to this end.

Furthermore, a policy review within the FAO endorsed this approach. Boerma had asked a consultant (Sir Otto Frankel) to examine the entirety of the FAO's policy on science and research in agriculture. The consultant's report recommended that the FAO strengthen and expand its support for science and research through a deliberate and well-orchestrated approach. The FAO Conference of November 1969 confirmed the organization's interest and active role in the field of agricultural research.

The World Bank

By the mid-1960s, the World Bank, too, was aware of the rapid spread of the Green Revolution in Asia and was considering how to support the financing of agricultural research in the developing world. Agricultural lending by the Bank was still relatively modest, and research projects were not yet part of the agricultural lending portfolio, except as components of projects for other purposes, such as agricultural education. A proposal for the World Bank to establish a separate foundation to fund such research, presumably to be modeled on the Ford and Rockefeller Foundations, had been tried out informally on the Bank's Executive Directors, who had shown little enthusiasm for it.

A staff working paper written in 1967 debated the Bank's role and found opinions sharply divided. Despite suggestions from the foundations, the FAO, and others that the Bank become more active in this field, considerable doubt was expressed within the Bank about whether countries would rush to borrow in support of national agricultural research programs. It seemed more likely that the Bank's role would be confined to technical assistance and some imprecisely defined coordinating function with the foundations and bilateral aid agencies in identifying research needs on a regional basis.

Robert McNamara, who became president of the Bank in April 1968, had considerable experience with applied research as president of the Ford Motor Company and as U.S. secretary of defense. Moreover, after coming to the Bank he continued to serve

as a director of the Ford Foundation and was familiar with its programs. Fired with enthusiasm following his participation in the first Bellagio meeting in April 1969, McNamara launched a campaign to place the Bank in the forefront of organizing the international funding of agricultural research.

McNamara promptly informed the Bank's senior staff about the Bellagio meeting, and staff work to flesh out a specific proposal began in earnest. An initial meeting was held with the Rockefeller Foundation, and the assistance of Sir John Crawford, vice chancellor of the Australian National University and a consultant to the Bank on agricultural matters, was enlisted. Discussion by the Bank's Board of Executive Directors (or Executive Board) in June 1969 of the problem of stabilizing the prices of primary products provided the opportunity to arrive at a decision that the Bank should be prepared to participate in financing agricultural research, as much as possible in cooperation with other national and international organizations.

An occasion for mobilizing international support was afforded by the annual meeting in September 1969 of the Board of Governors of the Bank and the International Monetary Fund, which was attended by ministers of finance and governors of the central banks of the member countries. After pledging to expand lending to the agriculture sector, McNamara in his opening statement referred to the response of agricultural production to the new technology, while warning that numerous problems would have to be solved "if the hopes for the Green Revolution are to remain green." He then went on to say:

> The Bank stands ready to offer both technical advice and financial assistance in all these problems. But there is something further I am convinced we ought to do. We should assume a greater role of leadership in promoting the agricultural research of today that will be the foundation of greater agricultural growth tomorrow.
>
> The economic efficacy of such research is dramatically apparent in the case of the new "miracle seeds." They are not the result of a miracle. They are the result of a relatively modest investment of funds, and a high degree of dedicated and creative work. The new rice strains, for example, were developed over a period of six years with a total investment of less than $15 million at the International Rice Research Institute in the Philippines.
>
> There is an urgent need for a great deal of this innovative research in fields such as the low-cost production of addi-

tional protein; the more effective use and control of scarce water supplies; and the elimination of animal and plant diseases which in some areas reduce livestock and crops by as much as a third . . .

I hope, then, that the Bank, and organizations particularly experienced in such matters—the United Nations Development Programme, the Food and Agriculture Organization, the aid institutions in countries such as Canada, France, Sweden, and the United States, and the Rockefeller and Ford Foundations—can join together with the developing nations in order to launch a new and sustained effort in applied research in each of these critical areas.[5]

The following month McNamara wrote to the director general of the FAO and the administrator of the UNDP, inviting them "to join with the Bank in exploring the possibility of mobilizing long-term financial support from international agencies, governments and private sources to supplement present arrangements for financing existing international agricultural research institutes and, over time, a number of new ones." The two agencies accepted in principle. The first formal steps were thus taken leading to the establishment, with the three agencies as cosponsors, of what would eventually be called the Consultative Group on International Agricultural Research.

Within the Bank, the idea of a consultative group emerged only gradually. Although it was clear among the three agencies that the Bank would take the lead in raising funds from multilateral and bilateral sources, the mechanism for doing so was still undetermined. A trust fund was considered, as well as a consortium or consultative group. A consortium implied a more formal pledging of funds from donors than was the practice for consultative groups. The Bank had already used both consortia and consultative groups to coordinate assistance to particular recipient countries, although consultative groups were more customary. In both cases, donors meet periodically—usually once a year—with officials of the developing country, in a one- or two-day meeting generally chaired by the World Bank, at which the country's economic development plans and problems are re-

5. Robert S. McNamara, address to the Board of Governors of the International Bank for Reconstruction and Development and its affiliates, September 29, 1969; reprinted in World Bank, *The McNamara Years at the World Bank* (Baltimore, Md.: John Hopkins University Press, 1981), pp. 78–80.

viewed and the aid intentions of the donors discussed. The consortium model appeared to gain favor as various papers and prospectuses were drafted by the staff.

The Foundations

A series of meetings was held between the Bank and the two foundations in the latter half of 1969 and early 1970. The foundations warmly welcomed the Bank's entry into the international research scene and the authority it could lend to efforts at raising funds. Progress was made on a variety of fronts in a very cooperative spirit. There remained a difference of view, however, on organization. Although neither the Bank nor the other UN agencies contemplated a direct managerial role in the existing or new international institutes that they would be assisting, they envisaged a more formal and active role for a consortium or consultative group than the foundations thought desirable. The latter, as previously noted, preferred to invite major donor organizations, or a consortium of donors, to name a member of the recipient institute's board of trustees. The views of one senior foundation official were put succinctly in his marginal comments on a draft proposal prepared by Bank staff:

Fund raising:	Yes
Management:	No
Consultative Group:	Maybe.

Concerned about the lack of progress in finding additional funds to cover the financing gap of the existing centers, a foundation official observed wryly at the end of November 1969 that: "It was expected from the beginning that the fund-raising would be difficult and time-consuming, and our expectations have been borne out." The foundations therefore intensified their unilateral efforts to raise funds from the donors present at Bellagio, and the Ford Foundation prepared a prospectus for this purpose. It envisaged that, even if what was sometimes referred to as "Mr. McNamara's consortium" should come into being, some donors might prefer to deal directly with individual centers. The time had obviously not yet arrived for the foundations to feel that they could prudently put all their eggs into the consortium basket.

A meeting between staff of the two foundations and the Bank on January 15, 1970 brought the organizational questions to a head, but did not resolve them. The foundations expressed

doubts about the consortium approach and about the proposed role of the three UN agencies in some form of cosponsorship. The basic objective of the foundations was to make the institutes independent as soon as possible, although they had no precise timetable for doing so; the UN agencies appeared to the foundations to envisage an organizational structure that would threaten the independence of the institutes and thus the integrity and scientific quality of their work. In lieu of a consortium or consultative group, the Bank might, the foundations suggested, create a group of "Friends of the Institutes." Alternatively, supporters could meet periodically to direct investment "permissively." In an internal memorandum commenting on the January meeting, a Bank staff member noted the lack of progress on this subject in discussions over the previous three months and the prospect of slow progress ahead.

Bellagio II

The pessimism on the part of the foundations and the Bank proved to be short-lived. Another opportunity to air the issue, this time before a larger audience, was provided in the following month. At the close of the Bellagio Conference in April 1969, it had been agreed that a meeting of "senior technical personnel dealing with agriculture" would be held early in the following year to prepare for a second meeting of agency heads at Bellagio in April 1970, one year after the original conference. The meeting, held at the Villa Serbelloni on February 3–6, 1970, was attended by a wider range of development assistance agencies than had participated in Bellagio I.

The background paper from which the Bank's representative (L. J. C. Evans) spoke to the meeting was thought by the foundations to be "much more reasonable" than the earlier consortium proposal. (In fact, positions had moved closer together on both sides.) In addition to providing financial assistance on its own, the Bank proposed that, together with the FAO and the UNDP, it seek to interest governments, regional development banks, and private organizations in ensuring long-term financial support. The Bank envisaged mobilizing resources through "a loose organizational framework, along the lines of the consultative groups which have been set up to coordinate development assistance." The group would meet regularly, probably once a year, to review the institutes' budgets, assess financial assistance needs, commission feasibility studies for new activities, and suggest specific

research projects to the institutes. The Bank was prepared to provide a secretariat and to administer a general fund to which some donors might wish to contribute. But the group would not undertake any management or programming role with respect to the institutes; it was important to preserve their autonomous, independent character. Some representation by donors on the boards of trustees of the centers would be appropriate, collectively or in relation to the magnitude of their support.

The summary of findings of this group of agriculturalists (as they called themselves), entitled "Accelerating Agricultural Modernization in Developing Nations," extended and developed the analysis of the role of new technologies. On the question of funding, the group pointed in the following way to the need to secure the current and future operational budgets of the four existing international centers:

> As finance for expanded research beyond the capacity of the Foundations is clearly required, an organization for funding is desirable. It is suggested that tentative proposals by the IBRD [World Bank] involving a consortium or consultative group or groups be examined and resolved, keeping in mind the need: (1) to encourage multilateral and bilateral donors to participate in the necessary funding, and (2) to make decisions arising out of other suggestions in this paper.

There was still a small difference of opinion between the foundation officials, who drafted the summary of findings, and the Bank staff, who had proposed wording to the effect that "proposals by the IBRD involving IBRD leadership of a consultative group should be encouraged and developed," rather than "examined and resolved," as more nearly reflecting the majority view. Whichever statement more accurately reflected the consensus of the group, it is fair to say that there were—and have continued to this day to be—misgivings on the part of the other participants about the Bank's role.They recognized the need for an organization like the Bank to *lead*, and were prepared to have it do so, but did not wish it to *dominate*.The thin line between leadership and domination has not always been an easy one for the Bank to walk to everyone's satisfaction.

Based on a very "impressionistic" view of the adequacy of existing technical knowledge, the agriculturalists also proposed the establishment of small task forces to determine the feasibility and potential usefulness of new international centers or ac-

tivities. The following subjects were suggested, with their priority to be determined by the feasibility studies:

- water management for crop production
- food legumes (grains, oilseeds, and pulses)
- starchy root crops
- livestock systems in Southeast Asia
- upland crops in Asia (soybeans, grain legumes, maize, millet, and barley) and appropriate cropping systems
- farming systems suitable to the semiarid areas of West Asia and Africa
- policy, management, and analyses of socioeconomic problems and development strategies.

The forthcoming Bellagio Conference in April was to be presented with whatever illustrative analyses were available (for example, on water management), with the recommendation that the foundations and other appropriate bodies be invited to establish the necessary task forces.

Bellagio III

The meeting of agricultural representatives, originally intended only as a preparatory session, has in retrospect been considered of sufficient importance to be labeled Bellagio II. When the heads of agencies convened a second time at the Villa Serbelloni, on April 8–9, 1970, in what is now referred to as Bellagio III, they had the recommendations of Bellagio II as their agenda. The list of agencies and representatives in attendance was much the same as at the original Bellagio Conference.

The April 1970 meeting discussed the formation of a consultative group—the idea was again put forwa-d by McNamara—to be concerned with the financial aspects of international agricultural research and training. Support for a consultative group had by now solidified, and the meeting endorsed the approach and urged that the World Bank, subject to the approval of its Executive Board, take such an initiative in consultation with the FAO and the UNDP. Another meeting of the Bellagio group was scheduled to take place in New York in December 1970 to consider funding of the present institutes and other matters, including the formation of additional centers. Five feasibility studies

were to be undertaken without delay on subjects recommended by the agriculturalists and reports presented to the December meeting:

- *Upland crops in Asia.* A study was to assess the need for an additional research center in Asia, where the greatest absolute increase in population was projected and where land shortages were most critical. The center would complement the work of existing international centers for wheat, rice, and maize by assisting with research and training in other important but neglected basic food crops, such as sorghum, millet, and food legumes.
- *Food legumes.* To combat protein malnutrition and supplement research then under way on cereal and animal proteins, recommendations were called for on actions to improve the more important legume crops, which were rich, but highly diverse, sources of protein.
- *Livestock in Africa.* An assessment was to be made of efforts to improve animal production and health in Africa, where problems of agricultural development were particularly acute because of the inexperience of many national governments and the shortage of trained personnel. Such an assessment would supplement the work of IITA in Nigeria on crops, soils, and cropping systems.
- *Water management systems for crop production.* A study was to assess ways to develop such systems rapidly and to train the technical personnel required to make existing and future irrigation schemes more efficient and productive.
- *Policy planning.* Research was called for on the need for new data to improve agricultural policies and programs. National planning agencies concerned with agricultural development were thought to be seriously handicapped by lack of information on which to base decisions regarding the order of priorities in the development process and the efficient allocation and use of resources.

At the close of Bellagio III, the international donor community had accepted the concept of some form of consultative group mechanism, cosponsored by the three UN agencies and led by the World Bank, to help raise funds in support of international agricultural research. The scene then shifted to Washington, where it became McNamara's task to secure the approval of the Bank's Executive Board for this novel approach.

The World Bank's Board of Executive Directors: Round 1

The first occasion to bring the matter before the World Bank's Executive Board had already arisen in March 1970, just before Bellagio III, in connection with the recommendations of the report of the Commission on International Development (the Pearson Report). Pearson Commission recommendations 24 and 27 called for multilateral lending agencies to finance research and development projects on a large scale. The report emphasized research in new techniques of education and in human reproduction and fertility control, but mentioned tropical agriculture among several other areas deserving investigation.

In commenting to the Executive Board on these recommendations in March 1970, McNamara referred to the work of the international agricultural research institutes, "always assuming they are soundly organized and managed," as being particularly worthy of the Bank's support. He mentioned the favorable response of the UNDP and the FAO to his October 1969 invitation, and he indicated that, if the exploratory discussions to mobilize long-term financial support for international agricultural research institutes proved successful, he would present specific proposals for Bank participation to the Executive Board for approval.

Recognizing the need to bring the Executive Directors fully into the picture if he was to secure their support, McNamara also sent them a background memorandum in March 1970, entitled "Support for Agricultural Research Institutes." In a somewhat unusual step, the draft had been cleared not only with the heads of the UNDP and the FAO but also with the Rockefeller and Ford Foundations. The memorandum made a number of points that have stood the test of time:

- The substantial increase in agricultural production needed in the developing world would have to come from higher yields per acre and from improved livestock. Both required new technologies, which farmers would use if the financial incentives were right and facilities were available.
- National research institutes in developing countries would have an important role to play and should be encouraged and supported.
- Experience with CIMMYT and IRRI demonstrated that an international institute with well-defined objectives, sound manage-

ment, and adequate funds, equipment, and research facilities could attract outstanding scientists from a number of countries and with a variety of disciplines, whose skills would thus be mutually reinforcing. The international institutes could not only expedite the development and application of new technology directly, but also could encourage and strengthen national research and extension organizations in developing countries in a variety of ways.

- Financial requirements of the existing centers exceeded the resources of the two foundations. There was an immediate shortfall in the prospective funding of the core budgets of IRRI and CIMMYT for 1970, and the need for additional funding would grow in the future.
- New international institutes would be required to cover other geographical and ecological zones and additional crops (as identified at Bellagio III). Feasibility studies would be required, and large sums would be needed for the capital costs of setting up four new institutes over the next five years and meeting their core operating budgets.

McNamara's description of the concept of a consultative group, although couched in tentative language, implied that staff planning was already well advanced:

> I have been tentatively thinking that something along the lines of the consultative groups which we have organized for the coordination of development assistance might be an appropriate vehicle. Such a group, composed of contributors and potential contributors, would consider which institutes required and deserved international support, review the institutes' budgets, assess the magnitude and priorities of financial assistance required, and examine the relationship of the institutes' programs to the economic development problems of the developing countries and to the investment programs being carried out in those countries by participants in the group. The group, or some members in the group's behalf, might commission feasibility studies and suggest research projects to the appropriate institute. On the basis of their analysis, members of the group would make their contributions, perhaps directly to a particular institute, perhaps to a central fund. I would think that the Bank might appropriately provide secretariat services for such a group, as it does for the aid coordination groups, and that if establishment of a fund appeared a desirable way to

handle the finances, the Bank might agree to administer it. All of this remains for exploration.

The Bank, the memorandum indicated, should not merely assist in mobilizing support; it should itself make a financial contribution. The preferred mechanism would be to make grants for agricultural research in limited amounts from any funds transferred out of the Bank's net income for the fiscal year to its concessional loan affiliate, the International Development Association (IDA).

Informal canvassing of the Executive Directors found a generally favorable response to the memorandum, but with some significant reservations. It was therefore decided to postpone what might prove to be a controversial discussion until after a meeting on the replenishment of IDA, to be held in Vienna in May.

Cosponsors and Foundations

In the meantime, and following Bellagio III, the Bank convened a meeting at UNDP headquarters in New York on May 13, to help work out the details of what was now unambiguously referred to as the "consultative group" proposal. Representatives of the three intended cosponsors met privately first, as an "Executive Committee"; they were joined in a second session by representatives from the Ford and Rockefeller Foundations and the Inter-American Development Bank. David Hopper, head of a new Canadian aid instrumentality, the International Development Research Centre (IDRC), attended as an observer.

The idea that the three UN agencies should constitute an Executive Committee had been introduced by the FAO and supported by the UNDP. The Bank had its misgivings about excluding other donors, particularly the foundations, whose reservations on the subject were well known to it. In fact, the first meeting of the Executive Committee was abbreviated because of the delayed arrival from Washington of the aircraft carrying the Bank staff members. It was also the last; other donors were not prepared to relinquish to the cosponsoring agencies the degree of control implicit in an Executive Committee.

The New York meeting focused on several key issues:

- the composition of the proposed consultative group (which governments, international organizations, and private organizations should be invited to participate, what the role of devel-

oping countries should be, and what the timing and agenda for the first meeting should be)

- the functions of the consultative group (whether it should fund new or existing institutes, what support it should give to national research programs)
- the creation of a technical advisory group of agricultural experts, serving in their individual capacities, to review research proposals, to assess the results of feasibility studies, and in other ways to provide technical expertise
- the selection of an initial list of possible new agricultural research institutes that might be commissioned over the next several years
- the arrangements for provision of secretariat services for the consultative group (the Bank's initial recommendation was that the secretariat comprise two full-time staff members, one of them seconded by the FAO).

Progress was made on each of these points, and one foundation official left the meeting satisfied "that there would be adequate room for maneuver to avoid the consultative group's becoming over-organized and burdensome."

The World Bank's Board of Executive Directors: Round 2

Continuing to press ahead, McNamara again wrote to the Executive Directors, on May 27, 1970, providing what was in the nature of a "progress report."[6] He advised them that recent discussions—presumably a reference to Bellagio III—had made it clear that "an initiative of the kind proposed would be welcomed

6. In describing at greater length the role of the World Bank, it has not been my intention to minimize the importance of the other organizations that were working toward the same objective. No doubt I have been guilty of the familiar author's failing of writing most about the things I know best. It is fair to say, however, that at this stage the Bank was in the key position in bringing the proposal to fruition. Moreover, the Bank's Executive Directors are representatives of member governments, and it was through their behind-the-scene contacts with their national representatives on the Bank's Executive Board (as well as in the FAO, the UNDP, the DAC, and other forums) that officials of the aid agencies of the United States, Britain, Canada, and other governments helped to exercise their influence.

by the governments and private entities which have thus far been the principal source of finance for international agricultural research institutes, as well as by other governments which are prospective contributors, and that the FAO and the UNDP are prepared to join with the Bank in organizing the undertaking." The Bank would act as chairman of the consultative group and would house and provide at least some of the requisite secretariat services. The first meeting of the consultative group was proposed for the second half of October. The meeting would be essentially exploratory and organizational, but it would also: (a) receive progress reports on the four existing institutes and on the status of feasibility studies being made for new institutes, and (b) consider how to meet the expected shortfall in the financial requirements of the existing institutes for 1971, then estimated at about $1 million. Finally, McNamara proposed that a meeting of the Executive Board take place in July to consider the Bank's role.

Despite these extraordinary efforts to keep them informed, the Executive Directors showed considerable divergence of views in their discussions of the issue on July 23 and July 30, 1970. Although there was widespread support for a greater Bank role in funding agricultural research, several directors held the view that, if a consultative group were to be formed, the FAO and not the Bank should take the lead.[7] Others questioned whether a consultative group was in fact required. Some expressed preference for greater coordination among regional or national research institutes rather than the creation of new international ones. There was concern about the implications of the proposal for Bank staff requirements. More time and thought were needed before concrete action could be taken.

Before the July 23 meeting adjourned, the staff indicated that in discussions with the FAO it had been agreed that the FAO would take the lead on scientific or technical matters (including the nomination or appointment of the chairman of a technical advisory group) and the Bank on financial and administrative matters. (The fact that Boerma and McNamara saw eye-to-eye on the respective roles of their two institutions proved to be a critical element in eventually gaining acceptance for the proposal of a consultative group.)

7. This was particularly the view of some European Executive Directors, whose governments may have felt more closely involved in the direction of the FAO's affairs than those of the Bank.

McNamara closed the meeting with two points. He conceded that the organizational proposals under discussion were not the only avenues, or perhaps even the best avenues, to approach the problem. But he stressed that the problem was very serious. Over the next decade the Bank expected to be investing some $4 billion in agricultural projects with a total value of perhaps $10 billion.[8] The research base with which to validate this large investment did not exist. Some way had to be found to ensure the developing countries and the donors that these projects would be of the maximum potential benefit.

The July 30 meeting covered much the same ground, with additional Executive Directors speaking for or against McNamara's proposal. The highly respected Pieter Lieftinck, dean of the Executive Board, agreed that the Bank should give agricultural research high priority, but doubted whether the loose organization of a consultative group could provide the stability and continuity of policies and finance needed for long-term research. The same kinds of doubts applied to the use of the annual transfer of Bank profits to IDA as the source of funding, because that transfer could not be subject to a long-term commitment.

In concluding the discussion, McNamara noted the nearly unanimous view that the Bank should act to stimulate further research in the field of agriculture. Some strong reservations had been expressed, however, and he had decided to defer a decision on to what action, if any, to take. After reading the transcript of the meetings and consulting further with the staff and with the directors who had expressed the strongest views, he would come back with a proposal some time in the future, preferably sooner rather than later.

These concluding remarks reflected discouragement at what clearly was a setback. But the discouragement and the setback were of short duration. One week later McNamara sent another memorandum to the Executive Directors, in which he stated that his review of the transcipt had confirmed that there was almost unanimous agreement on the urgent need for greater effort in research to support agriculture in the developing countries and that, with very few exceptions, the Executive Directors believed that the Bank should play a part in supporting such an increased

8. This was one of the very rare occasions on which McNamara, even speaking impromptu, did not have his numbers right. They were much too low, and he revised them upward in a subsequent statement.

effort. While a substantial majority endorsed his suggestion that a consultative group be organized, with the Bank, the FAO, and the UNDP as cosponsors, divergent views had been expressed by a few Executive Directors. He therefore proposed as a next step to consult with those governments that had expressed reservations to see whether a consensus could be reached. (In the meantime, plans to convene the first meeting of the consultative group in October or November were quietly shelved.)

There followed an intensive round of discussions in Washington and several European capitals. Some of the key governments, while not abandoning their opposition or reservations, softened them to the point that McNamara could inform the Executive Directors on October 30, with a "pleasure" that no doubt was genuine, that no objection had been interposed to the convening by the Bank, the FAO, and the UNDP of a meeting of interested governments, institutes, and private organizations. There were two important provisos. First, the meeting was to consider the establishment, terms of reference, and organizational arrangements for an International Agricultural Research Consultative Group "or some comparable mechanism," and second, the meeting would be a "preliminary" one, with the understanding that opportunity would be provided to all participants to raise any relevant issue for discussion and without prejudice to the question of their ultimate participation in a consultative group, should the meeting result in a decision to create one.

McNamara informed the Executive Directors that in the absence of advice by any of them to the contrary by a designated date (a standard formula) he would, in cooperation with the FAO and the UNDP, issue invitations to a preliminary meeting in early January 1971. No contrary advice was received.

This ended the period of active debate by the Bank's Executive Directors on the merits of the consultative group and of the Bank's involvement in it. With the exception of one government (France), which remained a lukewarm participant for the first six or seven years, the governments represented around the board table soon became strong supporters of the fledgling group and have, without exception, so continued to this day.

On November 19, McNamara issued invitations to fifteen governments to attend on January 14–15, 1971 what was cautiously described as a meeting "to organize long-term support for international agricultural research." A staff paper prepared by the FAO and the Bank and annexed to the invitation bore the more explicit title, "The Possible Objectives, Composition, and Orga-

nizational Structure of an International Agricultural Research Consultative Group."[9]

Bellagio IV

"Bellagio" had by this time become a code word as much as a geographical location, and the fourth Bellagio conference was held on December 3 and 4, 1970 at the headquarters of the Ford and Rockefeller Foundations in New York City (one day at each headquarters). The conference had been scheduled at the time of Bellagio III in April and was intended as a follow up to it. It took place in the shadow of the forthcoming preliminary meeting of the Consultative Group, and the ranks of the participants—again nominally heads of agencies—were swollen by other senior agency staff and observers.

As in the case of Bellagio I and III, the meeting began with an overview of the worldwide agricultural situation, which emphasized that developing countries had not yet achieved the capacity to feed their rapidly rising populations. Despite some progress, per capita food output remained low, and malnutrition was widespread. The developing nations would, therefore, have to continue to direct their efforts toward accelerating agricultural output and improving its distribution to meet food and nutritional needs.

The principal items on the agenda were the results of the five feasibility studies that had been commissioned at Bellagio III, four of which had been prepared by the two foundations and one by the IDRC. No final judgments were attempted, in recognition that the forthcoming meeting of the Consultative Group would soon take over responsibility for these matters. Nonetheless, the proposal for a new institute in Asia to deal with the semiarid tropics seemed the most likely to move forward in the near future; most of the other proposals were considered to require more preparatory work of one kind or another.

The participants at Bellagio IV also reviewed the financial requirements of the existing institutes. The additional requirements for the four centers by 1975 would be $6 million (the core budgets totaled about $10 million in 1971). Although this sum

9. One of the results of the January 1971 meeting was to reverse the word order of what had until then been referred to in correspondence and internal memoranda as the International Agricultural Research Consultative Group (IARCG) to its present, somewhat more euphonious version.

was characterized by one of the participants (McNamara) as "peanuts" (which, in a global context, it certainly was), the participants agreed that full funding of the programs of the existing centers should take priority over any expansion of their activities or the establishment of additional centers. The foundations reaffirmed that their financial resources were stretched to the limit by their present commitments to the four institutes (of $3 million a year from each foundation); if the foundations were to participate in the financing of any new institutes, they would have to be relieved of part of their present financial commitments to the existing ones.

The Bellagio IV participants considered close involvement by the foundations to be essential to the success of the international institutes. At the participants' urging, the foundations stated their willingness to continue their role in the management of the existing institutes, as well as to assist in the establishment of one or two new institutes should they later be commissioned.

FROM THE FIRST MEETING in Bellagio in April 1969 to the preliminary meeting to consider the Consultative Group on International Agricultural Research in January 1971, about twenty-one months elapsed. The first formal meeting of the Consultative Group in May 1971 took place slightly more than two years after Bellagio I. To some this may seem a long time, but to those familiar with the ways of international bureaucracies it may well be regarded as its own variety of miracle. For the heads of a large number of international and bilateral aid agencies, or their senior representatives, to meet at such frequent intervals and constitute themselves in effect as a working party to bring a new international organization into being is without precedent. It could not have happened without the sense of urgency that the three heads of the cosponsoring agencies attached to this enterprise and without their willingness to submerge jurisdictional interests to bring about a unique partnership among independent UN agencies. The same spirit was reflected in the efforts of their senior staff, working collaboratively and very effectively with the staff of the foundations, to make the Bellagio and related meetings successful.[10] No less important was the continuing and

10. A very partial list of those so engaged would include Richard H. Demuth and L. J. C. Evans of the World Bank, Meyer Cohen of the UNDP, Oris Wells and Peter Oram of the FAO, and Messrs. Hill, Bell, Ha. 1 and Wortman of the two foundations.

strong support of the Rockefeller and Ford Foundations and their willingness to share with the international donor community responsibility for the future welfare of the group of international institutes they alone had created and so carefully nurtured. Finally, the coalition formed at Bellagio succeeded in its objective because, in the words of one observer, it "maintained a careful balance between attention to the substantive target—the nature and needs of effective research—and work on the procedural problems—the ways and means of engaging sustained support from interested donor agencies."[11]

Appendix: Attendants at the First Bellagio Conference

Participants

Bell, David E., executive vice president, Ford Foundation, New York.

Boerma, Addeke H., director general, Food and Agriculture Organization, Rome.

Fournier, F., Office de la Recherche Scientifique et Technique Outre-Mer, Paris.

Gardiner, Robert, executive secretary, United Nations Economic Commission for Africa, Addis Ababa.

Hannah, John A., administrator, U. S. Agency for International Development, Department of State, Washington, D.C.

Harrar, J. George, president, Rockefeller Foundation, New York.

Hoffman, Paul G., administrator, United Nations Development Programme, New York.

McNamara, Robert S., president, World Bank, Washington, D.C.

Martin, Edwin M., chairman, Development Assistance Committee, Organisation for Economic Co-operation and Development, Paris.

Michanek, Ernst, director general, Swedish International Development Agency, Stockholm.

Myers, Will M., vice president, Rockefeller Foundation, New York.

Ohuchi, T., operations manager, Asian Development Bank, Manila.

11. "The President's Review," *Ford Foundation Annual Report* (New York, 1977), p. x.

Sawaki, Masao, director general, Economic Cooperation Bureau, Ministry of Foreign Affairs, Tokyo.

Strong, Maurice, president, Canadian International Development Agency, Ottawa.

Wilson, Geoffrey, permanent secretary, Ministry of Overseas Development, London.

Wolf, Alfred C., program adviser to the president, Inter-American Development Bank, Washington, D.C.

Consultants

Bachmann, K. L., Food and Agriculture Organization, Rome.

Chandler, Robert F., Jr., International Rice Research Institute, Los Banos, Philippines.

Clark, William D., World Bank, Washington, D.C.

Hardin, Lowell S., Ford Foundation, New York.

Henry, Paul-Marc, Bureau of Operations and Planning, United Nations Development Programme, New York.

Hill, Forrest F., Ford Foundation, New York.

Vallega, Jose, Food and Agriculture Organization, Rome.

Wortman, Sterling, Rockefeller Foundation, New York.

3

The CGIAR's Growing Years, 1971–76

THE PRELIMINARY MEETING on international agricultural research held at the World Bank's headquarters in Washington, D.C. on January 14–15, 1971 was well attended. Present were representatives of seventeen governments, three regional development banks, three private foundations, the International Development Research Centre, the Development Assistance Committee, and the three cosponsors—twenty-eight delegations in all. Robert McNamara could not be present because of prior overseas commitments—as he explained in a message read by the Bank's vice president, J. Burke Knapp, who chaired the meeting. His message to the delegates left no doubt of the significance he attached to the occasion: "In the perpetual struggle of man against hunger, your conclusions could be of decisive importance . . . support for [international agricultural research] will ultimately prove to be the highest yielding investment we can make, in terms of increased production and greater momentum for development generally."

Paul Hoffman struck a similar theme in his message to the meeting, which he hailed as an opportunity "to concert our efforts . . . to achieve the new thinking called for by the new dimensions of the age-old problem [of] how better to feed the family of man." The FAO contributed a background paper with an urgent view of the world food situation: to keep up with massive population growth and reach satisfactory standards of nutrition, developing countries would have to nearly double their food output in fifteen years—a rate of increase far beyond anything they had achieved in the past.

The Rockefeller and Ford Foundations, represented by J. George Harrar and David Bell, respectively, described the status, programs, and early achievements of the four international institutes that were in operation or under construction. They referred to the plans for further action that were in progress as a result of the Bellagio meetings. Particularly promising avenues of future research had been identified, although the expanding needs of the existing research programs, together with the requirements of future programs, exceeded the financial limits of the foundations. The foundations had thererore decided to seek public funding, and the Bellagio meetings had led to the proposal to form a cooperative association of donors, which might be called the Consultative Group on International Agricultural Research.

The meeting achieved its purpose. With only the representatives of France and the Federal Republic of Germany opposed to making a decision at that time, the delegates agreed to convene a formal, inaugural meeting of the CGIAR within three or four months. Six delegations (aside from those of the cosponsors) declared that their organizations were ready, without further formalities, both to attend the inaugural meeting and to join the Consultative Group. The six were the Ford Foundation, the International Development Research Centre, the Kellogg Foundation, the Rockefeller Foundation, the United Kingdom, and the United States. Although the meeting was not a pledging session, these donors were already able to indicate the amount of financing they initially could make available, as were the governments of the Netherlands and Canada, although they were not yet ready for the formal commitment to membership. The United States, for its part, reaffirmed the undertaking it had mentioned at Bellagio to cover 25 percent of the cost of the institutes, provided that the remaining 75 percent would be forthcoming from other members of the Group (a commitment to which it has faithfully adhered to this date).[1] The other delegations adopted, in varying degrees, a "wait and see" attitude, although most were able to indicate that they were favorably disposed toward future participation in the Group.[2]

1. The 25 percent commitment was initially limited to a maximum of $7 million, which has subsequently been raised periodically. Each year, USAID submits a budget request for the following year to the U.S. Congress, setting a maximum figure based on 25 percent of estimated requirements.

2. I shall refer to the Consultative Group on International Agricultural Research, for the sake of variety, as the CGIAR, the Consultative Group, or the

In response to a pointed question from one of the delegates, a spokesman for the World Bank said that the Bank would be a contributor (no sum was mentioned), although the precise mechanism for providing the grants was yet to be determined. The Bank also indicated that it had initially considered establishing a common fund for all participants, but had found that most prospective donors preferred to contribute directly to the centers, with some form of central coordination.

There were predictable objections at the outset to the establishment of yet another organization. The chairman responded with the observation that what was proposed was not an organization at all, but an arrangement for consultation. The Bank presided over a number of consultative groups for individual countries—to which the proposed consultative group was similar in many respects—but these were not considered to be formal organizations. In the staff summary of proceedings and major conclusions of the meeting, the proposed consultative group was described as "a *forum* for discussion and coordination" (emphasis added).

The principal business before the meeting was a paper, "Possible Objectives, Composition, and Organizational Structure of an International Agricultural Research Consultative Group," prepared by the World Bank through a lengthy process of consultation. Agreement was reached on a number of points, to be developed and presented to the Group at its next (and first official) meeting. Most attention was devoted to the proposed Technical Advisory Committee (TAC), an idea that had apparently originated with the foundations and that very much engaged the interest of the FAO; here again further work was promised (by the FAO in particular) before the inaugural meeting.

The two foundations participated actively in the meeting, and the other delegations looked to them for continuing leadership. They were pleased with its outcome. Their overall assessment, conveyed in a memorandum of information to the four directors of the existing centers, was one of cautious optimism about the new "forum":

> From private conversations and from the tone of the meeting it is our impression that the group will come into being on a rather informal basis; that several members will, over time, make substantial sums of new monies available for

Group. In the same vein, the terms center, institute, and IARC will be used interchangeably in referring to the international agricultural research centers.

agricultural research and training (Canada, United Kingdom, United States, IBRD and others); that these monies will be granted on a bilateral basis, the decisions having been influenced but not dictated by the multilateral forum and technical inputs provided by the group; that a technique for obtaining an adequate voice for the developing nations themselves in this forum has not yet been evolved.

In the aftermath of the meeting, the foundations considered that they would have some continuing responsibility for contacting donors and raising funds, albeit in close cooperation with the Group's Secretariat. Plans also went forward for the foundations to hold their third annual International Centers Week in New York in October, at which the centers' programs and budgets would be reviewed before an enlarged audience of donors. By the following year, however, International Centers Week was incorporated into a regular CGIAR meeting.

The First CGIAR Meeting, May 19, 1971

When the Consultative Group on International Agricultural Research held its first meeting in May, the same number of delegations that had met in January were in attendance. More to the point, seventeen delegations were able to declare that their governments or organizations had formally decided to join the Group.

This was an organizational meeting. McNamara had secured from his Board of Executive Directors, with virtually no dissent, approval to indicate that the Bank was prepared to make a grant of up to $3 million. The Bank would act as the "residual donor," meeting any funding requirements (to the $3 million limit) that remained after all other donors had contributed.[3] While this was no doubt welcome news in the corridors, the meeting itself was not concerned with raising funds.

3. The Bank's contribution was fixed at 10 percent of estimated requirements, and McNamara remained adamant on this point in the face of subsequent pressure from some donors (notably the United States) to increase it. Despite, or perhaps because of, his unflagging support for the system he had helped to found, in his private discussions with the CGIAR Secretariat and chairman, McNamara always insisted on two points: that every effort be made to ensure that only research work of high priority was funded by the centers and that the Bank's contribution not exceed 10 percent, so that other donors would have to provide their share.

The statement of objectives, composition, and organizational structure, redrafted following the January discussion, was approved at the meeting. The brief statement has since served, without amendment, as the only constitution, charter, or terms of reference that the CGIAR has had. It is reproduced in the appendix to this chapter.

The main objectives of the Consultative Group were fivefold:

- to examine the needs of developing countries for special efforts in agricultural research at the international or regional levels on critical subjects unlikely to be adequately covered by existing research facilities and to consider how these needs could be met
- to ensure the complementarity of international and regional agricultural research with national activities and to encourage full exchange of information
- to consider the financial and other requirements of high-priority international and regional research activities
- to review priorities for agricultural research in the developing countries on a continuing basis
- to consider ways of assessing the feasibility of specific proposals.

The chairman and secretary of the Group were to be provided by the World Bank and its base would be at the Bank's headquarters in Washington. The venue of meetings would be decided from time to time by the members.[4]

It had been recognized from the outset that the donors would need to be advised by a small group of scientists—"men of towering stature" in the words of the founders. The proposed size of the Technical Advisory Committee had grown from seven originally to twelve (a thirteenth was added in the following year), including the chairman. The need to accommodate a variety of disciplines and regions of the developing world (and to a minor

4. The first chairman of the Group was Richard H. Demuth, director of the Development Services Department, who had been principally in charge of the Bank's staff work on the CGIAR until that time. He retired from the Bank in 1973 but continued as CGIAR chairman until 1974. I succeeded him in 1974 as chairman, in my capacity as vice president, Projects Staff (later Operations Policy), and stepped down at the end of 1983 after ten years. S. Shahid Husain, who is vice president, Operations Policy, has served as chairman since 1984. The first secretary, later styled executive secretary, was Arie Kruithof. He was succeeded by Harold Graves (1972–74), Michael L. Lejeune (1974–82), and Curtis Farrar, the incumbent as of this writing.

extent the desire of each of the principal donors to have a national on the committee, even though he served in an individual capacity) overcame the desire to keep TAC to a more manageable size.

The organizational plan provided that TAC would be composed of distinguished international experts from developed and developing countries, nominated by the cosponsors and appointed by the Group. TAC was given five tasks:

- to advise the Consultative Group on the main gaps and priorities in research on agricultural problems, both technical and socioeconomic, of developing countries
- to recommend to the Group feasibility studies on how best to organize and conduct agricultural research on urgent problems
- to present its views and recommendations to the Group on these and other feasibility studies
- to advise the Group on the effectiveness of existing international research programs
- to encourage in other ways the creation of an international network of agricultural research institutions.

After considerable discussion, the role of the FAO in relation to TAC was resolved in the organizational plan. The plan provided that TAC's chairman would be appointed by the Consultative Group and its secretary by the FAO.[5] Sir John Crawford was selected by the Group as TAC's first chairman.[6] The other members of TAC, who had been nominated by the cosponsors, were also approved by the Group. When TAC reached its full complement in 1972, there were, in addition to the chairman, six members from developing countries and six from industrial ones. The original members of TAC brought expertise in eight fields: agronomy, genetics, plant pathology, irrigation, livestock production, animal health, research management, and economics. Harrar,

5. There have been four executive secretaries of TAC: Peter Oram (1971–76); Philippe Mahler (1976–82); Alexander von der Osten (1982–85); and John Monyo, who took up the post at the end of 1985.

6. Sir John stepped down after serving for six years. He was replaced by Ralph W. Cummings, who had been the first director of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), at the beginning of 1977. In his turn, Cummings was succeeded in 1982 by Guy Camus who, in addition to serving as director general of the French Office of Scientific and Technical Research Overseas (ORSTOM, its French acronym), had been a trustee of both IITA and CIMMYT and a former member of TAC. Camus is currently serving a second three-year term.

then president of the Rockefeller Foundation, agreed, somewhat reluctantly because of other commitments, to become one of TAC's initial members. A lengthy and detailed agenda for the first meeting of TAC, including review of the status of the studies commissioned by the Bellagio Group and others, was also approved by the CGIAR at its first meeting.

TAC was asked to hold its first meeting as soon as possible and was able to do so by the end of the following month. The meeting was held at FAO headquarters in Rome, a practice that TAC has continued with at least one of its meetings each year. All of the persons invited to serve agreed to do so, a record of individual participation and support that has been sustained in virtually all of the Group's activities since then.

The World Bank agreed to finance the services of the executive secretary (later the Secretariat as its numbers grew) of the Group, and the FAO agreed to pay those of the executive secretary of TAC. The three cosponsors had not yet agreed on how the costs of TAC's operation should be covered. Shortly thereafter they decided to split the costs equally among themselves and, later, to share similarly the costs of the other members of the TAC Secretariat.

All those concerned with founding the Consultative Group recognized that its purpose was to serve the interests and needs of developing countries. How best to include these countries in the Group's deliberations and decisionmaking proved, however, to be a vexing problem that has not been fully resolved to this date (see chapter 7). The issue was raised at the preliminary meeting in January, and the Bank was asked to prepare a paper for consideration at the May meeting. When the Bank's Board of Executive Directors met just before the May meeting to consider the Bank's role and financial support, they were sufficiently disturbed about the need for adequate representation to request that their concerns be put before the Group.

The paper prepared (by the CGIAR Secretariat) on the subject of participation by developing countries noted that these countries were not likely to be sources of financial assistance to the institutes (a prediction that proved to be somewhat inaccurate) and that they were instead claimants for funds on behalf of particular research programs of interest to them. If all developing countries interested in the Group's activities were to become members, the Group would become unwieldy and ineffective. The most effective way for developing countries to participate in the Group's activities was through membership of their nationals in TAC and

through the boards of trustees of the centers (at which they were already well represented). The various studies commissioned by the Group, or by TAC on its behalf, would also provide opportunities for consultation with officials of developing countries.

In the Secretariat paper and in the discussion at the January and May meetings, a number of alternative ways to secure the participation of developing countries were brought up and discarded. The Organization of American States or the Organization of African Unity was considered to be too political. The regional development banks (for Africa, Asia, and Latin America) disclaimed competence to represent their individual member countries. The host countries where the centers were located (Mexico, the Philippines, Nigeria, and Colombia at the time) were considered likely to be partial.

In the end, the May meeting adopted, on a trial basis, a proposal that the FAO seek to obtain from its five regional groupings the designation of one developing country to represent each region for a period of two years. After this period, membership would rotate or a different solution would be sought.

In practice, the FAO regions found it difficult, for political reasons, to select only one representative country each, so at the second meeting of the Group in December 1971 the FAO sent forward the names of two countries instead of one for each developing region. The Group was rescued from an embarrassing situation when a delegate from a developing country proposed that each pair should share a single seat, alternating at their own discretion. But, with a few notable exceptions, attendance of the developing country delegates has been sporadic and their participation less than the Group had wished.

By the close of the inaugural meeting, the basic organizational structure of the Consultative Group, and of the larger international agricultural research system of which it was a part, was essentially in place:

- independent research centers, each with its own board of trustees, composed of international teams of scientists working on specific crops or agroecological regions of the developing world
- the Consultative Group itself, an entity without legal personality, voting process, or burden-sharing arrangements, whose members were a highly diverse group of international, regional, national, and private donors, together with countries elected to represent the five regions of the developing world
- the Technical Advisory Committee, a group of distinguished

scientists from industrial and developing countries, to advise the Group

- three cosponsors from the United Nations system, whose membership gave status to an otherwise informal group, but whose collective functions, other than to nominate members of TAC and to fund it, were undefined
- officials, consisting of a chairman appointed by the World Bank, also with undefined functions except those of a presiding officer, and two secretaries, one for the Group and appointed by the Bank and the other for TAC and appointed by the FAO.

This was a novel approach, which bore only a superficial resemblance to the informal consultative groups for individual aid-recipient countries with which the Bank and its member countries were familiar. Clearly, more would be expected from the Group if it was to mobilize funds on a long-term basis, set priorities for existing research activities, organize and fund new initiatives, and somehow ensure that the finances contributed were soundly administered and effectively used.

How, and indeed whether, a group that stressed informality to the point that it was referred to as a "forum" rather than an "organization" could accomplish these tasks remained to be seen. Those most directly concerned with the affairs of the Group, including the donor representatives, were for the most part novices to the task. But in some major respects, the system was already a going concern: several research institutes were in place and functioning well, and the Rockefeller and Ford Foundations were able and willing to continue to provide intellectual and professional leadership as well as financial support. So the members of the Group embarked on this new venture with enthusiasm and goodwill, but with only limited awareness of the magnitude of the task they had assumed.

At this point I will abandon for the most part the chronological order around which the preceding discussion has been organized. To deal in sequence with each of the Group's meetings would be tedious, and many subjects appeared on the agenda of more than one meeting before they were finally disposed of. Instead, I have divided the period 1971 to 1985 into three chapters: this one covering 1971–76, the period of rapid growth; chapter 4 covering 1977–79, a time of consolidation within the CGIAR system; and chapter 5 covering 1980–85, the period in which the

CGIAR came of age. The major issues raised, the problems encountered and solved (or not solved), and the directions in which the Group developed will be the topics for discussion.

Funding the System

The early years of the Consultative Group were marked by a rapid, almost explosive, growth in membership, in funds provided, and in the number of institutes and activities carried out under its auspices.

When the first formal pledging session of the Group was held, at the time of the second meeting in December 1971, eleven donor members announced their intention to contribute $15 million in 1972. The ranks of donors expanded during the year, as potential contributors who had been sitting on the fence waiting to see how the Group developed came down on the side of membership. By the end of 1972, sixteen donors had contributed close to $21 million.

During the years 1972–76, the number of donors continued to expand. The amount of their grants to the centers, and the number of senior staff employed by the centers, grew even faster, as the following figures indicate:

Year	*Donors*	*Grants (millions of dollars)*	*Senior staff*
1972	16	20.8	133
1973	18	25.0	193
1974	20	34.6	250
1975	23	47.6	300
1976	26	62.9	324

The USAID contribution of 25 percent of the requirements of the system, together with the World Bank's readiness to provide up to 10 percent, gave a solid foundation on which the contributions of others could be built. Canada, Germany, the United Kingdom, and the Inter-American Development Bank became major donors. Many of the smaller countries (such as Switzerland, Australia, and some of the Nordic countries) pledged sums that were large in relation to their size. Of the industrial countries, only France held back; its contributions did not rise significantly until the end of the decade. Japan initially was a minor contributor, but as its appreciation of the work of the system and identification with its programs grew, Japan became one of the largest financial supporters.

The two pioneer donors—the Ford and Rockefeller Foundations—began in 1975 to reduce their financial participation in the Group, initially by the amount that they contributed to the International Food Policy Research Institute (IFPRI) which, as indicated below, they were obliged to set up outside the Group.

Fund raising in these early years was not difficult. The amounts involved were small relative to the aid budgets of most donor countries. The central objective of the Group—to reduce hunger by increasing food production in the developing countries—was universally popular and received further impetus from the food crisis that led to the World Food Conference of 1974.

Moreover, the programs supported by the CGIAR were very attractive. During a quarter century of official efforts to assist the development of poor countries, donors had often been uneasy about the quality and efficacy of the projects they were helping to finance. Projects of better quality were welcome, and the international agricultural research centers appeared to be outstanding examples. Furthermore, donors were free, not only to determine the overall size of their contributions without any onerous (and invidious) exercise in burden sharing or aid allocation, but also, if they so desired, to select the specific institutions and programs with which they wished to be identified.

Finally, the enthusiasm of the early members, the informal spirit of the Group's meetings, the high professional content of the meetings, and the manifest goodwill that pervaded them were infectious qualities to which new donors quickly succumbed. Donors were alerted by TAC, by the chairman and the Secretariats, and by the centers' budget documents that the needs of the international agricultural research system would increase substantially from year to year as new activities were introduced and the existing centers expanded to reach their full potential. Many donors accordingly built regular annual increases into their budget planning.

Taking on New Activities

The main business of the Group during the early years was to consider the addition of new institutions or activities. Acting on the advice of TAC, the Group weighed a number of proposals. Some were quickly adopted; others had to follow a more tortuous path, including false starts and mistakes, to reach eventual acceptance; and a few were rejected outright or placed in limbo. By the end of 1976, seven new institutions had joined the system,

an impressive expansion from the original four that were in various stages of operation or construction when the Group began five years earlier and that were the fruits of a decade of activity by the two foundations.[7] The studies launched by the Bellagio Group in 1970 played an important part in getting new activities off to a fast start.

The seven new institutions and the year in which they were incorporated or, in some cases, the year in which a previously established institute achieved a form acceptable to the Consultative Group were

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), 1972
- Centro Internacional de la Papa (CIP, International Potato Center), 1972
- International Laboratory for Research on Animal Diseases (ILRAD), 1973
- International Board for Plant Genetic Resources (IBPGR), 1974
- West Africa Rice Development Association (WARDA), 1974
- International Livestock Center for Africa (ILCA), 1975
- International Center for Agricultural Research in the Dry Areas (ICARDA), 1976.

ICRISAT: How to Start an International Program

The International Crops Research Institute for the Semi-Arid Tropics has the distinction of being the first center established under the aegis of the Consultative Group. The institute was designed with a dual purpose: (a) to develop and demonstrate improved cropping patterns and farming systems that would make the best use of the relatively meager resources of upland areas of the tropics characterized by low rainfall and lack of irrigation and (b) to improve cereals (sorghum and pearl millet) and grain legumes (chickpeas and pigeon peas) grown in semiarid areas of Asia and Africa.

Of all the ideas awaiting the Consultative Group's attention, ICRISAT was the most urgent, being concerned with wide areas and large populations in the developing world. TAC quickly en-

7. These four centers were once irreverently referred to by Sir John Crawford as the "BC" centers.

dorsed the idea of ICRISAT, and the Group moved promptly to create the new institute. In so doing, the Group established a sequence of actions and a pattern of organizational arrangements that, for the most part, became the standard for launching other enterprises under its sponsorship.

To begin with, ICRISAT had been well studied. In 1970, the Rockefeller Foundation had prepared an extensive study of agriculture in upland areas of low rainfall as part of the Bellagio Group's proposals. At TAC's first meeting, a mission of experts was commissioned to make field visits to relevant areas and prepare a specific proposal. The mission, headed by Ralph Cummings (formerly of the Rockefeller Foundation and at the time with the Ford Foundation), was able to present its main recommendations to TAC's second meeting, in October 1971, and to make a written proposal to the meeting of the Consultative Group which followed in December.

The Group warmly accepted the proposal, now formally endorsed by TAC, that ICRISAT be established with headquarters in India. Then additional steps were taken:

- An executing agency was appointed to act for the Group to carry the proposal forward until such time as ICRISAT had acquired a governing board and sufficient staff to manage its own affairs. The Ford Foundation was appointed by the CGIAR chairman to play this role.
- A self-selected "advisory group" (which soon was called a subcommittee), consisting of intended donors to ICRISAT, was organized to oversee and approve the preparatory work as it proceeded.
- Members of the subcommittee agreed to establish an initial fund to finance the preparatory phase of the project and signed a Memorandum of Understanding formally stating their commitments to this effect (the latter practice was not consistently followed for subsequent institutes).
- The World Bank agreed to act as fiscal agent to collect, disburse, and account for the initial fund.
- The executing agency appointed a project development officer to continue the planning and preparation begun by the Rockefeller Foundation mission of 1971. Cummings, the leader of the mission, agreed to undertake this assignment.

Cummings and the executing agency were able to move with exceptional speed. He was a long-time veteran of agricultural

development programs in India and knew the country and its authorities well. At the first meeting of the subcommittee, held in January 1972, he was able to submit a draft Memorandum of Agreement with the government of India that, in effect, stated all the provisions of the charter under which ICRISAT would operate in India. After approval by the subcommittee, the memorandum was signed by the government of India in March. (With hindsight, it can be questioned whether sufficient attention was given at the time to the question of how ICRISAT could serve the African regions within its mandate. TAC addressed the question, but was unable to resolve it and therefore left it to ICRISAT's board.)[8]

Only two more meetings of the subcommittee were needed. At its second meeting in April, the subcommittee approved the executing agency's choice of a research and headquarters site offered by the government of India near the large urban complex of Hyderabad/Secunderabad. Choosing from an extensive roster of nominees prepared by the executing agency, the subcommittee also selected nine of the eleven elective members of the institute's fifteen-seat board of trustees. (Of the four nonelective members of the board, one was the director general of the institute and three were appointed by the host government.)

In July, ICRISAT formally came into existence and its board met for the first time. The chairman of the Consultative Group (acting as authorized agent of the World Bank) and the assistant director general of the FAO for the South Asian region were present to sign on behalf of their organizations, and thereby give effect to, the constitution (charter) of ICRISAT. On October 28, by a notice in the official *Gazette*, the government of India recognized ICRISAT as an international organization covered by the United Nations Privileges and Immunities Act of 1947. No other CGIAR enterprise ever achieved similar status; the other country-based institutes were incorporated under the national law of their host governments. (This international status was to serve ICRISAT in good stead at a later date, when India's Supreme Court rejected a suit brought by some workers that would have made the center subject to India's labor legislation.)

8. On this and a number of other points, I am indebted to an article by Lloyd T. Evans, a former TAC member, "A Malthusian Optimist at Work on the World Food Problem," in *Policy and Practice: Essays in Memory of Sir John Crawford*, eds. L. T. Evans and J. D. B. Willes (Sydney: Pergamon/Australian National University, 1986).

ICRISAT's governing board chose Cummings to be the director general.[9] The board also approved a comprehensive program of activities and a capital budget for the completion of ICRISAT's physical facilities. In record time, ICRISAT was under way.

A new problem for the CGIAR surfaced in 1974, however. The old ICRISAT donors' subcommittee was convened by the CGIAR chairman to consider a worrisome situation: it appeared that the cost of constructing and equipping the center would considerably exceed the amount of funds that the donors were prepared to provide. A sign of danger had been detected by CGIAR Secretariat staff who, when reviewing the plans in 1973, thought that the center had underestimated the extent to which inflation would raise costs. Subsequently, at the Secretariat's request, World Bank architects familiar with conditions in India examined the estimates. They concluded that the estimates not only made insufficient allowance for inflation, but also failed to take other contingencies into account. Bank staff also felt that the designs called for a higher standard of construction than was appropriate or necessary; a report prepared by an expert of USAID was sharply critical of ICRISAT plans on somewhat the same grounds.

The total capital costs of ICRISAT, the Secretariat thought, might amount to $19.5 million. This was about $6 million more than the institute's 1972 estimate and would raise planned expenditures for 1974–76 to $5 million more than the Secretariat expected donors to be able to provide.

The donors' subcommittee, however, was hesitant to intervene in a way that would reduce the capital plan approved by ICRISAT's trustees. In the end, donors agreed that in the years 1974–76, ICRISAT should plan its expenditures at a level of $33 million (including $17 million for capital costs), the maximum amount that donors appeared likely to provide. The subcommittee also agreed that capital expenditures deferred beyond this period could be proposed later if funds were available. In the end, the construction period was stretched out by two years. The center was built on the scale and to the standards proposed by ICRISAT, but remained during the years 1974–76 within the three-year ceiling established by the Group's donors.

9. Ralph Cummings had just taken over the directorship of IRRI in June 1972; arrangements for him to transfer to ICRISAT were concluded in August and September of that year.

CIP: Choosing a Board of Trustees

After ICRISAT, no other program won such quick acceptance from the CGIAR or made such rapid progress. The next three proposals to come to the CGIAR were deferred or rejected by it. They were the Centro Internacional de la Papa (CIP, the International Potato Center) in Peru, the Asian Vegetable Research and Development Center (AVRDC) based on Taiwan, and the International Soybean Resource Base (INTSOY) located in the United States.

CIP was the descendant of two earlier efforts: a potato program in Peru initiated by the Rockefeller Foundation and a potato research program being carried on in Peru by North Carolina State University under contract with USAID. The center, created by Peruvian law in 1970, was still in the early stages of development when the CGIAR itself was formed in the following year.

The director general of CIP appeared at four meetings of TAC, over a span of two years, before winning the committee's final endorsement and, in turn, the CGIAR's. Less than 20 percent of the world's potatoes are grown in developing countries, but TAC accepted the argument that the potato had potential for the tropics and could prove to be a major source of calories, protein, and vitamins. This was to be accomplished by the extension of the geographical coverage of the potato to the lowland tropics, with the aid of introgression from wild species. TAC did, however, have technical questions about the center: its program of activities, and its core research program in particular, did not seem sufficiently well defined. In 1971, the CGIAR voted the center a preliminary "bridging" grant to give it time to develop its plans before the next round of financial commitments by the members of the Group.

TAC's further question about CIP was whether it really was an international institution. As the chief grounds for this doubt, TAC noted that the center's governing board was composed only of Peruvian and American nationals. To deal with this question, CIP arranged to amend the Peruvian law creating the center; under the amendment, CIP's Board of Trustees was enlarged to include three nominees of the Consultative Group.

The idea of nominees designated by the Consultative Group was borrowed from the charter of ICRSAT, itself a carryover from earlier days. When the first international centers were organized in the 1960s, their charters specified that the Rockefeller and Ford Foundations should have membership on their boards. For

the foundations, this was an important means of maintaining a degree of control over the centers for which they expected to provide all or a large majority of the funding. It also gave the host governments an earnest of continuing foundation support; when the Ford Foundation attempted to give up its seat on the IITA board in 1973, the Nigerian government insisted that it stay.

The Consultative Group found it impractical to specify which particular donors should be represented on the boards of new centers, for there were now too many donors to be accommodated. Nevertheless, the problem had to be solved for CIP. The entire membership of the CGIAR was asked for nominations, and a final choice of three was made by an ad hoc committee of donors to CIP.[10] The committee behaved admirably: it looked to the interests of the CGIAR as a whole and kept in mind the desirability of full participation of all members, large and small. Before balloting began, representatives from the three largest donor countries on the committee made statements explaining why nationals of their countries should *not* be selected. The successful candidates were, in fact, from the three smallest countries: the Netherlands, Denmark, and Switzerland. CIP then joined the system, having the distinction of being the first center to do so without the backing of one of the foundations.

Asian Vegetables and American Soybeans: Centers Out of Bounds

TAC's scientific character could not shield it from political complications in two of its early recommendations. The first, in 1972, was that the Group pay the cost (about $1 ' million) of completing the physical plant of the Asian Vegetable Research and Development Center—which in the end the Group did not do. There were several awkward things about the AVRDC: first, as TAC recognized, it was somewhat too far north to be typical of vegetable cultivation in tropical Asia; and second, on a CGIAR agenda crowded with high-priority claimants, there was doubt about the relative importance of vegetables. The third difficulty was, for the Group, insurmountable: the center was located on the island

10. With characteristic informality, the Group has used the terms "committee" and "subcommittee" interchangeably and without differentiation of responsibility or function.

of Taiwan, which was under a government that most members of the CGIAR (the United States was an exception) did not recognize.

In view of these anomalies, TAC did not propose that the center become a part of the CGIAR system: it proposed, instead, an unspecified "loose link" with it. The chairman of the Group made a novel suggestion that the Group accepted: that the AVRDC be considered a kind of "associate" member of the CGIAR system. In this capacity it would be encouraged to exchange information with other centers, to engage in cooperative programs with the centers when appropriate, and to join with other centers in making an annual program presentation to the Group.

That AVRDC got as far as it did was doubtless a tribute to its director, Robert F. Chandler, Jr., who had been the founding director of IRRI. The status accorded AVRDC owed much to the respect and affection that the international agricultural community felt for Chandler.

No such redeeming feature was available to save another proposal, likewise judged to be from the wrong place. The proposal, made by the chairman of TAC in 1973, was that a way be found for the CGIAR centers and programs to draw upon the resources of the large soybean research program being carried out by the University of Illinois in the United States, with the cooperation of the University of Puerto Rico and with financing from USAID. It was suggested that the program be transformed into an International Soybean Resource Base (INTSOY) and that INTSOY take the lead in strengthening national and regional soybean programs in developing countries through research, training, communications, and technical assistance.

The soybean was, indeed, an attractive subject for research. Like other grain legumes, it has a high content of nutritionally valuable protein. But unlike most grain legumes, it also produces rather high yields per unit of cultivated area. Although IITA had a soybean component in its own legumes program, the CGIAR system was not making a major effort to exploit the potential of the soybean.

As an approach, however, INTSOY presented problems. Its base in an industrial country put it outside the CGIAR's normal sphere of operations. It was, moreover, not an autonomous institution; it was administratively a part of the University of Illinois, which in turn was under the control of the state of Illinois.

At the behest of TAC, the CGIAR agreed that the TAC and CGIAR Secretariats should confer with the sponsors of INTSOY (the Uni-

versity of Illinois and USAID) to see whether a formula could be devised that would make INTSOY acceptable to the Group. A proposal emerged under which INTSOY would have its own director, program, and budget; it would undergo periodic reviews by TAC; and it would not request CGIAR funding for its core research or for work done in developing countries. It was hoped, however, that the Group, besides giving its blessing to the enterprise, would provide a small revolving fund ($300,000 for a start) needed to maintain a pool of experts at INTSOY while they were waiting for their next assignments.

Many members of the CGIAR disliked the INTSOY proposal. Several donor countries had research institutions of their own that were doing good work on problems of significance to developing countries. Why should an American program be singled out for special favor? Soybean research did not seem sufficiently important to overcome these objections, and when the INTSOY proposal was brought to the Group, it failed of adoption. A similar fate would later befall another institution located in the United States and funded by USAID—the International Fertilizer Development Center (see chapter 4).

ILRAD and ILCA: Nonidentical Twins

Animal health and production in tropical Africa was another one of the subjects given highest priority in the Bellagio meetings. Rockefeller Foundation surveys of the scope and nature of the problem and of the research required were completed in October 1971. The surveys looked toward the establishment of two programs: one for a research laboratory on animal diseases and the other for a center on animal production and health.

TAC agreed that research should proceed on these two tracks. It felt that rapid progress could be made toward the establishment of a laboratory to carry out immunological studies that would help in the control of two diseases afflicting cattle in Africa and preventing the use of vast areas of potentially productive range land: these diseases were theileriosis (east coast fever), a tick-borne disease, and trypanosomiasis (sleeping sickness), carried by the tsetse fly. It was thought that these studies might reach a successful conclusion in seven to ten years (in the event, an overly optimistic judgment).

The second effort visualized by TAC was to be devoted to multidisciplinary research aimed at developing and improving live-

stock production in tropical Africa, which suffered from a complex combination of ills: among them were a dearth of water and rangeland resources, inadequate animal nutrition and poor health measures, unsuitable social systems and economic policies, and insufficient marketing systems.

In TAC's view, these two projects were related. Successful immunization of African livestock against disease would obviously have profound effects on animal production. The Consultative Group took the view that the two projects were not merely related, but should be carried out as a single effort under a single board of trustees.

To guide the further development of the two projects, the chairman of the CGIAR appointed a subcommittee on African livestock, which held more meetings over a longer period of time than any other subcommittee of the Group. It spent many hours discussing the timing and means of unifying the administration of the two programs. For the time being, however, it was thought preferable for the disease laboratory to proceed as rapidly as possible, subject to later integration with the production effort.

The Rockefeller Foundation agreed to act as executing agency for the laboratory project, and it named an executive team headed by William R. Pritchard of the University of California at Davis. The team's proposal, completed in May 1972, was accepted by the subcommittee as a basis for conclusive negotiations for the formal establishment of an International Laboratory for Research on Animal Diseases.

An expression of interest in providing a home for the laboratory had already been received from the East African Community, an association of Kenya, Tanzania, and Uganda for certain common services, of which agricultural research was one. The community had room to spare on land assigned to the East African Veterinary Research Organization (EAVRO), one of the cooperative undertakings that it sponsored, at Muguga, located outside of Nairobi, Kenya. The Group required that ILRAD, like other institutions in the CGIAR network, be autonomous. On a formal level, this raised the question whether an autonomous institution would fit within the legal and administrative framework of the East African Community (somewhat resembling the question in the INTSOY case). On a more pragmatic level, the East African Community had already begun to disintegrate because of tensions among its members. It was credibly reported from Nairobi that Uganda (which felt that Kenya was already getting preferred treatment by the community) was opposed to the es-

tablishment of ILRAD as a neighbor of EAVRO. In any case, the final answer of the community, received after five months of waiting, was negative.

The subcommittee fortunately had an alternative at hand. In June 1971, President Jomo Kenyatta of Kenya, in a letter to McNamara, had invited the CGIAR to establish its projected disease laboratory on the precincts of the University of Nairobi's Veterinary Research Organization. An inquiry from McNamara ascertained that the invitation was still open. In April, a CGIAR mission composed of the chairman of the Group and Sterling Wortman of the Rockefeller Foundation reached agreement with the Kenyan government on a Memorandum of Agreement on the establishment of ILRAD, and in June the subcommittee completed its work by selecting a majority of the board of trustees and the director general of the laboratory. With a meeting of its board of trustees in November 1973, ILRAD was under way.

Under the continuing strong leadership of the Rockefeller Foundation (one of whose officers, John Pino, was chosen chairman of the ILRAD board), the staffing of the laboratory and the design and construction of its physical facilities were expeditiously completed. Apart from the delay occasioned by the East African Community, ILRAD had been organized almost as quickly as ICRISAT and for much the same reasons: prior study by one of the foundations and an executing agency thoroughly acquainted with the kind of research to be undertaken and with the government and the country setting in which the research was to take place.[11]

The mysteries of the diseases ILRAD is studying, however, have proved to be deeper than had been hoped or expected. A promising vaccine against east coast fever is being field tested, but effective immunological measures against trypanosomiasis still seem to lie in the future.

Between ILRAD and its companion project, which came to be known as the International Livestock Center for Africa (ILCA), the contrast was strong. ILRAD had the benefit of a sharply defined objective, an experienced executive agency, and a developing country interested in providing a home. ILCA's objectives were literally almost as wide as tropical Africa, its executing

11. Lloyd Evans has observed that TAC appears not to have debated the fact that, as an international center built around one discipline and focused on only one factor affecting production (animal disease), ILRAD was a major departure from the previous pattern of CGIAR-supported centers.

agency (the World Bank) had never set up a center, and the government of its host country was overturned by revolution while the establishment of ILCA was still in progress.

A survey sponsored by the Rockefeller Foundation in 1971, led by Glenn Beck of the University of Kansas, had provided a broad assessment of the problems of animal production in Africa. It proposed that an attack on these problems be mounted from principal research stations in the three major cattle-raising areas of tropical Africa—the Sahel region of western Africa, the humid tropics of western central Africa, and the eastern plateau—one of which would contain the headquarters of the program.

In its initial discussions, TAC was not able to develop a consensus in favor of this or any other formulation. It therefore recommended that another mission be dispatched to study the question and provided it with extensive terms of reference. The Consultative Group agreed. A four-man team was recruited, headed by Derek Tribe, professor of animal nutrition at the University of Melbourne, Australia, and assisted by six consultants. The team spent six months (April–September 1972) traveling and writing its report.

In the end, the team proposed not a program, but a concept: a "decentralized" center that would serve as a focal point for documentation and knowledge concerning animal production in tropical Africa; that would study systems of animal production, and methods of improvement, in its own base area; and that would second staff for cooperative programs to study animal production systems and devise multifaceted programs for their improvement in individual countries of Africa. Since each program would depend on prior analysis of the system involved, the report had no specific research programs to propose. It recommended, instead, that the center take three years to develop techniques of systems analysis, documentation, and training, and that its collaborative programs with individual countries begin toward the end of that time.

Systems research, although more concerned with crops than animals, was already being conducted in the CGIAR, notably at CIAT, IITA, IRRI, and ICRISAT; by 1974, farming systems was to rank second only to cereals as a subject of research. Early in 1973, TAC warmly welcomed the Tribe mission report and strongly supported the idea that systems research should be applied to animal production. This judgment was accepted by the African livestock subcommittee, which (along with TAC) stipulated, nev-

ertheless, that ILCA should develop its programs in less than the three years recommended in the Tribe report. The subcommittee also accepted that the specific content of ILCA's research programs would have to be based on further study and would therefore have to be determined by ILCA's own governing board.

The World Bank was then chosen to be the executing agency to carry forward the establishment of ILCA; it sought the cooperation of the IDRC, particularly in preparing lists of nominees for the directorship and board and in selecting a site for ILCA. In June 1973, the subcommittee chose a majority of the members of ILCA's board.

The Tribe mission had considered seven possible sites for ILCA's headquarters, of which four appeared to be feasible: Dakar, Senegal; Yaounde, Cameroon; Nairobi, Kenya; and Addis Ababa, Ethiopia. Discussion in the subcommittee exposed the awkwardness of choosing either a French-speaking or an English-speaking site; in the light of this and other considerations, IDRC opted for a linguistically neutral site in Ethiopia.

In July, a World Bank-IDRC mission, led by L. J. C. Evans, the recently retired director of the Bank's Agriculture Projects Department, visited Ethiopia to inspect potential sites and to discuss with the authorities a draft Memorandum of Agreement that would set out the provisions of the center's charter. The mission left the country feeling that it had reached substantial agreement with its Ethiopian hosts. To the surprise and consternation of the executing agency, however, the Ethiopian authorities, unilaterally and without further consultation, adopted the memorandum, but with crippling amendments and deletions, as the charter of ILCA. As modified, the charter establishing ILCA no longer had provisions affording ILCA and its non-Ethiopian employees tax, customs, immigration, and other privileges appropriate to its international status. ILCA was left to pursue its business on the same basis as any foreign-owned private commercial company operating in Ethiopia.

An effort was made to repair the damage at an informal meeting of the designated members of ILCA's board in London. An Ethiopian member agreed that his government would issue a side letter restoring the lost privileges. This was done early in 1974. The situation, nevertheless, remained obscure and difficult: shipments of equipment and supplies to ILCA, for instance, were persistently obstructed by customs authorities.

Meanwhile, the government of Ethiopia was nearing collapse.

In September 1974, an army coup deposed Emperor Haile Selassie, who had displayed an interest in ILCA and had received the members of its board in his palace offices. Once the revolutionary regime had settled in place, however, the fortunes of ILCA improved. Formal amendments to the Memorandum of Agreement were drawn up in December and, in May 1975, were ratified by the Council of Ministers. The ratification, in effect, confirmed the existence of ILCA as a legal entity and afforded the center nearly the same rights, immunities, and exemptions as were enjoyed by UN agencies in Ethiopia. The Bank decided in September 1975 that the preparatory phase had been completed. Relations with the host government have remained good, although not always easy or trouble free.

ILCA, however, continued to have problems. Although doubts had not surfaced fully in CGIAR discussions, some participants had felt that the proposed systems approach was too broad to focus sufficiently on critical problems. The World Bank staff was sharply divided on the subject; the Rockefeller Foundation, despite its strong interest in livestock research in tropical Africa, made no grant for the center; and the UNDP, having solicited a proposal from ILCA for a cooperative project in Mali, sent the proposal back on the grounds that it was too vague to justify UNDP support.

Translation of the ILCA concept into a concrete program of activities has proved to be difficult. The first two directors of ILCA, able scientists both, were unable to accomplish it. TAC continued to hold a watching brief on the center and sent a number of special missions in attempts to firm up a program, but progress was slow. The Secretariat did not recommend, and the CGIAR did not approve, the development of the center at the budgetary levels requested by its director and board of trustees until a program that would commmand the respect and support of TAC and the donors was in place and being effectively managed. This began to happen early in the 1980s.

The idea of integrating ILCA and ILRAD under a single direction failed the test of time. In successive drafts of the two charters, the idea was watered down until adopting it became optional. The option was never exercised, and even the proposal that each board send representatives to meetings of the other took a while to be put in practice. But cooperation between the two separate centers has improved with time and changes in leadership, and ILCA now has staff resident at the ILRAD campus working on a joint project on trypanotolerance.

Plant Genetic Resources: A Question of Control

The continuing development and spread of improved varieties of plants has meant that farmers all over the world have replaced a profusion of traditional varieties of wheat, maize, and other plants with a relatively small number of new ones. At the same time, changes in land use and agricultural practices have been leading to the disappearance of the wild progenitors and weedy relatives of present-day cultivated crops. These traditional and wild plants, now vanishing, take with them a genetic endowment that is potentially of great value in further plant improvement, especially in the ability to grow in difficult soils, in resistance to pests and diseases, and in tolerance of drought and extremes of temperature.

The idea of the International Board for Plant Genetic Resources originated in a proposal prepared by the FAO at the request of TAC in 1971. The main feature of the proposal was that a mechanism should be established to encourage, coordinate, and support action to conserve genetic resources and make them available for use. IBPGR was thus the first CGIAR-sponsored program that did not take the form of an agricultural research center. IBPGR is not a research but a service organization; its purpose is to promote and assist in the worldwide effort to collect and conserve the plant germ plasm needed for future research and production.

The issue that for several years blocked action by the CGIAR was how the coordinating mechanism should be related to the FAO. Two models were presented to TAC at its meeting in October 1971. The FAO proposed that the work of collection and conservation be done at existing centers, in both industrial and developing countries. To invigorate their work, the FAO proposed an emergency, five-year program of gene collection and an addition to the budget of its Crop Ecology and Genetic Resources Unit to enable it to act as a center for liaison among genetic programs.

A more ambitious proposal was put forward, at the request of TAC, by the distinguished Indian scientist, M. S. Swaminathan, one of its members. It called for the establishment of new genetic resource centers, as well as the strengthening of existing ones, and envisioned a considerably higher level of activity and expenditure.

TAC was unable, in the state of its knowledge and in the brief time at its disposal, to choose between the two models or to fashion one of its own. It therefore arranged for a working group of experts to formulate a program. The working group met in

March 1972. It recommended the establishment of regional centers in zones of genetic diversity; the formation of a network of cooperating institutions, both inside and outside the zones of genetic diversity; and a coordinating committee and staff.

The working group commented that too little effort was being devoted to plant collection and conservation, largely because of the absence of central, coordinated, and inspired leadership. The FAO, the working group felt, was clearly the appropriate agency to take administrative care of the project and should operate a trust fund provided to cover the costs; however, a central committee and staff should be largely independent in scientific and technical matters. The whole undertaking, the working group observed, would be essential to improved crop production and accelerated plant breeding.

In scale, the working group's ideas were larger than any yet advanced. TAC asked Swaminathan to prepare a somewhat reduced proposal, calling for a slower buildup of new centers and a larger role for the international centers of the CGIAR system. Along the way, the question had been raised by the British observer at TAC meetings whether the proposed program could, in fact, be considered a research activity at all and whether it was eligible for consideration by the CGIAR. The chairman of TAC, however, was confident that TAC's terms of reference were comprehensive enough to embrace the plant genetic resources project, particularly those terms charging the committee with identifying the main gaps in research on agricultural problems of developing countries and with encouraging the creation of an international network of research institutions.

The Swaminathan paper, accepted by TAC in August 1972, called for an independent board of experts to design and direct an international genetic resources program, with administrative and technical support provided by the FAO. In the FAO itself, however, a different idea took shape, and the agency lobbied for its view among CGIAR members in Europe. At the next meeting of the CGIAR, in November 1972, a number of delegations spoke in support of the idea that the FAO, rather than an independent committee under the aegis of the CGIAR, should coordinate the genetic resources program as part of its regular activities. The FAO said that it could perform this function provided that it could find the additional funds that would be needed.

At an impasse, the CGIAR agreed to its chairman's proposal that the FAO and TAC should consult further on the question of what role the FAO might play in the program. By the time of Interna-

tional Centers Week in the summer of 1973, no solution had been reached, because TAC held out against any arrangement that would submerge a small genetic resources program in the massive administration of the FAO. The Group therefore supported its chairman's suggestion that a subcommittee, containing representatives of TAC and the FAO, as well as of potential donors, should be created to wrestle with the problem. At the request of several donors and the FAO, the chairman himself agreed to chair the subcommittee.

The subcommittee met at FAO headquarters in Rome. On the first day, the impasse continued. On the second, it disappeared when the question was taken to the director general of the FAO (Addeke Boerma), a seasoned veteran of interagency diplomacy. Boerma quickly agreed that the coordinating mechanism should be an independent board and that the FAO could appropriately play a supporting role. Thus, the organizational obstacles to the IBPGR were resolved. Agreement was reached that the FAO would provide the secretariat of the board, together with required logistic support; that the board would consist of fourteen members (at least four from developing countries), of whom one would be a nonvoting member appointed by the FAO;[12] and that the chairman of the board, who might be from outside the board's membership, would be selected by the board in consultation with the director general of the FAO. In February 1974, the IBPGR, composed of members selected by the subcommittee (and including a member from the Soviet Union) held its inaugural meeting, and Richard H. Demuth, who had recently retired from the chairmanship of the CGIAR, was chosen to be chairman.

The director general of the FAO also retired at this time. His successor accepted the IBPGR arrangement with reluctance, and for several years the FAO gave it scant support. In time, however, arrangements improved, although problems remained. In 1983, history seemed to repeat itself: a decision by the FAO Conference to launch an international effort toward the collection and preservation of genetic resources under FAO auspices has reopened the controversy and cast a shadow on IBPGR's future role (see chapter 5).

Since its establishment in 1974, the IBPGR has not created any of the new regional germ plasm centers that had been conceived

12. The subcommittee had proposed that the FAO representative be a voting member of the board, but the FAO responded that this was contrary to established policy.

by the working group and Swaminathan. It has worked with existing institutions, including the IARCs. It is active in promoting and assisting in the collection and conservation of germ plasm for more than fifty crops and has done much to stimulate and widen awareness of a precious natural resource.

CATIE, Africa, and WARDA: Regional Experiments

When news of the founding of the CGIAR reached developing countries, it seemed to some onlookers that the Group represented a golden opportunity to find funds for strengthening weak and faltering national or regional institutions already in being. At its second meeting, TAC was presented with proposals that had these objectives.

A project for research in Latin America was brought forward by a member of TAC, Manuel Elgueta (a Chilean). He presented a paper from the Inter-American Institute for Agricultural Cooperation (called IICA, its Spanish acronym) entitled, "Integral Project for Research, Training and Technical Assistance for Protein Food Production." The objective of the project was to strengthen programs aimed at higher production of vegetable and animal protein by providing added budgetary support for IICA's Center for Research and Training in Tropical Agriculture (CATIE, its Spanish acronym)—then about two-thirds unused—at Turrialba, Costa Rica.

Early discussion in TAC recognized the similarity of CATIE's research objectives to those of CIAT, in Colombia, and especially to CIAT's beef program. A subcommittee of TAC, nevertheless, was organized to consider broadly the research needs of tropical America and to outline a possible cooperative structure for the research programs in the area. After visiting programs in progress, the subcommittee was convinced that CIAT should be the focus of any cooperative effort undertaken to increase protein production. CIAT should be provided sufficient resources for this purpose, with the fashioning of the cooperative arrangements left to it. The proposal to support CATIE thus failed to gain TAC's endorsement.

A parallel and contemporaneous proposal for research in Africa was made by L. Sauger, director of the National Agricultural Research Institute of Senegal and a member of TAC. Sauger's proposal called for assistance to research on millet, sorghum, and cowpeas through added funding for an anglophonic net-

work of research stations centered on Samaru, in northern Nigeria, and for a francophonic network centered on Sauger's own institute at Bambey, with substations in Niger, Mali, and Burkina Faso.

TAC was impressed by the difficulty of trying to operate such a "loose and diffuse network of national stations"; moreover, the responsibilities proposed duplicated those already envisaged for cooperative arrangements to be made by ICRISAT for research in West Africa. TAC entrusted further consideration of the matter to a mission headed by Hugh Doggett, a Canadian expert. Doggett's mission swung the whole project back into the orbit of ICRISAT, which already had made contact with some of the West African stations with which it would cooperate. ICRISAT has since considerably extended its activities in West Africa, including the creation of a substation in the Sahel. As in the case of CATIE, the Sauger proposal failed because TAC was unwilling to supplement the resources of existing regional centers whose work overlapped an international center within the CGIAR system.

Nonetheless, another proposal to promote regional programs, which came before TAC along with the CATIE and Sauger initiatives, met with some success. This was from the West Africa Rice Development Association (WARDA), a grouping of countries, originally eleven and today sixteen, formed to promote self-sufficiency in rice in a region where the large potential for this crop was for the most part untapped. WARDA had been formed at the same time as the CGIAR itself by a multinational group of donors under the aegis of the FAO. A proposal from WARDA for financial assistance reached TAC's agenda in August 1972.

Several members of TAC raised questions of principle. How would support for this network of national research programs fit into TAC's definition of international research? To what extent would TAC be justified in recommending the financing of a regional undertaking based on strengthening national efforts? To some, the project seemed neither international, on the one hand, nor clearly bilateral, on the other.

The chairman replied that both the CGIAR and TAC understood the need to feel their way on such questions. The questions soon arose in TAC's discussion of the paper on priorities in agricultural research (discussed later in this chapter). Members of TAC were increasingly concerned about the deficiencies of national research; in this context, TAC felt that regional programs with national participation could help build up national capabilities and that they deserved further study.

A critical difference, moreover, separated the WARDA project from those of CATIE and Sauger. WARDA was not proposing to occupy ground already mapped out for other programs of the CGIAR system; in fact, it was contemplated that, in a chain of rice research efforts, WARDA would link IRRI at one end and national programs at the other. The concept was that IITA, with backstopping from IRRI and the French Institute for Research on Tropical Agriculture (IRAT, its French acronym), would play a central role in supplying information on advanced rice technology to WARDA, while WARDA in turn would stimulate and assist the national programs in applied research, demonstration work, and field testing of varieties.

TAC therefore took the view that WARDA was potentially "a praiseworthy effort." But the association was still vulnerable to the criticism of the Sauger project, of being loose and diffuse. WARDA's research program had four principal components, one of which—a system of coordinated field trials—was particularly interesting to the Consultative Group. TAC therefore asked the directors of IRRI, IITA, and IRAT to consider how to establish clear connections with WARDA. When the executive secretary of WARDA came back to face further TAC discussion in July 1973, the program of coordinated field trials proposed for CGIAR support had been scaled down to $4.5 million from a projected five-year cost of more than $10 million. The executive secretary of WARDA also expressed willingness to strengthen the direction of the association, either by putting a controller in charge of financial and technical management or by entrusting the same functions to a management committee comprising representatives of WARDA, IRRI, IITA, and IRAT.

On this basis, TAC recommended acceptance of the WARDA system of coordinated field trials for support by the CGIAR. At its meeting in November 1973, the Group concurred. But when individual members were asked to indicate specifically their willingness to provide financial support, silence fell. On further consideration, TAC's chairman was not satisfied that the research program of WARDA, as it was then conducted, was up to the standard expected of an international center. TAC, he said, would continue to press for adequate scientific direction of the program; if this could not be achieved, TAC might consider withdrawing its support from WARDA.

In search of a remedy, the chairman of TAC agreed that the scientific adviser soon to join the CGIAR Secretariat would visit WARDA, accompanied by a member of the TAC Secretariat, to work

out ways of meeting TAC's objectives. The team visited WARDA in September 1974. It recommended streamlining WARDA's four-part research program into a single integrated activity, simplifying WARDA's elaborate committee structure for overseeing research, and appointing for two years an experienced research manager as adviser to WARDA's director of research. TAC indicated that it would formally endorse this revised WARDA program at its next meeting in February 1975.

In the meantime, funds for WARDA began to trickle in, and the suggested reforms began to take place. The informal participation of IRRI and IITA in planning WARDA's research and training programs was formalized by a written agreement in 1976. Robert Chandler, the former director general of IRRI (and AVRDC), and one of the world's premier managers of rice research, carried out a detailed survey of WARDA's activities and made recommendations for their improvement and better integration. The CGIAR continued to confine its support to only that part of WARDA's program dealing with rice field trials.

Enough has since been done by WARDA to show that a regional effort can usefully assist national research programs. As in the case of regional grouping in other areas, however, support by WARDA's own African members is not vigorous (members' subscriptions are chronically in arrears), and persistent financial and administrative problems, as well as questions about its scientific programs, have caused the CGIAR and TAC to give close attention to WARDA over the years. WARDA's problems again reached a critical stage in 1984–85, as described in chapter 5, and its future once more is clouded. The CGIAR has found no occasion to repeat the WARDA model of regional intergovernmental cooperation elsewhere.

ICARDA: A Center in Search of a Home

The sense of urgency about the world's food supply that had attended the birth of the CGIAR in 1971 was redoubled early in the Group's existence. Widespread famine began to appear in Africa and South Asia, where hundreds of thousands of people died of starvation in 1973–75.

It was against this background that the Group considered closing a gap still remaining in its research system. No center had been created for the needs of the geoclimatic zone of North Africa and the Middle East. Filling that gap proved to be perhaps

the most formidable task undertaken by the Group—intrinsically complex and further complicated by other factors, especially political instability in the area.

The region in question is vast, containing nearly 200 million people and twenty-two countries and stretching from Morocco in the west to Afghanistan in the east. It lies mostly outside the tropical zones that previously had dominated the attention of the CGIAR, and its climate and conditions of cultivation are of a kind largely unknown in the areas for which earlier centers had been established.

The research needs of the area had been noted by TAC at its first meeting. It was expected that the FAO would field a mission to survey what needed to be done, but Swedish funding on which the survey depended did not materialize. In April 1972, TAC decided to proceed independently.

A TAC Secretariat desk study recommended a major center with a three-part program, including: research on barley and lentils; adaptive work on wheat and some other cereals (such as sorghum, pulses, and rice) on the basis of materials supplied by CIMMYT, ICRISAT, and IRRI; and research on farming systems of dry areas, including both crops and livestock (particularly sheep). This paper virtually settled the question of whether there should be a Middle East center; what remained was the need for a specific proposal.

Early in 1973, TAC dispatched a seven-man team, headed by Dunstan Skilbeck of London University, which spent six weeks in the region. The team recommended the establishment of a center whose main function would be to assist, encourage, and stimulate research; it also would conduct research of its own and discharge the customary center functions of training and documentation. Technical solutions to the production problems of the area, the mission felt, already were known (in retrospect, a highly optimistic view); what was needed was leadership. This could be provided, in the mission's view, only by an independent, international center complementing national and regional efforts.

The mission had no difficulty in resolving the issue of whether to establish a single, dual, or multiple center. A single center would give economies of scale and would have a desirable psychological effect. A divided center, the mission believed, would be divided both in authority and economy; it would also fail to achieve an effective relay point for the work of other centers. The mission chose Lebanon as the site of the center.

At the hands of TAC, the Skilbeck report suffered the same fate as had the Beck report in the earlier case of ILCA. TAC thanked the authors, and then set aside its principal recommendations. As a next step, the chairman of TAC set up a working group comprising three TAC members, Skilbeck, and two other members of the Skilbeck mission to produce a different proposal more consistent with TAC's own views. On the basis of the resulting report, TAC opted in February 1974 for a larger project than the Skilbeck report originally envisioned, with a research program of larger scale (although concentrated on fewer subjects), a larger staff, and larger facilities, to be administered by a principal center and two or more associate centers. The project, which for several years would be given a variety of names and acronyms, eventually came to be called the International Center for Agricultural Research in the Dry Areas (ICARDA).

Laying out the research to be undertaken brought out another issue: duplication of research interests among centers. TAC agreed that one of ICARDA's chief responsibilities should be the improvement of barley, a principal crop of the region—but CIMMYT already had a small barley program. ICARDA also was expected to have a major interest in durum wheat (an important staple in the area), as well as in the more widely grown, softer bread wheats. CIMMYT, for its part, not only had already established a program of durum wheat research, but had a dozen wheat scientists at work in outreach programs in countries of the Middle East. After discussing various ways of dividing responsibility for wheat and barley research, TAC was unable to resolve the question and concluded that it should be worked out between the boards of the two institutions.

The question of where ICARDA should be located, it was remarked in a later elaboration of the project, "has been the most studied, difficult, and in certain respects vexing issue to be resolved." One of the contributions that ICRISAT had made to the methodology of the CGIAR was a listing, in the report of the Cummings mission, of the desirable features for the location of a new agricultural center. These included: proximity to a range of typical ecological conditions; adequate land for campus and off-campus research; ready accessibility to a large international airport; proximity to a center of population with reasonable amenities for center staff and families; availability of trained local technical, administrative, and clerical staff; and a host country willing to accommodate the center and to give it and its expatriate staff reasonable tax and import concessions and gen-

eral freedom of operation. As the experience of earlier centers had shown, it was difficult for any single location to provide all of these features. The usually decisive factor was the availability of amenities—since, if amenities were scarce, it would be difficult to attract the highly qualified staff that was the lifeblood of a center.

With ICARDA, TAC was for the first time attempting to choose the location of an international center—a task previously left to subcommittees of the CGIAR—and it proceeded with even more than its customary deliberation. The working group created by the TAC chairman had confirmed the Skilbeck mission's choice of Lebanon as the site of ICARDA's headquarters station and had designated Syria as the location of one of the center's associate stations. Uncertain whether sufficient land could be made available in Lebanon and aware that agricultural practices there were not fully typical of the region, TAC asked its Secretariat to prepare a position paper on the subject.

TAC discussed the Secretariat paper at its meeting in July 1974. In the end, the nontechnical attractions of Lebanon persuaded TAC to ratify the choice of the Bekaa Valley, not far from Beirut, as the headquarters site. The committee understood that enough land was available in the valley to enable the center to study both irrigated and rainfed cultivation, but it left open the possibility that additional land for rainfed crops might have to be found in Syria, within feasible traveling distance of the Bekaa. Associate stations would ultimately have to be established in Algeria or Tunisia, where a true Mediterranean climate prevailed, and in Turkey or Iran, typical of areas characterized by winter snows and high elevation. The location and the precise form of association of these later stations, the committee decided, should be left for the board of the headquarters station to determine.

The center, as TAC finally saw it, would deal with improvement of the staple crops of the region (wheat, barley, broad beans, lentils, and possibly oilseeds and cotton), soil and water management and conservation, and sheep farming and fodder crops—all as components of farming systems and intensified land use. A strong training and seminar program would be established. Cooperative relationships would be set up with CIMMYT in maize and with ICRISAT in sorghum, millet, and chickpea research.

Turning again to the question of overlapping responsibilities, TAC recommended that work on the breeding and germ plasm of

barley should gradually be shifted to the Middle East center, with CIMMYT conducting adaptive research in Latin America. CIMMYT would retain the major responsibility for bread wheat, on which ICARDA would do adaptive work in the Middle East. Durum wheat would remain for the time being with CIMMYT; the possibility of transferring this work to ICARDA could be discussed later between CIMMYT and the new center. (This division of responsibility did not succeed in practice, and in 1982–83 a working compromise between the two centers had to be developed under the auspices of TAC and the Group as a whole.)

The CGIAR agreed to these prescriptions in its meeting of August 1974. But a new issue was raised: was it appropriate for the Group to fund a center in a region where some countries had large financial resources of their own from oil revenues? Some members said that they would find it difficult to subscribe to the new program unless support were forthcoming from the region itself. More generally, some members hesitated to embark on a large new enterprise without the help of new donors for the research system as a whole. The chairman of the CGIAR observed that in seeking to enlist new donors from the region, the aim should be to have them support more activities than the Middle East center alone, to avoid having the system split into a series of regional activities commanding only regional support.

The Group agreed to follow its usual practice of creating a subcommittee to proceed toward the establishment of the new center. But caution seemed desirable. Some clarification of fundamental questions was needed: in particular, how much financial support for the center could be expected, and accordingly, on what scale should it be planned? It also was felt desirable to take soundings in the region, to avoid confronting the countries with a fait accompli in the establishment of the new program.

The chairman therefore took the unusual step of appointing a preparatory group to meet ahead of the subcommittee itself. The group was composed of the three cosponsors of the CGIAR and interested donors and was chaired by David Hopper, president of IDRC. It met in October and made a number of decisions, composing the terms of reference and otherwise defining the scope of work to be done by the subsequent subcommittee.

In its next meeting (October 1974), the Consultative Group approved the recommendations of the preparatory group, and twelve members expressed their intention to contribute to the initial work of establishing ICARDA. A subcommittee was estab-

lished, and in succeeding months its chairman (Hopper) traveled widely to acquaint governments in the region with the ICARDA proposal and to ascertain their wishes about the kind of research to be conducted. The Lebanese government was willing to make land available in the Bekaa Valley, but Hopper's visit confirmed that more land would be needed; in Syria, he found the authorities receptive and willing to provide land near Aleppo—subject to the important proviso that the work to be performed in Syria would be comparable in importance to that in Lebanon.

The search for new donors to the CGIAR also went ahead. The chairman of the subcommittee and the chairman of the CGIAR visited Iran, Saudi Arabia, and Kuwait and invited them to become members of the Group.[13]

It was in an optimistic mood about prospective resources that the ICARDA subcommittee met in June 1975. A draft program and budget prepared by Robert Havener, then director of the Ford Foundation's Arid Lands Agricultural Development Program (ALAD) based in Lebanon, and by Lowell Hardin of the Ford Foundation presented a minimal and an optimal model of operation for ICARDA. The subcommittee accepted the larger model, calling for the operation of three stations in Lebanon, Syria, and Iran.[14]

The subcommittee appointed the IDRC to serve as executing agent. Havener was given a leave of absence to serve as project development officer, and the Ford Foundation made arrangements for the ultimate transfer of ALAD equipment and appropriate staff to ICARDA. Omond Solandt took the lead on behalf of the IDRC. Consultants criss-crossed the area to identify specific operational sites in the three host countries. Suitable sites were found in all three countries (although final choices had not been made in all cases), and the authorities expressed willingness to make the land available.

13. Saudi Arabia, Iran, and the Arab Fund for Economic and Social Development, based in Kuwait, did become donor members. Saudi Arabia made grants, limited to ICARDA, for 1976 and 1977; Iran made grants to several CGIAR research programs, including ICARDA, for the years 1976–78; and the Arab Fund became a regular donor beginning in 1977. The International Fund for Agricultural Development and the OPEC Special Fund became members of the Group in 1979 and 1980, respectively, and Saudi Arabia again became a donor in 1982.

14. At one point Sir John and Hopper proposed that the three stations become independent (but coordinated) centers as an inducement to Iran to become a donor, but this idea did not long survive.

The subcommittee itself proceeded with the legal establishment of ICARDA. In October 1975, it chose eight of the eleven elective trustees, composing an effective majority of the center's fifteen-man board (which also included the center director ex officio and one representative of each of the three host governments). In November, representatives of the IDRC and of the three cosponsors signed the charter of ICARDA, officially giving birth to the new center. In June 1976, the IDRC signed the protocol with Syria establishing ICARDA in that country and, in July, signed the protocol with Iran. The subcommittee then turned control of ICARDA over to the board of trustees, which held its first meeting in August 1976 in Tehran.

But ICARDA was not destined to be completed according to any of the various TAC-CGIAR designs. Adverse acts of God and man have not been unknown to the CGIAR system. CIP's headquarters was once struck by an earthquake; IITA was established during a protracted civil war; and ILCA's founding was accomplished during a revolution. ICARDA, however, was struck by misfortune not once but twice: by a civil war in one country and a revolution in another.

In March 1975, civil disturbances began in Lebanon and grew into a full-scale, lengthy civil war. The Bekaa Valley, intended site of the headquarters of ICARDA, became a battleground. In the absence of a sitting parliament in Beirut, the ICARDA protocol could not be signed, and the establishment of ICARDA in Lebanon did not proceed. Nonetheless, ICARDA maintained a small office in Beirut that served for a time as headquarters, and some research work has been done in the Bekaa.

In Iran, suitable land was eventually found near Tabriz, but problems of local procedure forestalled acquisition of the site for ICARDA by the government. They were still to be resolved when, in February 1978, riots broke out in Tabriz, signaling the start of increasingly widespread and violent protests that led to the downfall of the government. The project to establish an ICARDA station in Iran was abandoned and never revived.

In 1985, however, ICARDA is alive and well and operating effectively in the region of Aleppo, Syria, where it is carrying out the essential elements of the program once foreseen for the Lebanon-Syria combination of stations. In its present form, it may well be more suitable than the cumbersome and costly three-station arrangements once envisaged, although the high plateau region is still not being adequately served.

CARIS: Short-lived

For the sake of completeness, mention should be made of a proposal by the FAO to establish a computerized service to make available information about current research activites in developing countries. This was the Current Agricultural Resources Information System (CARIS), for which a pilot project had been conducted in West Africa. In 1974, TAC reviewed the proposal to expand the pilot project into a worldwide system and recommended that the Group provide bridging finance until the FAO could pick up the costs in its next budget biennium starting in January 1977. With some reservations about funding the budget of one of the cosponsors, but considering that the amount of money requested was small (about $700,000 for the two years) and the time for which it was needed short, the CGIAR agreed to provide funds to get the system started. CARIS was underwritten by the Group during 1975 and 1976, after which its expenditures were absorbed in the FAO's budget and CARIS disappeared from the CGIAR system.

Setting Priorities

Considering new research activities and bringing to fruition those that it and the Group favored occupied much of TAC's crowded agenda during the early years. Each research proposal that came before TAC was given careful attention. TAC was reluctant to foreclose any line of inquiry that held promise, and several suffered a lingering death at its hands: aquaculture (fisheries) was considered eleven times, vegetables nine times, and the water buffalo seven times during the period 1971–76.

This was not TAC's sole preoccupation, however. One of TAC's principal functions, according to its terms of reference, was to advise the Group on the main gaps and priorities in research on agricultural problems of the developing countries. TAC took to this task promptly, and at its second meeting (October 1971) agreed that its chairman would draft, for its consideration, a paper on priorities in agricultural research. In writing this "strategy paper," as he called it, Sir John enlisted the help of Forrest Hill, at the time chairman of the boards of both IRRI and IITA.

The strategy paper, after several rounds of discussion and revision, was accepted by the CGIAR in 1973 and was updated but not

radically amended twice thereafter. A fourth review of strategy and priorities was still being considered by the Group at the end of 1985 (see chapter 7). The first TAC paper established cereals (rice, maize, wheat, barley, millet), food legumes (beans, peas, lentils), and starchy crops (potatoes, cassava) as top priorities for the Group's efforts; ruminant livestock (cattle) and rangeland improvement was next. Lower down came aquaculture, fruits, and vegetables, followed by industrial crops, such as cotton and jute. Even lower in priority was forestry. Certain other products of importance (swine and poultry) seemed to TAC to be sufficiently covered by research in industrial countries that they need not concern the Group for the time being.

Besides specific crop and livestock production, the paper noted, TAC and the Group needed to consider inputs to production (water, plant nutrients) and to study the socioeconomic setting of agriculture in the developing countries (factors promoting or impeding the adoption of improved technology). TAC felt doubtful, however, that the subject of socioeconomic factors could ever be covered adequately by a single center in a single region, and different aspects might deserve different priorities at different times and in different regions.

A revised strategy paper was prepared by TAC, in conjunction with the forthcoming first review of the CGIAR system (see below), for consideration by the Group in the summer of 1976. Although TAC made a thorough reexamination of priorities, its recommendations did not deviate significantly from the original strategy paper. But its new findings clarified and sharpened priorities and took account of the development of the research network in the intervening years.

In the second paper, TAC continued to give first priority to research designed to increase the amount and quality of basic staple foods. Within this overall priority, primary emphasis was given to cereals, but TAC also attached great importance to the food legumes (including groundnuts and soybeans), to the starchy roots and tubers, to ruminant livestock, and to aquaculture. At the same time, TAC gave high priority to research on cropping intensification (which it thought could be the major source of growth after improved productivity of the major food staples had been soundly established), to postharvest technology, and to socioeconomic research on farming systems. Nonfood commodities were given second priority, but one of growing significance as a means of providing income to farmers and foreign exchange to countries. In this connection, the sec-

ond report noted that for fibers as a group two-thirds of the total value came from processing and postharvest activities within the developing countries where they were produced, whereas the value added after harvesting was much lower for most of the other crops falling within the CGIAR's ambit.

TAC's second strategy paper also identified a number of important fields of research to which it assigned no specific priority. One was socioeconomic research that would aid in the formulation of national policy. Another was research on factors of production, such as fertilizers, pesticides, and the use of irrigated water. TAC concluded that more factor-oriented research was called for, but that new mechanisms were not likely to be needed for the purpose. Much research was already under way in industrial countries on these factors of production, and application of the results to individual problems at the international centers was also expanding. While leaving the door slightly ajar to consider specific proposals on their merits, TAC felt on the whole that factor-oriented research should go hand in hand with the research on particular commodities being conducted at the IARCs.

TAC also addressed the linkages between the applied research conducted by the international centers and, on the one hand, basic and strategic research conducted mostly in the industrial countries and, on the other, adaptive research carried out by national programs in the developing world (for a fuller definition of these terms, see chapter 7). As to the former, TAC felt the need for a more systematic approach and closer communication between the IARCs and the industrial countries to balance basic and applied research. (Although progress in this direction is taking place, no formal steps have been adopted by the Group pursuant to TAC's suggestions, despite occasional prodding from the CGIAR Secretariat.)

On the issue of strengthening national research capacity in the developing countries, the Group had been aware from the beginning that such programs were likely to be the weakest link in the chain through which the technology developed at the international centers (often in collaboration with national programs) was adapted to local circumstances and made available through national extension systems and supporting services to individual farmers. TAC clearly recognized the need to strengthen national research efforts in many developing countries. It saw a role for the centers in collaborating with national research programs, where this collaboration served a research purpose for the center itself. But it did not think the centers should go fur-

ther, and it doubted the ability of the CGIAR itself to act effectively in coordinating efforts at the national level. Not finding a solution within the CGIAR, TAC in effect left the problem of strengthening national research programs on the doorstep of the individual donors, to handle in their bilateral relations with developing countries. The members of the Group thought otherwise, however, and a major initiative was shortly to be undertaken by the Group.

Reviewing the System

As the research system supported by the CGIAR grew rapidly in size and complexity, and as the Group took over from the foundations responsibility for ensuring that the IARCs continued to perform as "centers of excellence," the need for a comprehensive system of review was recognized. Donor members had to be able to assure themselves and their authorities that the funds being contributed were used effectively and for programs of high priority.

At the second CGIAR meeting, in December 1971, members accepted the chairman's suggestion that the Secretariat (still thought of as one Secretariat comprising Bank and FAO wings) screen requests for financial support to see that they all were justified. This was done in 1972 and 1973 on the basis of a simplified model proposed in a Secretariat discussion paper. A more comprehensive approach was needed, however, and at the CGIAR meeting late in 1973 the chairman appointed a subcommittee to prepare a report on the subject. The subcommittee was chaired by David Bell, who continued to play an active—often key—role in CGIAR affairs until he retired from the Ford Foundation in 1981; the other members were Haldore Hanson (director general of CIMMYT and that year's chairman of the center directors' meetings) and H. C. Pereira, a member of TAC.

Details of the Bell subcommittee report (prepared with the help of Lowell Hardin of the Ford Foundation) will be discussed in chapter 6, since the report set the pattern for the comprehensive—some would say elaborate—system of review now in place. The Bell report endorsed the regular annual review of the programs and budgets of the centers by the Secretariats (by then divided into two). TAC was to be informed by a center of any major changes proposed in its program and given an opportunity to comment. (At a later date TAC was given overall responsibil-

ity for the annual program and budget reviews.) The Bell report recommended that an annual report (which became known as the integrative report) be prepared by the CGIAR Secretariat to review the research system as a whole and to address the overall financial requirements and availabilities.

The Bell report also considered longer range reviews, in which members of the CGIAR had already expressed interest. It concluded that there should be periodic assessments of the overall scientific quality of each center: evaluation should be made of the continuing need for the center's work, to ensure that activities were not carried on longer than necessary and that activities of lower priority gave way to more important ones. The CGIAR, the subcommittee observed, "looks to the TAC to assure that such periodic external reviews are made; it would seem feasible for the TAC to meet its responsibilities in most cases by (1) assuring itself that the center's own assessment process is adequate, and (2) participating in the center's assessment process by mutual agreement with the center's director." Such reviews, the subcommittee thought, should be made no less frequently than every five years.

In practice, TAC did not leave the initiative for these long-range scientific reviews in the hands of the centers, as proposed by the Bell subcommittee and agreed to by the Group. After consulting the center directors and winning their agreement and that of the Group, TAC took the lead in scheduling and organizing review teams in which at least one and occasionally two or three TAC members were expected to be the core members,[15] and staff of the two Secretariats participated. The responsibility for advising the Group on the scientific merits of centers' programs thus shifted to TAC, albeit in close consultation and cooperation with the center concerned. The system of quinquennial reviews, as they soon came to be called, began with a visit to IRRI at the end of 1975. CIMMYT received its in-depth review in March–April 1976, and both reviews were discussed by the Group at its autumn meeting in 1976.

IRRI and CIMMYT Quinquennial Reviews

The IRRI quinquennial review was headed by M. S. Swaminathan, director general of the Indian Council on Agri-

15. This practice has not been regularly followed in recent years.

cultural Research and one of the original members of TAC (and later, by one of those quirks of fate, to become the director general of IRRI, in which capacity he came before the Group to discuss the findings of the second quinquennial review of the center). The review panel's nine members included specialists in plant breeding, entomology, plant physiology, crop management, plant pathology, economics, soil science, and water management. The director general of IRRI had been invited to submit suggestions for the panel members to be selected and the disciplines to be covered, but Sir John made it clear that, while such suggestions would be taken very seriously, ultimate responsibility for selection rested with TAC.

The IRRI review panel members visited IRRI programs in Thailand, Indonesia, and the Philippines; most of the two and a half weeks that they spent in the field, however, were at IRRI headquarters. The last four days were devoted to writing several drafts of the report and discussing issues with the management and staff of IRRI. Such a tightly packed program, ending up with a provisional draft of the report for discussion with the center, was the prototype for all external reviews carried out subsequently. Thereafter, as more experience was gained, increasing efforts were made to brief review panels before their departure and much greater efforts made to have the center analyze its own programs, prepare written answers to questions sent out in advance, and identify the issues it thought the TAC panel should address.

Such preparations were more evident in the case of CIMMYT, but they put heavy demands on the staff of the center. The director general of CIMMYT estimated that something like 10 percent of the time of the international staff during a twelve-month period was spent in preparing for the review team, receiving it, and following up on its recommendations. This estimate was greeted with some skepticism by members of the Group, but there was no doubt in anyone's mind that the process of making an external review in the pattern established by TAC was very demanding. Like that of IRRI, the CIMMYT panel comprised nine persons; it was headed by Ralph Riley of the Plant Breeding Institute in Cambridge, England.

In both cases, the reports of the panels were given to TAC in draft for comment before being put in final form. The chairman of TAC indicated, however, that the reports were those of the panels and should be submitted as such to the Group. TAC's comments and further views were to be submitted separately.

The recommendations of both the IRRI and CIMMYT review panels covered a wide range of subjects. Both addressed many matters of policy, and the IRRI panel also made specific recommendations about additions to plant and staff and about operating procedures. Each panel, in its own way, covered such things as the appropriateness of the staff and facilities for carrying out the center's program, the multidisciplinary approach to research, the priority to be given to the various aspects of plant breeding, the importance of research on plant diseases and pest control (the IRRI panel made seventeen separate recommendations in this area), work on cropping systems, and economic studies. Both panels emphasized the importance of bringing the findings of the economists' work on the constraints to and consequences of adopting the technologies developed by the centers to bear on improving the centers' research programs. They also addressed research on soil fertility, the use and control of water, and the degree to which the centers should be involved in basic research. Much attention was given to the training programs of the centers and especially to their collaborative programs with national research agencies.

The Group considered the IRRI and CIMMYT external reviews separately and at length during its autumn 1976 meeting. In introducing them, the chairman of TAC, attending his last meeting in that capacity, described the reviews as cooperative ventures between TAC and the centers and not in any sense as "inspections." Nor had they produced final judgments, but only recommendations for consideration by the boards of the centers. The director general and board chairman of each center commented on the report, generally welcoming it and indicating readiness to adopt its principal recomendations.

Comments from members of the Group ranged from matters of broad policy to minor detail. There was some difference in the way the two reports had presented their recommendations. The IRRI recommendations were many and detailed and, among other things, proposed a substantial increase in the capacity of the center in several of its programs, including the addition of some thirteen senior staff positions. The recommendations of the CIMMYT review, in contrast, concentrated more on specific points of policy. Considering the short time each panel had for its work, their reviews were thought by the Group to be searching and constructive.

There were some disappointments, nonetheless. For example, there was some regret that it had not been possible for the re-

viewers to learn more about the impact of the centers' work on agricultural production in the developing countries that they served, and some members felt that even more time should have been devoted to assessing the effectiveness of the cooperative programs with national researchers. It was also noted that the reviewers did not go very deeply into questions of research management, and there was some suggestion that this was an area to which the Group would have to turn its attention in due course.

On the whole, however, the Group was well satisfied with these first two reviews. That the reviews had found little fault with IRRI and CIMMYT was not surprising, for these were the flagship centers in the system and already had impressive records. The members of the Group felt that high standards had been set in the conduct of such external reviews, that they had been accomplished in a spirit of cooperation, that they had a salutary effect on the thinking of the center scientists with regard to objectives and strategies, and in a more general way had helped to point out the need for clearer attention to priorities and to forward planning. Most important, these external reviews by teams of experts had given the donor members reassurance that their support for the CGIAR was well justified.

The First CGIAR Review: Taking Stock of the System

The Bell subcommittee report had suggested parenthetically (since the matter was outside its terms of reference) that the Group might someday need periodically—perhaps every five years—an overall review of the whole CGIAR system. The assessment, as the subcommittee put it, should consider "the usefulness, accomplishments, and deficiencies of the system of centers in the context of the worldwide problems to which the centers' work is addressed."

The need for such a full-dress review of the system as a whole became apparent sooner than the "someday" that the subcommittee had envisaged. In 1975, as the CGIAR Secretariat added up the balance sheet of center funding requirements and prospective donor contributions, a significant shortfall appeared for the first time to be in the offing. With the continued rapid expansion of the centers and the addition of ICARDA, a question loomed large: how far could the system continue to grow? The Secretariat's integrative report recommended that a review of the system be undertaken, and a paper presenting a specific proposal,

prepared at the Group's suggestion in July, was discussed and endorsed at the October 1975 meeting.

The exercise was to be conducted by a special committee (appropiately denominated the review committee) that would make recommendations for decision by the Group. The terms of reference of the review committee were comprehensive:

- to review projections of production of major food commodities, compare them with projected nutritional needs, and assess the increase in rates of yield and production that might be feasible over the next ten years as a result of research and its application
- to review the objectives and prospects of major research programs to increase production of the principal food crops and animal products
- to review, in the light of the above, the need for research that could be undertaken under the auspices of the CGIAR
- to suggest boundaries for the international centers in their own research programs, collaborative research with national programs, training, and transfer of technology to beneficiary countries
- to suggest boundaries for the activities and responsibilities of the CGIAR itself
- to consider whether there should be any changes in the research priorities recommended by TAC
- to consider whether there should be a limit on the growth and size of the centers individually or collectively over the following five years
- to estimate the funding required during the following five years, ascertain the likely availability of funds and, if a shortfall seemed probable, recommend mechanisms for bringing resources and needs into balance
- to consider what measures might be necessary to ensure that staff and money were used efficiently and to suggest any changes needed in the procedures of the CGIAR, TAC, and the centers, individually or in relation to each other.

Responsibility for appointing the members of the review committee was entrusted to the chairman of the Group. (The members of the Group, having been consulted informally, had agreed that the chairman of the Group should also chair the review committee.) Although a smaller committee would have been

preferable on grounds of efficiency, fourteen members were appointed in order to provide a broad cross section of the donor members of the Group, TAC, and the centers, even though all review committee members served in their individual capacities. The committee was thus a group of insiders; it was assisted by a full-time study team of four scientists drawn from outside the system and headed by Alex McCalla of the University of California at Davis.

After a spring and summer of intensive work by the study team, including travel to all parts of the system and numerous interviews, and three meetings of the review committee, the committee presented an extensive report to the Consultative Group meeting in October 1976. The recommendations, twenty-two in number, were debated closely by the Group. Most of them were accepted with virtual unanimity.

The report took as its point of departure an appraisal of world food needs by Nathan M. Koffsky, an agricultural economist who had worked with the original Bellagio group. His paper for the review committee repeated the warning sounded by the FAO study provided to the preliminary meeting of donors in January 1971. "In many countries of the developing world," it observed, "performance in food production lags seriously, building up food shortfalls which could well prove unmanageable. Thus, there is an urgent need to improve yields in most of the array of food crops as soon as possible." In suggesting guidelines for research, the paper endorsed the TAC and CGIAR's emphasis on cereal crops.

The first three recommendations had to do with the continuing need for the CGIAR and with the scope of its activities. The committee recommended that:

- The Group should "proceed on the basis that it should continue to function for the forseeable future."
- The research activities supported by the Group were appropriately focused on "food commodities which . . . collectively represent the majority of the food sources of the developing world and no major changes or additions are called for at this time."
- The "next few years should be viewed as a period of consolidation." Although TAC should continue to explore the need for new initiatives and changes in existing programs, the CGIAR itself should be cautioned against undertaking initiatives requiring major financial commitments.

The second set of recommendations covered issues regarding the research centers. They addressed the scope, balance, and boundaries of center programs. It was recommended that all activities undertaken by a center be regarded as components of a single, integrated program regardless of the source of funds and that the entire program be subject to the Group's review procedures. This recommendation was addressed to the increasing use of "special projects," an issue of continuing and nagging concern that will be discussed in chapter 7. Every center had specially funded activities that were not part of its core program. The committee felt it illogical to exclude these from the center's regular program and budget and from scrutiny under the Group's review procedures.

A related and equally troublesome issue had to do with the "boundaries" of the work of the centers, particularly in relation to national programs. The committee recognized the value of the centers' programs of cooperation with national research, but cautioned against allowing these activities to become such a substantial part of the centers' work as to compromise or distort their fundamental research mission. The report embodied its views on the boundaries of the centers in a table that classified the range of activities into those that were appropriate, those that were sometimes appropriate, and those that were inappropriate as a basis for cooperative programs with national research institutions. The evaluation of promising new breeding material for adaptation, productivity, and pest tolerance and the testing of key components of farming systems were thought to be clearly appropriate, while managing national research organizations or making recommendations to national governments on agricultural economic policy and related issues were deemed inappropriate. In the middle, as sometimes appropriate, were such things as on-farm trials to demonstrate the applicability of a center's new technology or assistance in the development of a national research institution doing research of direct relevance to the international center. (Further details are given in chapter 7.) Finally, the review committee recommended that all centers develop more effective forward planning, a point that had been made strongly in the external reviews of IRRI and CIMMYT.

The review committee then turned its attention to intercenter relationships. It recommended that collaboration between centers working in the same region or on the same commodity be encouraged and, furthermore, that agreements between centers

on these matters should be put in writing and recorded with the CGIAR Secretariat. This was another indication of the growing conception of the centers as an integrated system rather than a mere collection of activities with a common source of funds. There followed two recommendations on center management, one sharpening the criteria and procedures for selecting and appointing board members and the other proposing that each board of trustees broaden its membership by including three members selected in conjunction with, and ratified by, the CGIAR.

The rest of the recommendations had to do with the Group's policies and procedures for long-term planning, evaluation of programs, allocation of funds, and management of the system. The report recommended that there should be an overall review of the Group every three to five years. It said that quinquennial reviews of each center should be continued, but recommended that TAC give greater emphasis to periodic, cross-center analyses of particular activities in which several or most centers engaged, as was done in subsequent reviews of farming systems research and training.

One of the issues addressed by the review commiteee was the expected life of a center. The conclusion was that no center should necessarily be regarded as continuing indefinitely. None was judged due for phasing out in the medium term (that is, in the next five to ten years), but centers should at least be responsible for justifying periodically their continued existence.

Another question of the same character was whether there was an optimal size beyond which a center should not be permitted to grow. The study team had been preoccupied with this issue, and it was discussed at length by the review committee and then by the Group. The conclusions were ambiguous. While no one thought that centers should grow indefinitely, there was a great reluctance to adopt any formula for establishing the maximum size of a center. It was generally felt that flexibility should be preserved and that each center should determine its size.

There was always some concern on the part of its members that the Group might indulge in too much reviewing of the activities of the centers, thereby overburdening their management and scientific staff. Nevertheless, the members of the Group felt a continuing need to be informed and to satisfy themselves that the centers' work was germane to the objectives of the Group. The review committee in effect endorsed the review policies and

procedures already in place and recommended that there should be another review of the system as a whole in five years' time.

To facilitate longer-term planning, the review committee recommended a move toward biennial budgets instead of the one-year budgets commonly used. This was endorsed by the Group, though there was some question as to how effective longer budget periods could be in the absence of longer-term commitments by donors. Nevertheless, the Secretariat was invited to introduce a system of biennial budgeting. (It did so over the course of the next few years, but the new system did not work very well, particularly in its first years, when the centers suffered from higher inflation and rising operating costs while contributions grew more slowly than in the past.)

The review committee recognized the increasing possibility of shortfalls in CGIAR funding and made recommendations bearing on this prospect. If a center were seriously underfunded for two or three years (apart from funding provided by the donor of last resort), the future of the center should be reviewed by the CGIAR. The creation of a standby committee should be authorized, to be activated for the purpose of advising on measures to deal with significant shortfalls in funding or on other issues of interest to the Group or its chairman.

The standby committee recommendation received a lukewarm endorsement. There had always been within the Group reluctance to give committees or subcommittees authority to act on its behalf. They ran against the spirit of egalitarianism and the consensual decisionmaking that were fundamental to the Group's way of working. So the standby committee was accepted only on the clear understanding that it would not be convened unless it were really necessary; its role would not be to make final decisions, but simply to advise the Group on how to proceed in situations in which TAC and the CGIAR Secretariat working directly with the centers had been unable to arrive at a solution. In the event, although on one occasion members of a standby committee were designated by the chairman and alerted to the possible need to serve, no standby committee was ever convened. TAC and the Secretariat were in each instance able to work out reductions in center programs that the center directors accepted. Perhaps this was a case of the center directors' preferring "the devil they knew." TAC and the Secretariats were at least familiar with the programs of the centers, while the members of a standby committee could hardly become well informed in the short time available to them.

A recommendation of the study team that the review committee did not endorse, and which the Group did not press, was that the TAC and CGIAR Secretariats be merged into a single, presumably more efficient, service. Although from the beginning TAC and the Consultative Group itself were each provided with an executive secretary, they and the staffs that they began to acquire were originally thought of as two wings of a single secretariat. But after several years it was apparent that they were distinct entities, each with its own responsibilities and perspectives, and while they increasingly coordinated their separate efforts they continued to be independent. The committee debated this question at some length, but its members were very much aware of the practical problems that stood in the way. If the two Secretariats were merged, it would only make sense that the amalgamated operation be located in either the FAO or the World Bank. Either solution would not have been acceptable to at least one of the cosponsors and to some members of the Group.

On a related and perhaps more important subject, there was insistence that the two Secretariats should be independent from the host agencies that housed them and appointed their staffs. This point was raised by the study team and the review committee, and during the discussion at the 1976 meeting representatives of both the FAO and the World Bank formally confirmed that the two services were responsible directly to TAC and the Group, respectively, and did not report to the management of the agency. (This agreement has held up in practice; it has, among other things, had the salutary effect of ensuring a readier approval by the agencies of the budgets of the Secretariats.)

On the whole, members of the Group were pleased with the results of their first stock-taking. The report was seen as essentially cautious and conservative, but this fitted the new mood of the Group after a period of almost breathtaking expansion. The basic recommendation to treat the next three years as a period of consolidation was universally accepted, though many pointed out that this should not mean a period of stagnation.

Choosing a New TAC Chairman

Relations among the three cosponsors, although always excellent at the working level, occasionally gave rise to moments of trial. When Edouard Saouma was elected director general of the FAO in 1972, it took some time for him to become familiar and

comfortable with this novel activity whose cosponsorship he had inherited. Thus, there was an episode that strained relations in 1976 when the director general summarily fired the executive secretary of TAC, who was highly regarded by the Group, without consulting or giving prior notice to the TAC chairman or the other cosponsors.

Another difficulty surfaced when Sir John Crawford was coming to the end of his period of service as chairman of TAC in 1976. According to the CGIAR's organizational plan, the chairman of TAC was to be nominated by the cosponsors and approved by the Group. But the three cosponsors were unable to agree on a candidate. The FAO considered that, as a matter of principle, the chairman should come from a developing country. Although the FAO nominee was a highly qualified member of TAC, the other cosponsors argued that the nomination should go to the most qualified individual and considered that other candidates were as well if not better qualified. (To complicate the matter further, one of the nominees, David Hopper, who was president of IDRC and also a TAC member, had run against Saouma for the director generalship of the FAO in a contested election.)

With the three cosponsors unable to agree, and with the Group lacking any mechanism for formal voting, a solution had to be improvised. Following one of the informal consultations with Group members that were often part of the decisionmaking process, the chairman appointed a nine-man subcommittee broadly representative of the Group's donor membership to choose a nominee. The subcommittee chose Ralph W. Cummings by secret ballot. His nomination was warmly endorsed by the Group members, relieved at their successful passage through a difficult moment. The first five full years of the Consultative Group's activities thus ended on a positive note.

Appendix: Statement of Objectives, Composition, and Organizational Structure

This statement was approved by the Consultative Group at its first meeting on May 19, 1971. It was subsequently issued as annex III to the summary of proceedings of the meeting.

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

Objectives, Composition and Organizational Structure

A. *Objectives*

1. The main objectives of the Consultative Group (assisted as necessary by its Technical Advisory Committee (TAC) described in Part C below) are:

(i) on the basis of a review of existing national, regional and international research activities, to examine the needs of developing countries for special effort in agricultural research at the international and regional levels in critical subject sectors unlikely otherwise to be adequately covered by existing research facilities, and to consider how these needs could be met;[1]

(ii) to attempt to ensure maximum complementarity of international and regional efforts with national efforts in financing and undertaking agricultural research in the future and to encourage full exchange of information among national, regional and international agricultural research centers;

(iii) to review the financial and other requirements of those international and regional research activities which the Group considers of high priority, and to consider the provision of finance for those activities,[2] taking into account the need to ensure continuity of research over a substantial period;

(iv) to undertake a continuing review of priorities and research networks related to the needs of developing countries, to enable the Group to adjust its support policies to changing needs, and to achieve economy of effort; and

(v) to suggest feasibility studies of specific proposals to reach mutual agreement on how these studies should be under-

1. Research is used in this document in a broad sense to include not only the development and testing of improved production technology, but also training and other activities designed to facilitate and speed effective and widespread use of improved technology.

2. Final decisions on funding remain a responsibility of each member in connection with specific proposals.

taken and financed, and to exchange information on the results.

In all of the deliberations of the Consultative Group and the Technical Advisory Committee, account will be taken not only of technical, but also of ecological, economic and social factors.

B. *Composition*

2. The co-sponsors of the Group are the Food and Agriculture Organization of the United Nations (FAO), International Bank for Reconstruction and Development (IBRD), and the United Nations Development Programme (UNDP). As of June 1, 1971, its membership, in addition to the co-sponsors, consists of the following countries, regional development banks, private foundations and other organizations interested in supporting international agricultural research related to the problems of the developing countries:

Governments	*International Organizations*	*Others*
Canada	African Development Bank	Ford Foundation
Denmark	Inter-American Development Bank	IDRC
France		Kellogg Foundation
Federal Republic of Germany		Rockefeller
Netherlands		
Norway		
Sweden		
United Kingdom		
United States		

3. The following are participating in the Group as observers:

Governments	*International Organizations*
Australia	Asian Development Bank
Belgium	Development Assistance Committee of OECD
Finland	European Development Fund
Italy	
Japan	
New Zealand	
Switzerland	

Some of the observers indicated they may join as members.

4. Arrangements will be made through FAO for the designation, for a period of two years, of not more than five governments, each representing a major region of the developing world, to participate as members of the Group. Other interested parties may be invited to join the Group or to participate as observers, as decided by the members.

5. Membership in the Group involves no commitment to provide funds.

6. The Chairman and Secretary of the Group will be provided by the IBRD and its base will be at IBRD headquarters in Washington, but the venue of its meetings will be decided from time to time by its members.

C. *Supporting Services*

Technical Advisory Committee

7. A small Technical Advisory Committee (TAC) will be created by the Consultative Group, composed of distinguished international experts from developed and developing countries, nominated by the co-sponsors and appointed by the Group. Appointments will be for three years except that in the case of the first appointees (other than the chairman) four, selected by lot, will have one-year appointments and four, similarly selected, will have two-year appointments. The TAC will be supplemented by advisers with special expertise, who may be invited to serve individually or on panels to consider particular problems. TAC will report to the Consultative Group.

8. TAC will, acting either upon reference from the Consultative Group or on its own initiative:

(i) advise the Consultative Group on the main gaps and priorities in agricultural research related to the problems of the developing countries, both in the technical and socio-economic fields, based on a continuing review of existing national, regional and international research activities;
(ii) recommend to the Consultative Group feasibility studies designed to explore in depth how best to organize and conduct agricultural research on priority problems, particularly those calling for international or regional effort;
(iii) examine the results of these or other feasibility studies and present its views and recommendations for action for the guidance of the Consultative Group;
(iv) advise the Consultative Group on the effectiveness of specific existing international research programs; and
(v) in other ways encourage the creation of an international network of research institutions and the effective interchange of information among them.

These terms of reference may be amended from time to time by the Consultative Group.

9. The Chairman of the Technical Advisory Committee will be appointed by the Consultative Group and its Secretary will be provided by FAO. Its meetings will normally be held at FAO headquarters in Rome.

10. As a supporting service to the TAC, FAO will endeavor to supply up-to-date information on current and proposed research activities related to the problems of the developing countries.

11. FAO will consult with TAC concerning the feasibility, method and cost of establishing a comprehensive data bank on agricultural research related to the needs of the developing countries, and the form in which this information can be made readily available to potential users and will prepare a report on this matter for the consideration of the Consultative Group.

The Secretariat

12. The Secretariat will be composed initially of the Secretary of the Consultative Group and the Secretary of the Technical Advisory Committee. Arrangements will be worked out to ensure liaison and collaboration between the two wings of the Secretariat.

D. *Financial Arrangements*

13. IBRD has agreed to pay for the personal services and travel costs of the Secretary of the Consultative Group, and FAO has agreed to pay for the personal services and travel costs of the Secretary of the TAC.

14. The expenses of the members of the TAC and of its advisers will be shared equally by the co-sponsors, subject to the necessary budgetary authorizations.

15. With respect to feasibility studies referred to under 1(v), arrangements for financing will be made by the Consultative Group or by individual members on an *ad hoc* basis.

Washington, D.C.
May 31, 1971

4

Consolidating the System, 1977–79

TAC'S SECOND REVIEW of priorities, the positive findings of the external reviews of IRRI and CIMMYT, and the first review of the CGIAR all confirmed that the Group, and the system it supported, were moving in the right direction. The decision to view the years 1977 through 1979 as a period of consolidation during which no new activities would be adopted was reassuring to the many donors who were becoming concerned about the rapid growth of the centers and the mounting financial demands. Moreover, the consolidation period provided breathing space to consider other issues that had not been adequately addressed.

Impact of the System: How Green the Revolution?

One such issue was the impact of the work of the centers on the growth of agricultural production in the developing world and, more particularly, on how the benefits of that growth were shared among farmers and between farmers and other parts of society. Much had already been written about the Green Revolution, at first highly favorable, but later with a more critical tone. No one doubted that large increases in wheat and rice production had been brought about by massive adoption of the new varieties, but some critics asserted that the benefits had flowed more to the relatively well-off than to the poor. The work of the international centers, these critics said, was not consonant with the growing interest of the development community in improving the lot of the poorest of the poor. Within the Group there was

also concern about whether the spectacular results in rice and wheat could be matched in the other crops that had come within the Group's mandate or, indeed, whether those results could be achieved in rice and wheat in the more difficult ecological zones that had become subjects of research.

The time had come for the Group to make its own assessment of the impact of the work it supported. But its first effort was modest in scope. The Secretariat engaged Grant M. Scobie of North Carolina State University to review the voluminous literature on the subject (in the course of his work he drew up a bibliography of 510 publications, which he described as "not pretending to be complete"). The 1978 integrative report included a section on the impact of international agricultural research based on Scobie's paper. The report pointed out that a review of this impact must concentrate on the high-yielding varieties of rice and wheat developed by IRRI and CIMMYT (and the Mexican program that preceded CIMMYT), since only these two international centers were more than ten years old and thus had sufficient time to develop improved varieties and have them adapted and put into production. Nevertheless, since the research orientation and strategies of most other centers were similar to those of IRRI and CIMMYT, some general conclusions might be drawn about the potential of the CGIAR system as a whole. The gist of the report's assessment is given in the rest of this section.

The first high-yielding varieties of wheat and rice were introduced in 1965 and 1966. By 1978, over one-third of the area given to these cereals in developing countries was sown to high-yielding varieties. This amounted to 55 million hectares, more than the whole cereal-growing area of Central and South America combined. The highest rate of adoption was in Asia where 72 percent of the wheat area and 30 percent of the rice area were sown to high-yielding varieties. Latin America was second with 31 percent, then the Near East with 17 percent; Africa was far behind with only 7 percent. Moreover, adoption of the new varieties was continuing to expand at about 4.5 million hectares a year. As the area sown to the new varieties increased, so did production of rice and wheat in the developing countries: rice grew by 2.4 percent annually from the mid-1960s to the mid-1970s, compared with only 0.9 percent annually in the early 1960s; wheat grew by 4 percent, compared with 2.4 percent in the earlier period. Over half the increase in production was estimated to be due to improved yields. In contrast, production of maize, sorghum, millet, and other coarse grains actually fell during the same ten-year period.

Because the new technology combined high-yielding varieties with adequate water and other inputs, it was difficult to isolate and compare the performance of the new varieties with that of the traditional ones usually grown under different conditions. Many studies suggested that the new rice technology package typically yielded 40 percent more than the traditional varieties and practices it replaced, while in the case of wheat the increase averaged about 100 percent. Even a modest increase in yield over a wide area results in a very substantial additional amount of grain harvested. If production of rice and wheat increased about half a ton per acre on the total area planted to the higher-yielding varieties—not an unreasonable assumption—incremental production would approach 30 million tons annually with a value of $3 billion to $4 billion, depending on the price assumptions used.

The new technology had a significant impact on the lives of people in the farming areas where it was adopted and, presumably, in the urban areas where much of the wheat and rice was consumed. Most important, neither farm size nor land tenure was a serious impediment to adopting the varieties. There was no evidence that the new technology was inherently better suited to larger-scale production. In areas for which the new varieties were ecologically suited, they were taken up by large and small farmers, landowners and tenants.

The press had sometimes asserted that the new technology had benefited large farmers more than small ones, even under similar growing conditions. This was a complicated matter, but some generalizations were possible. First, early adopters of a new technology almost invariably gained in the short run because they benefited from selling small additional amounts in a very large market. Because larger farmers had greater access to information and greater ability to bear risks, they were more likely to be the innovators who captured these early gains. Until the smaller farmers caught up, the larger farmers got a windfall, but this was transitory. Second, as long as there was inequality in the ownership of land, large farmers would gain more income than small farmers, thereby widening the difference between income levels. Since the new technology was equally applicable to all sizes of farms, there was no reason to expect that the relative distribution of income would be significantly altered, but, in the absence of redistribution of land, absolute differences in income would certainly widen. Finally, the feasibility of designing a technology for wheat or rice exclusively for the benefit of small farmers was questionable. As the integrative report ob-

served, "if income distribution between large and small farmers is an objective of international or national policy, there are institutional and policy mechanisms other than research which would be more effective in serving this purpose."

The new technology may have accentuated differences among regions and income levels, because it worked best where land was good and water and fertilizer were readily available. In some areas, particularly in Asia, small farmers were almost as likely to have good land and water as large farmers, but in others, such as Latin America, the better land was in the hands of large farmers while small or tenant farmers were concentrated in less-favored areas. Introduction of high-yielding varieties had little impact on the less-favored areas and on farmers dependent on dry-land agriculture.

The new varieties had a favorable effect on the distribution of income among consumers. Because demand for basic foodstuffs tends to be inelastic, significant increases in output are likely to lower the real price of food. The poor spend a much higher proportion of their total income, and of incremental income, on food. Therefore, any decline in food prices induced by expanded production benefits the poor more than others.

The impact on employment and wages was also favorable. There was a modest increase in direct use of labor, averaging between fifteen and thirty additional man-days per hectare. However, because the labor force in most developing countries is growing rapidly and individuals can migrate, wages tended to remain constant. But the principal impact on employment lay beyond the farm and came about through the secondary effects of the additional income generated. Part of the additional income was spent on food, including fruits, vegetables, and meat, whose production is generally more labor-intensive than that of food grains. The rest of the additional income went for products like textiles, footwear, and furniture, all of which gave rise to new jobs.

Finally, there was the question of whether the high-yielding varieties had, on balance, affected nutrition favorably or unfavorably. Some had argued that the greater profitability of the high-yielding varieties had caused land previously planted to pulses and other food crops with higher nutritional value to be turned over to wheat and rice. But studies by ICRISAT demonstrated that in India the nutritional impact of the new varie[illegible] was favorable; although some of the increase in acreage pl[illegible] high-yielding cereals was at the expense of more nu-

tritious crops, the additional production more than outweighed this loss. Malnutrition, as it was coming to be understood, derived primarily from inadequacy in the quantity of food consumed.

The Scobie report's favorable assessment of international agricultural research had important implications for the CGIAR. To extend the benefits of the Green Revolution, more research was needed on the food crops and farming systems of less favored environments. Not much usable technology for these areas had yet come out of the CGIAR system, but the potential was good. At least 55 to 60 percent of the research funded by the Group was devoted to crops—such as sorghum, millet, cassava, and food legumes—typically grown and consumed by the poor and to farming systems in semiarid and arid conditions typical of smallholder agriculture in many areas. Inasmuch as ICRISAT, ICARDA, IITA, ILCA, and CIAT focused largely or exclusively on research on these crops and systems, and IRRI was allocating more than half its research budget to rainfed, deep-water, and cold-tolerant rice, the CGIAR could be said to be actively engaged in seeking to provide technology for the resource-poor farmers.

Another important finding was that the economic returns from investment in research were very high, much higher than from most other investments financed by international and bilateral aid programs. It followed that much more could be invested in research before the rate of return fell to the level of the return on alternative investments. A case could therefore be made—and the Secretariat did not miss the opportunity to make it—that the donors should continue to increase their contributions to the international centers substantially. Justified as this conclusion might have been, however, it came at a time when donors were beginning to feel the combined pinch of inflation and severe budget constraints.

Costs and Benefits of Agricultural Research

The economic returns from agricultural research—measuring the relationship between costs and benefits—were in fact the subject of a separate study commissioned by the Secretariat a year earlier and carried out by G. Edward Schuh and Helio Tollini of Purdue University. Their report, "Costs and Benefits of Agricultural Research: State of the Art, and Implications for the CGIAR," was discussed at the autumn meeting of the Group in

1978. The Group had agreed to undertake this study without much enthusiasm. Everyone understood that the CGIAR system was heading for a period during which rationing of resources was virtually inevitable and that basic to any allocation of resources was a judgment of the relative importance of the kinds of research undertaken. No one seriously questioned either that the centers' research should be conducted in a cost-conscious manner or that it should focus on tangible results or benefits. Specifically at issue was the application of the technique of cost-benefit analysis to quantify and compare the results of agricultural research. Although it was recognized that such cost-benefit analysis was widely used in making investment decisions in other fields, there was doubt that it could be usefully applied to research.

Schuh and Tollini's terms of reference asked them to review existing methods suitable for assessing the impact of agricultural research and its cost-effectiveness; to identify the methods that could most usefully be applied to CGIAR programs and to determine the extent to which they were already in use; and to suggest how to provide the Group with useful continuing information for evaluating the cost-effectiveness of individual programs and of the system as a whole. The authors soon concluded that it would be more useful to discuss how to improve the process of making decisions on the amount of funds to be allocated to research, the choice of research problems to be investigated, and the appropriate research strategy to be employed. They pointed to the inherent difficulties of evaluating and analyzing research. One was the importance of serendipity: how long it would take to solve a problem could not be predicted, and chance often played a part. Another was the danger that too much emphasis on programming and on justifying every endeavor in economic terms could stifle the researcher's creativity.

There were also conceptual and practical difficulties. One of the most formidable was how to measure the value of the inputs and output of research. The valuation of inputs was the easier task, for research typically involved the use of traditional inputs such as skilled labor, land, buildings, and materials. But one of the principal inputs was knowledge from previous research, on which it was difficult to put a value. The output—new knowledge—was not produced in easily identifiable units for which there was a market. Furthermore, the output of research was more valuable if it gave rise to a technology that could be readily

adopted on farms, but evaluating the potential for adoption was hard enough after the research was finished and almost impossible beforehand. The need to look forward rather than backward was a problem in itself, for while the findings of ex post analysis could be used to improve research in the future, ex ante analysis was what was needed to make plans and allocations. As if these problems were not enough, there were also questions about the impact of economic policy, good or bad, on the rate of return on investment in research and about how to value negative results—finding that something will not work—and "joint outputs"—the new skills and knowledge acquired by the researchers that may be applied to future research projects.

Given these problems and the esoteric character of the subject, the authors produced a commendable report for those who took a serious interest in it. It is not surprising, however, that the findings of the study were received by the members of the Group with hardly more enthusiasm than they had exhibited when deciding to undertake it. Robert Cunningham, the representative of the United Kingdom and a long-time skeptic on the subject, expressed the general feeling when he said that it was good that the CGIAR had taken a look at the subject, for the "system needed to get it out of its system."

"Associate Status": In or Out?

By the time the Group entered the period of consolidation, the number of centers had grown from the original four to eleven. Three other centers regularly made presentations of their programs at International Centers Week. All three received most, if not all, of their funding from donors who were members of the Group, and they had a special relationship with it, but they were not officially sponsored by the Group. With benevolent and useful imprecision, they were referred to as having "associate status," a term without official definition or sanction. The first of the three centers on which associate status was bestowed was, as described in the preceding chapter, the Asian Vegetable Research and Development Center (AVRDC). The two others were the International Food Policy Research Institute (IFPRI) and the International Fertilizer Development Center (IFDC), both of which will be discussed later in this chapter. The common thread in according associate status to these three institutions was that, in each case, some members of the Group were embarrassed to take the institution into the CGIAR system, but the Group as a

whole thought it useful to have close links between the institution and the centers they sponsored, and so invited it to participate in a limited way.

Of the eleven centers officially sponsored, nine had been inherited or created by the Group and two—CIP and WARDA—had been adopted. Once the Group was established and its effectiveness in marshalling resources for international agricultural research demonstrated, other international research centers or activities sought adoption, too. If they could not be adopted, they sought associate status to share at least in the prestige of the CGIAR and to improve funding prospects. The Group had no clear-cut policy on granting associate status, and by 1977, in a period of consolidation, the need for one was pressing.

The Group, TAC, and even the centers were ambivalent about what the policy should be. No one was eager to grasp the nettle. In the end, the Secretariat set the process in motion in October 1977 by submitting a paper, "The Concept of 'Associate Status,'" in which it analyzed the current situation, laid out the basic policy options, and discussed the possible advantages and disadvantages of each. Its recommendations were only procedural: that the issue be aired at the meeting of the Group in the following month but no final decision made; that TAC address the subject at its next meeting; that the Secretariat garner views from the various interested parties and, in consultation with TAC, prepare a definitive paper for the Group's meeting in the following year; and, finally, that meanwhile the Group not expand the number of the centers granted associate status.

These recommendations were accepted. During the following year the subject was further discussed at informal meetings of donors, at a meeting of the center directors, and at the June meeting of TAC. These discussions confirmed that there were still wide differences of opinion on what the Group's policy should be. Again, the Secretariat took the initiative in presenting a paper that analyzed the issues and options and made recommendations.

The first issue was universality. The CGIAR had been established to support selected programs that furthered its objectives. There was nothing to suggest that it should be the exclusive or even the principal source of funding for international research on all the agricultural problems of the developing world, or that it should exercise influence over research that it did not fund. But, as the Secretariat said, "as time has gone by and the CGIAR's prominence has increased, a supposition that the CGIAR's re-

sponsibility for international agricultural research is universal seems to have sprung up. There is some risk that both donors and research institutions are coming to believe that only those research programs sponsored by the CGIAR merit international support. This belief pushes the CGIAR towards monopoly and thereby both increases the claims on its resources and makes it more difficult for worthy research efforts which do not happen to be sponsored by the CGIAR to get funds."

The second issue was the availability of resources. The extension of the CGIAR "family" to include related or associated research might induce donors to increase the amounts devoted to international agricultural research as a whole, but there was also the risk that the resources would not be increased proportionately and thus would be spread more thinly.

The third issue was accreditation. Should the Group take responsibility for accrediting, as it were, research that it did not officially sponsor or fund? The Group could hardly give official recognition, thereby implying that it found the activity worthwhile, unless it had a process for assessing the worth of the activity. Such a process of accreditation would obviously add to the work of TAC and the two Secretariats and become an important CGIAR activity in its own right.

A final issue was the character of the Group. In discussions in TAC, the point had been made that much of the strength of the CGIAR system lay in its sharp focus. A proliferation of programs coming under the aegis of the Group could diffuse its interests and efforts and thereby weaken it. In addition, introducing a new class of institutions, by enlarging the system and making it more complicated, might increase the weight of procedures needed to administer it, detracting from the informality that had traditionally characterized the Group and was deemed one of its strengths.

The Secretariat paper offered three policy options. The first was to expand the scope of the CGIAR and, in addition to sponsoring and fully funding a core network of centers, to give recognition to an outer ring of institutions formally accredited but not funded by it. The second was to stick with the status quo, a policy that differed from the first in that granting special recognition would be done without a thoroughgoing accreditation process. The third was for the CGIAR to concentrate on the particular research that it considered of high enough priority to warrant being fully funded by it. It would be left to the centers in the system (including any that might be added in the future) to build

up such links with other research institutions as seemed useful, and to the Group to invite from time to time outside institutions to make presentations during its annual meeting.

The Secretariat concluded that "the CGIAR System of fully-funded activities has grown rapidly and appears likely to continue to do so through expanding present programs or adding new ones. Option One would significantly expand the Group's range of interests and responsibilities. This may be desirable in itself, but it is questionable whether this further expansion can be handled without increasing the Group's resources and services and somewhat changing its character. Unless the Group is willing to accept these changes, it would be preferable to choose Option Three." The Group agreed with this conclusion, and associate status was laid to rest. IFPRI eventually gained admission to the system; IFDC did not. AVRDC and the IFDC continued to appear before the Group to present their programs, but less frequently as time went on.

ISNAR: Strengthening National Programs at Last

The research output of the international centers stands, as we have seen, at an intermediate point in the chain linking basic or strategic research—conducted mostly in the industrial countries—with the national agricultural research programs in developing countries. These programs receive varieties from or exchange them with the IARCs, test and adapt the varieties in local conditions, and, in collaboration with the national extension services, make the varieties and other elements of the new technology available to farmers. The Group had been preoccupied from its very beginning with the adequacy of the national programs and with what the international centers should—and should not—do to assist them.

Certain relations between the IARCs and national research programs grew up naturally and were essential to the accomplishment of the centers' mission. A network through which to exchange genetic materials with national programs was necessary to test and validate the plant-breeding output of the IARCs under the wide variety of climatic and ecological conditions contained within their regional or global mandates. CIMMYT—with several stations in different locations in Mexico—eventually was exchanging genetic materials with over a hundred developing countries. (The evolution of these networks, in which national

programs have assumed increasing responsibility as participating partners, is traced in chapter 7). Training programs for nationals from developing countries were an important activity of all the production-oriented IARCs and helped to build up a cadre of experienced researchers in many national programs. Workshops, symposiums, and publications were other ways of disseminating the findings of the centers to a worldwide audience of national researchers. Relations with national programs in the host countries were particularly close. These programs tended to be among the first to benefit from the internationally sponsored research.

These myriad activities, while important, underlined the magnitude of the gap between the international research programs and many of the national efforts. The gap was brought home forcefully to the research staff and managers of the international centers as they saw the wide disparity between the yields achieved in their trial plots and those in farmers' fields—sometimes just a few miles outside the center's gates—although they recognized that many factors other than research contributed to the gap. The centers thus felt strongly pulled to provide greater help to national programs. Various donor members, as part of their bilateral programs of assistance to individual developing countries, also drew the centers into closer ties with national programs, often through special projects outside the centers' core budgets. Although these special projects were becoming important features of the work of some centers and giving useful assistance, they could not provide a full answer to the needs of national programs. By virtue of their specialized mandates, individual centers were not able to provide technical assistance on much of the multifarious crops and other research issues with which a national program was concerned. Even in areas consistent with the centers' mandates the magnitude of the problem far exceeded the capacity of the centers to extend assistance.

What was the best way to ensure that national research programs could make use of the technology being developed in collaboration with the international centers? The question had engaged the attention of TAC from its first meeting and appeared on the agenda of virtually every subsequent meeting. Although TAC and the first review committee helped to define the boundaries to the appropriate activities of IARCs in support of national research, they were primarily concerned about preventing the centers from transgressing these boundaries, to the detriment of their essential research functions. This was a legitimate and nec-

essary concern, but it did not solve the problems of the weaker national programs; nor did the injunction to the donors to work through their bilateral programs rather than through reliance on the IARCs seem likely to deal adequately with the problem in the near term.

This was the situation confronting a group of European donors when they met in the spring of 1976, in preparation for the annual round of CGIAR meetings. The fact that the Rockefeller Foundation had recently established the International Agricultural Development Service (IADS), which stood ready to help developing countries in dealing with their research problems as well as in other ways, heightened interest in giving the CGIAR added capacity of this kind. This interest led to a decision by the European donors to organize a meeting in Munich in April 1977, under the auspices of the German Foundation for International Development. This was an informal meeting of representatives of donor agencies, including most of the more important donors to the CGIAR. Werner Treitz, head of the German delegation to the CGIAR, was chairman of the meeting, and John Pino, who had inherited the mantle of George Harrar and Sterling Wortman as director of agricultural sciences at the Rockefeller Foundation, was the vice chairman.

The outcome of the Munich meeting was a formal request by the participants, in the form of a letter to the chairman of the Group from Treitz, that the CGIAR consider, at the earliest opportunity, the establishment of "an international service (such as the present International Agricultural Development Service) with the task and purpose of strengthening agricultural research in developing countries. We see the service as operating in full cooperation with and supplementary to existing and related programs of the FAO and other organizations." The proponents contemplated that the service would cooperate, at the request of developing countries, in planning and implementing national agricultural research programs and would help to create or strengthen national research institutions. The proponents believed that such a service could function most effectively if it were international and autonomous in character, had an international staff, and derived financial support from an international group of governments and organizations. So they urged the Group to consider the establishment of such a service and to "place this matter on its agenda for one of its meetings in 1977, especially since the Technical Advisory Committee has ex-

pressed the judgment that the matter is one of highest priority." Meanwhile, Harold Graves, former executive secretary of the CGIAR, was engaged by the Munich participants to write a paper describing in more detail the need for this service and its objectives, structure, program, initial staffing, and budget.

The chairman transmitted Treitz's letter and Graves's report to TAC for discussion at its meeting in September, shortly before the meeting of the Group. TAC endorsed the proposal in principle but thought that it needed to be worked out in more detail, and accordingly recommended that a task force be established for this purpose.

At its meeting the following week, the Group welcomed the proposal to establish the new service. It agreed with TAC's recommendation of a task force and asked the chairman of the Group to select the chairman and members of the task force and get it under way as soon as possible. This decision came barely one year after the Group had come out strongly in favor of a three-year period of consolidation during which no new programs were to be added; however, it had been agreed that during this period further initiatives could be considered. It is an indication of the urgency the members attached to finding a solution to the problem of how to strengthen national research that, largely on their own initiative, they should have brought forward the idea of a new service so early. The intention that it be a modest effort, not calling for much money, was probably also a factor.

Richard H. Demuth, who had been the first chairman of the Group and later chairman of the IBPGR, was named chairman of the task force, and Nathan Koffsky, staff director. The task force had fourteen members in addition to the chairman, drawn from national research institutions in both the developing and industrial countries, donor institutions, and the IARCs. It was given until August 1978 to submit its report.

The task force reviewed the agricultural research needs of developing countries and the assistance to their national programs being provided by international organizations, bilateral aid programs, and the IARCs. This review confirmed the need for an organization that was autonomous and international in character, flexible and capable of quick response to requests from developing countries, with a staff qualified to provide long-term assistance and persuade sources of external finance to support research systems in the countries served. The task force concluded that an organization of the requisite quality and character

should be within the ambit of the CGIAR and that the improvement of national agricultural research systems should be its sole business.

The task force recommended the creation of a new service—the International Service for National Agricultural Research (ISNAR), based on five principles:

- It would provide assistance only at a country's request.
- It would complement, and not compete with, the many other sources of technical assistance.
- It would help governments to deal with the whole range of problems in their agricultural research systems, including training national personnel and establishing secure links between research and extension.
- It would work closely with the nationals of each assisted country to enable that country to become self-sufficient in the planning and implementation of agricultural research as soon as possible.
- It would normally provide long-term assistance only when the costs were fully funded by a source other than the CGIAR, on terms precluding the possibility of any future claim on the CGIAR for this purpose.

This last principle was intended to overcome the fears of some donors that the CGIAR would become responsible for open-ended commitments for assistance, which would be contrary to the concept that had underlain the proposal from the beginning—that the resources to assist individual countries, as distinct from those necessary for the entity itself, should be provided separately by donors under their aid programs.

Although ISNAR would be organized and managed like other CGIAR centers, its staffing and the funding of its programs would have a different balance, reflecting the fact that it was a technical assistance service and not a research center. ISNAR would have only a small core program employing about twenty senior or middle-level professionals, plus a third that number of consultants. A larger program of direct services to developing countries would be funded not through the CGIAR but by interested donors. Recognizing that a service of this kind would be a departure for the CGIAR, the task force recommended that it be viewed as an experiment. After five years of operation it should be evaluated and a decision made whether it should continue.

The concept of ISNAR, despite its support from an important group of donors, generated considerable controversy. To begin

with, there was the question of whether the service should be created by a new entity or whether IADS should be taken over and adapted to the purposes of the Group. Those at the Rockefeller Foundation who had created IADS, and some of those on the IADS board of trustees who had been selected from among prominent donor members of the Group, had hoped initially that IADS would be adopted by the Group and had worked to that end. But the CGIAR system had evolved to the stage where some donors felt uncomfortable about taking on yet another institution created by one of the foundations. There was a lingering sentiment—rightly or wrongly is beside the point—that the Ford Foundation's promotion of ICARDA had been linked to a desire to find a home for its Arid Lands Agricultural Development Program (ALAD). Moreover, there were signs that the foundations intended again to offer IFPRI to the Group. Despite the Group's great respect for the two foundations whose initiatives had established the basis for the CGIAR, it wanted its own identity. At the same time, the European members, Japan, and Australia were anxious to shed the image, acquired in the early days, that the CGIAR was an Anglo-American club. The task force therefore decided not to adopt IADS, a decision endorsed subsequently by the Group.

Another controversial issue was whether ISNAR should be responsible for implementing the program for strengthening national research that it worked out with the country it was advising. The FAO and many donor countries had their own programs for helping to strengthen national research, and they were not eager to have ISNAR take over responsibility for activities for which they were already providing staff and money. This was one of the main reasons the task force came out with a clear recommendation that ISNAR should not normally have an implementing function, although it might help to implement important research programs where the government was unwilling or unable to obtain the requisite assistance elsewhere.

The biggest controversy, however, was with the FAO, which had objected from the beginning that it thought ISNAR was unnecessary. The FAO was resentful that the international community sought to set up a rival organization—one that was not a research institution, but a service to provide technical assistance of a kind that the FAO felt was its own responsibility. Director General Saouma of the FAO proposed that a Research Development Program be established within the FAO, which he was confident could do the job as well or better if donors would provide it

with the funds, or even part of the funds, that would otherwise go to ISNAR. Consequently, the FAO opposed the creation of ISNAR at every step, and a wide breach opened between the task force and the FAO, culminating in a bitter exchange of letters between Demuth and Saouma.

Those members of the Group who were also members of the FAO always were uncomfortable when controversy flared between the CGIAR and the FAO, which after all was the lead agency on food and agriculture matters in the United Nations system. When the report of the task force was discussed by the Group in the autumn of 1978, this breach with the FAO was clearly a matter of concern. Because of this concern and other reservations held by some members of the Group, ISNAR's passage was not entirely smooth. Nevertheless, at the end of the debate the chairman of the Group was able to say that he detected that a majority, though not all, of the members were in favor of going ahead with ISNAR. The chairman proposed that reservations could be dealt with in the process of bringing ISNAR into being. Serious thought should be given, for example, to a suggestion made in the course of discussion that the FAO be given a permanent seat on the board of trustees of ISNAR.

When this statement of the consensus of the meeting was accepted without demurral, an audible sigh of relief went through the assembly. The CGIAR had successfully negotiated another difficult passage, establishing what promised to be an important new activity while avoiding an open break with one of the coponsors. Relations with the FAO improved markedly from then on and were exemplary when it came to the selection of the next chairman and executive secretary of TAC (see chapter 5).

A meeting of the newly designated subcommittee of interested donors took place immediately after the close of the Group's meeting. Within a few weeks, William A. C. Mathieson was appointed chairman of the ISNAR subcommittee and the German Technical Assistance Agency (GTZ, its German acronym) was named executing agency. The latter designation marked the first time that this function was given to a European organization. The Netherlands was selected to be the host country, with the Hague the site of ISNAR's headquarters. A constitution was drawn up and an agreement negotiated with the Netherlands giving ISNAR privileges and immunities similar to those enjoyed by other international centers. A board of trustees was appointed by the ISNAR subcommittee, contributions of funds were

obtained from donors, and the new Service became operational in November 1979, precisely at the close of the three-year period of consolidation.

IFPRI: The Second Time Around

An institute for research on food policy was one of the highest priority activities identified by the Bellagio meetings. Its importance was reconfirmed at a special seminar held at the World Bank in 1973. When TAC took up the subject, it concluded there was need for an institute to keep the global food and agriculture situation under independent review, to select key policy issues for analysis, and to identify research needs that bore on world food production and use. At the summer meeting of the Group in 1974, when TAC's recommendation was put before the Group, it was evident that the views of members were mixed. Some said that the world would continue to be faced intermittently with serious food deficits in some countries, and it would be of great value to have a source of highly professional analytical advice. Other members were skeptical. They pointed out that many organizations already were working in the field and doubted that an institute of the size proposed (with a staff of twelve professionals) could make a significant contribution. Moreover, it seemed undesirable to make a decision without knowing what might eventuate from the forthcoming World Food Conference. Not voiced at the meeting, but suspected to be in the minds of the relevant donors, was reluctance to expose the agricultural policies of industrial countries—as well as those of the European Economic Community—to critical review and comment by a CGIAR body.

At the end of the 1974 discussion, the chairman of the Group concluded that there was support for the idea of establishing an international research institute on world food policy matters but, in light of the diversity of views expressed, he would not ask the Group to endorse any specific proposal at that time. The matter should be deferred to the next meeting; meanwhile, consideration of it within the Group should proceed.

Accordingly, it was agreed that a working party of those interested would explore the subject. This was done and the question was reconsidered at the autumn meeting, at which time Sir John Crawford, who had been chairman of the working party, re-

ported that IDRC and the Ford and Rockefeller Foundations were willing to accept initial responsibility for funding a new institute. The issue outstanding was therefore not one of funding, but of the proposed institute's relationship with the Group. The second discussion failed, however, to develop any clear consensus either on the suitability of establishing a food policy research institute or on the relationship it should have to the Group.

The chairman therefore offered the members two alternatives. The first was that the Group take no further action at that time, while understanding that the IDRC and the two foundations might wish to consider how to proceed in light of the outcome of the World Food Conference and that the Group should be kept informed of their thinking. If the IDRC and the foundations should decide to establish the center themselves, the Group would wish to establish an effective communications link with it. Recognizing that it would be a pioneering activity, the Group would be prepared to reconsider the question of adopting it at some future date. The second alternative was that, in addition to the first proposal, the Group would endorse the usefulness of the foundations' establishing such a center. The Group opted for the first alternative, declining to go so far as to support the establishment of a new institute.

As it turned out, nothing resulted from the World Food Conference bearing on the question of whether to establish a food policy research institute. The IDRC and the Ford and Rockefeller Foundations went ahead to create what was called the International Food Policy Research Institute (IFPRI) and bore the full cost of its operations in the initial years. In keeping with the idea that the Group should have an effective communications link with it, IFPRI was accorded associate status.

The three sponsors of IFPRI continued to believe, however, that it should be a part of the CGIAR system and planned to bring it back to the Group after it had some time to prove its worth. Accordingly, in September 1978 they formally requested that the Group reconsider IFPRI's application. By then IFPRI had built up a sizable staff and was expected to increase it to about twenty to twenty-five professionals, which called for a budget of around $2.5 million a year. Since IFPRI was already in being, the Group had only to decide whether to adopt it, with whatever changes were needed, and so no elaborate process such as attended the creation and acceptance of ISNAR was called for. Nevertheless, the Group as always looked first to TAC for its advice and recommendation.

IFPRI turned out to be less controversial than ISNAR. Not only had it been fully discussed four years earlier, but it was already in operation; it was thus a known quantity. Moreover, IFPRI had gotten off to a good start and was well regarded by a number of developing countries and, most important, by the FAO. Nevertheless, TAC examined it thoroughly early in 1979 and when it came to make its recommendations to the Group at the May meeting raised some issues for discussion.

TAC's general conclusion was that IFPRI would make a significant contribution to the achievement of CGIAR objectives. It therefore recommended that the Group adopt IFPRI, but with some qualifications. The first had to do with its mandate. TAC observed that IFPRI's mandate as formulated in its constitution was significantly broader than TAC had originally proposed for an institute of this kind. TAC therefore recommended that IFPRI should give its principal emphasis to the problems of developing countries and that its work on trend analysis and international food trade should only be in support of the main emphasis of its research. Second, TAC was concerned that there was a potential conflict between the roles of IFPRI as a research organization and as a provider of services to other institutions such as the World Bank and the CGIAR itself. While TAC did not preclude IFPRI's entering into contracts to collaborate with, or provide services to, other institutions, especially the international centers, it felt IFPRI should be cautious about committing too much of its limited resources to such work. It should keep its focus fairly sharply on its own research program.

The third qualification was more problematic. The special team under the chairmanship of Carl Thomsen, a TAC member, which had examined IFPRI on behalf of TAC, had felt strongly that IFPRI should move from its location in Washington, D.C. to a developing country. It felt that "such a location would place its research staff in an environment which would be more relevant to the objectives of the Institute. It would also avoid the perception of IFPRI . . . as having a somewhat privileged status in the CGIAR system. It could also protect IFPRI from undue donor influences and demands in its analysis of the world food problems." The team feared that IFPRI, if it continued to remain in Washington, might be used by the CGIAR as a kind of policy advisory body for allocating resources among the other centers, a role the team strongly opposed. TAC, agreeing with its examining team, attached these qualifications to its otherwise strongly favorable recommendation that IFPRI be included in the CGIAR system.

As in the earlier IFPRI discussion, the views expressed by members of the Group in considering IFPRI's application were mixed. There was concern about the qualifications raised by TAC, but some members went further and questioned the need to add an institution of this kind to the system. The questioners, however, were in the minority, and there was strong, though not unanimous, support for adopting IFPRI. The meeting agreed that the questions of IFPRI's mandate and role as a service institution could be dealt with in the course of regular reviews of its program. On the question of location, it was decided that IFPRI should analyze and report back to the Group on the advantages and disadvantages, including the cost, of moving.

Thus, IFPRI was adopted subject to some technical amendments to its constitution and bylaws to bring them into line with those of other centers, and it was agreed that beginning in 1980 its program would be funded through the CGIAR. When IFPRI subsequently presented a closely reasoned paper explaining why it should remain in Washington, there was no dissent.

The favorable decisions on creating ISNAR and adopting IFPRI marked the end of the period of consolidation. Strong reservations persisted, however, about expanding the system further, as became evident during the Group's deliberations on other matters at the May 1979 meeting.

TAC's Third Review of Priorities

As part of the first review of the CGIAR, TAC had revised its original policy statement on priorities for supporting international agricultural research. As the period of consolidation drew to a close, TAC again addressed the question of priorities. Out of its deliberations came its third priorities paper, presented to the Group in May 1979. It was, in fact, the first item on the agenda and set the stage for consideration of other matters at the meeting, which included the discussion on IFPRI already described. Although this third statement on priorities covered much the same ground and reached much the same conclusions as the previous exercises, it was more comprehensive and better geared to operational decisions. It was a useful guide not only to the Group for making broad policy decisions, but also to TAC itself in carrying out its responsibilities for reviewing the programs of centers and judging the merits of possible new activities. The

allocation of increasingly limited resources was very much on everyone's mind, and this new TAC statement, more than the previous ones, provided practical guidance.

TAC recommended three broad priorities for the use of the Group's resources. First priority should be given to ensuring the continued support of the international centers and other related activities already sponsored by the Group, but with some internal adjustments and priority shifts. TAC noted, for example, that since ILCA and ILRAD were well established (and livestock research was taking place at some of the other centers), a high proportion of the Group's resources was being allocated to livestock as compared with other commodities. Because the amount spent on livestock research might be disproportionate to its contribution to calorie and protein supply, TAC recommended that no further increase in livestock research be accepted before the existing programs had been thoroughly reassessed. While this was the major recommendation on the allocation of resources among existing CGIAR centers and programs, TAC also felt that within the research effort on roots and tubers probably an undue proportion of the resources was allocated to potatoes.

If additional funds were available, TAC recommended as a second priority that they be allocated to certain selected initiatives that filled the most important research gaps. It identified five research areas: in descending order of priority, they were research on tropical vegetables, on water management, on plant pest and disease physiology and ecology, on food policy, and on aquaculture. In introducing this list, the chairman of TAC noted that TAC had already submitted proposals to the Group on two subjects—vegetable research and food policy research—but had not as yet taken up the other three. TAC would, however, be turning its attention to them.

TAC also identified other gaps, but felt they were of lower priority. They included research on oilseeds, plantains, agroforestry, water buffalo, cotton, fertilizers, tropical soils, postharvest technology, farm mechanization, and some animal diseases other than those already covered by ILRAD. There were, however, two commodities—soybeans and coconuts—which TAC felt warranted further consideration. The other topics would not be pursued unless some new information convinced TAC to the contrary. The Group accepted these recommendations on priorities as the basis for its consideration of proposals coming before it.

Vegetable Research Postponed

The Group did not have to wait long to address the issue of priorities, for on the agenda of the same May meeting were three proposals. One of them was IFPRI, which, as already mentioned, was accepted into the system. Vegetable research, on which TAC had long been working, did not fare as well. TAC recommended that a new vegetable research program be added to the CGIAR system. It had considered various ways of organizing a suitable program and had eventually come down in favor of a new institute to be called the International Vegetable Research Institute for the Tropics (IVRIT). Its functions would be to act as the primary repository for genetic material of selected tropical vegetable species, to conduct research to improve production technology, to establish cooperative programs with national research institutions for testing new technology, and to act as a center for maintaining and exchanging information. Its research would be directed at the small vegetable producers, mainly resource-poor farmers and kitchen gardeners in rural areas, though it was recognized that a good part of the technology developed would also apply to market gardens that served urban areas and to commercial enterprises growing vegetables for export. IVRIT would not be a large center; a senior staff of sixteen, together with the necessary support staff, would call for an annual budget (at 1978 prices) of about $3 million. Capital requirements to establish the institute were estimated to be around $4 million.

Although the Group did not quarrel explicitly with TAC's recommendation that vegetable research should have first priority among possible additions to the system, it was not disposed toward establishing a new vegetable research center. Questions were raised about the practicality of carrying out research on an international scale on vegetables, many of which were grown only in limited areas. Moreover, there were so many species and varieties of edible vegetables that it was hard to see how a single center could develop a program that could pay adequate attention to many different kinds which, though not important globally, might well be important regionally. There was some objection to funding research on vegetables for export.

It was recognized that TAC had wrestled with these same questions and reservations, and even though TAC was not unanimous in putting forward the IVRIT recommendation, a majority of its members had concluded that the nutritional importance of vege-

tables warranted making a serious attempt to develop improved varieties. Nevertheless, when the time came to bring the discussion to a close, it was obvious that a significant number of the Group's members had serious reservations about the merits of the proposal. In other cases, such as ISNAR and IFPRI, the Group had decided to admit the institution to the CGIAR system and to handle the questions and reservations during the process of implementing the decision, but in the case of IVRIT these seemed too fundamental to be dealt with in this way. The chairman therefore recommended that TAC be asked to bring back a more refined proposal. The members of the Group agreed and the matter reverted to TAC.

In retrospect, there were some underlying complications that did not surface clearly during the Group's discussion. One was a feeling of embarrassment over the inability of the Group to accept AVRDC. Another was reluctance to become committed to providing resources for yet another institution, even though a small one, when ISNAR was already on the books and IFPRI, which was the next item on the agenda, might well also be accepted. Indeed, it was evident at the meeting that the sponsors of IFPRI were particularly vocal in suggesting a postponement of action on IVRIT. For whichever reason or combination of reasons, IVRIT could not muster enough support to be accepted. Despite the Group's invitation, TAC never put forward another proposal on vegetable research.

IFDC: Postponed Indefinitely

The third of the centers that had enjoyed associate status during the time that it was in vogue was the International Fertilizer Development Center (IFDC). IFDC originated as an offspring of a National Fertilizer Development Center maintained by the Tennessee Valley Authority (TVA) at Muscle Shoals in Alabama. As its name implied and as its charter and enabling legislation stipulated, the national center was established to develop technology for the U.S. fertilizer industry. A small special staff worked on international fertilizer development, and in 1974, at the time of the worldwide energy crisis and serious food shortages in the Sahel and other regions, the U.S. government sought to expand the international effort. The idea of a cooperative international fertilizer center was raised by the U.S. delegation to the World Food Conference in 1974, but in the interests of speed

the government decided to proceed independently. The TVA's international program was separated from the national effort and established by legislation as a new institute—the International Fertilizer Development Center—with USAID providing the bulk of the funds to operate it, although some funding was obtained from foreign sources.

Because the IFDC had been established outside the processes of the CGIAR, the United States was in a difficult position when it subsequently sought to persuade the CGIAR to adopt the institute. No one questioned the usefulness of IFDC or the importance of plant nutrients in increasing agricultural production in developing countries. But the Group was reluctant to incorporate into the system—and assume financial responsibility for—what it regarded as essentially an American effort, and one that had the further disadvantage of being located in the United States rather than a developing country. USAID was willing to fund IFDC's core program during its early years, and as a gesture to the United States and a recognition of the importance of fertilizer development to the work of the IARCs, TAC recommended that the centers maintain a close working relation with IFDC. So the Group invited IFDC to inform the Group of its program at Centers Week and to make available its annual program and budget statement. The center directors, for their part, invited the director of IFDC to attend their regular meetings.

The United States nevertheless persisted in its efforts, and at the Group's meeting in November 1978 formally requested that consideration be given to the adoption of IFDC. The Group thereupon asked TAC to look into the matter.

TAC dispatched a team to Muscle Shoals to assess the quality of IFDC's program, and with this team's report in hand considered the request at its meeting in February 1979. It had two separate questions to answer: was IFDC's program of high quality, and was it of high enough priority to be included among the programs supported by the CGIAR? TAC concluded that there was no doubt about the quality of the program and its usefulness to developing countries, but it questioned its priority for the CGIAR. It noted that IFDC operated in a field in which the United States was uniquely able to make a significant contribution to international agricultural development. In this respect, IFDC was similar to research institutions maintained by several other aid-giving countries. (The United Kingdom, for example, maintained the Tropical Products Institute and the Center for Overseas Pest Research. The Netherlands operated the Royal Tropical Institute,

and France had a number of research institutions working for the benefit of developing countries.) TAC felt it would be illogical for the Group to adopt IFDC but not these other nationally supported institutions.

There was an added problem. Fertilizer was but one factor in agricultural production, and TAC and the Group had voiced doubts for some time about supporting institutions for research on single factors of production. TAC also noted that IFDC's program covered only part of the work needed on fertilizer production and that a major portion of the responsibility for studies on crop responses to fertilizers, and for comparative evaluation of alternative fertilizer products, would devolve on other organizations, such as the international centers and the national programs of the developing countries themselves. Moreover, the strength of IFDC's work lay in chemical engineering and fertilizer processing technology. The processes and products developed by IFDC would have to be taken up by the fertilizer production industry before they could become available to farmers, which meant that IFDC's work was far removed from the end product. For all these reasons, TAC did not recommend the inclusion of IFDC in the CGIAR system. Nevertheless, it thought highly of IFDC's work and recommended that donor members of the CGIAR, if so minded, support it outside the CGIAR framework.

In considering IFDC's application as reviewed by TAC, the Group found itself in an awkward position. It was obvious that most of the donor members were reluctant to shoulder responsibility for an activity that had been organized by the United States, was located in that country, and had been maintained by it for some years, albeit with some international support. But at the same time the members did not wish to rebuff the Group's largest donor, even though they may have thought privately that the United States had made a mistake in pressing for IFDC's inclusion in the face of the known resistance. Sensing the discomfort, the United States representative suggested that the Group might wish to postpone action. In summarizing the ensuing debate, the chairman said he found a small number of members in favor of admitting IFDC immediately; a larger but still small number in favor of accepting TAC's recommendation that IFDC's request be rejected; and a larger group, which he felt made up a majority and expressed the Group's consensus, in favor of postponing IFDC's application until the Group had considered new studies by TAC on factor-oriented research and the role of plant nutrient research. This last course was accepted, but it was generally

understood that the issue of IFDC would not be raised again. IFDC has continued to pursue effectively its mandate to assist developing countries and has established strong collaborative arrangements with a number of the CGIAR centers.

As the three-year period of consolidation came to an end, the Group was feeling its way carefully. In picking up ISNAR and IFPRI but putting IVRIT and IFDC aside, it was being cautious about taking on new commitments. The inclusion of ISNAR and IFPRI brought the number of centers in the system to thirteen—where it has remained to this day. With the successful consolidation of its operations, the Group could begin to plan the course it would follow in the years ahead.

The First Five-Year Plan

In its early years, finance was no problem for the CGIAR. The amount contributed each year was ample to cover the growing needs of the centers; in fact, the World Bank, which acted as donor of last resort, often did not have to put up the total amount it stood ready to provide. Requirements rose rapidly as the existing centers expanded their programs and new centers were added, but so did contributions. In 1972, total contributions were about $20 million. A year later the total had risen to about $25 million. In 1974, contributions jumped to about $35 million, and continued to rise rapidly in the following years: to $48 million in 1975, $63 million in 1976, and $77 million in 1977—increases in the range of 23 percent to 38 percent in nominal terms and 13 percent to 24 percent in real terms. Not only did many donors regularly increase their contributions, but there were new donors each year. About half of the annual increase came from larger contributions from donors already in the Group, and the other half from new donors. But in 1978 there was, for the first time, some sign of slowing down. The increase, to $85 million, was only 10 percent. The high rates of increase of the early years were not to be seen again, particularly if allowance is made for the impact of inflation.

The slowing trend noticeable in 1978 was largely due to a relatively small increase in new donor members. By then, all the larger potential donors had become members of the Group. The slowdown was accentuated by the withdrawal of Iran and Saudi Arabia as donors, the former following the revolution and the latter because of a change of heart, which fortunately lasted only

a few years. Although the rate of increase in contributions had begun to slow, the absolute increase continued to be large, so that in 1979 the total contributed was about $100 million.

Attainment of an annual level of contributions of $100 million was a milestone that signaled a change in attitude toward the financing of the CGIAR. Previously, any member's contribution was not large in relation to its total outlay for technical assistance to developing countries, or even in some cases to the amounts it provided for research on their agricultural problems. At $100 million, however, the CGIAR had reached a level of visibility that had both practical and psychological import. It became an important claimant on available resources, in competition with other claimants. At the same time, increased visibility made it possible to bring the CGIAR to the attention of policymakers in the larger donor countries and to seek their endorsement of it as deserving priority.

One such opportunity occurred in June 1979, when the leaders of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States held their annual economic summit meeting, in Tokyo. Among other things, they focused on the world food problem and the steps needed to increase agricultural output. They stressed the importance of agricultural research. The final communique said, in part:

> We will place more emphasis on cooperation with developing countries in overcoming hunger and malnutrition. We will urge multilateral organizations to help these countries to develop effective food sector strategies and to build up the storage capacity needed for strong national food reserves. Increased bilateral and multilateral aid for agricultural research will be particularly important. In these and other ways we will step up our efforts to help these countries develop their human resources, through technical cooperation adapted to local conditions.

The United States proposed to the summit meeting that contributions to the CGIAR be doubled over the following five years, and this proposal was repeated in a message from President Jimmy Carter that was read by the U.S. representative at International Centers Week in October 1979.

The chairman and Secretariat, having played a small part behind the scenes in preparing this subject for the summit, took the opportunity to get the donor members of the Group to commit themselves to increasing the resources of the CGIAR over a

period of years in keeping with the long-term nature of agricultural research. To this end, the Secretariat in its 1979 integrative report suggested that a realistic target would be to double (in current dollar terms) the funds provided over the five years 1980 to 1984. This five-year indicative plan was intended to be the first of a series of rolling five-year plans, updated and extended by one year annually. It proposed starting at $124 million in 1980 and providing for growth in real terms of 10 percent annually, which it assumed would imply growth in current terms of about 20 percent. This was no more than had occurred in the past; in fact, it represented a slowdown from the rate of growth that prevailed in early years. To make room for some new activities, the existing centers would be allowed only modest real growth once they reached maturity and full development.

The integrative report also suggested that the time had come for another review of the CGIAR and the system supported by it. The proposed five-year plan called for an increase of almost one-third in the number of centers or other entities funded by the Group, and total expansion of the system, including growth in existing centers, of almost one-half. "By sheer size," the Secretariat noted, "and in the face of competing demands among centers for funds, the governance and management of the system are likely to become the major issues facing the Group over the next few years. The challenge will be to maintain the unique characteristics and strengths of the CGIAR as it becomes a larger, more complex institution." It suggested that a comprehensive review be undertaken in 1981, with some preparatory work to be done by the Secretariat during 1980.

With an expansionist five-year plan and a proposal for a comprehensive review before it, the Group's deliberations at the end of October 1979 included a wide-ranging discussion of its activities and the future direction they might take. It was abundantly clear that the CGIAR was a long-term enterprise with a continuing and increasing claim on the resources of its donors. The Group's members displayed caution about expanding the system indiscriminately, but they identified a number of areas in which they thought the Group should become involved or should do more. These included training, agricultural engineering, soil management, pest management, water management, and some other areas identified earlier by TAC. While recognizing that the Group was entering a new phase, they were reluctant to see any sweeping change in its basic structure. Everyone wished to preserve the Group's special characteristics—informality, de-

centralization, and relative lack of bureaucracy—but saw the need for improved planning, both for the system collectively and for individual activities, and for sound and responsive management.

Looking back, the October 1979 meeting was, in its hopes and enthusiasm, a high point in the evolution of the CGIAR. The five-year plan was accepted. The donor members, in general, favored expansion on the scale proposed, even though some were already feeling the pinch of budget constraints and most indicated that they could only commit funds for a year at a time. The meeting, in short, was a strong reaffirmation of support for the CGIAR.

5

Coming of Age, 1980–85

THE YEARS 1977 to 1979 were a period of self-imposed consolidation for the CGIAR, though real growth continued as well. But the year following acceptance of an expansionist five-year plan in October 1979 brought a turnaround in the Group's circumstances and marked the beginning of a period of constraint. The reason was not so much a matter of policy as a consequence of worldwide economic difficulties.

Adjusting the Five-Year Plan

In December 1979, the Secretariat's annual budget instructions to centers for the first time included guidelines indicating a limit for each center on the amount it might expect to receive from its donors in 1981. This innovation was a logical extension of the concept of a five-year plan for the system as a whole, and the guidelines issued were designed to ensure that the total amount requested by the thirteen centers would fit within the amount projected for 1981 in the plan.

By July 1980, however, when TAC began its review of the 1981 budget, it was clear that donors' contributions would not reach the target. Proposed budgets had to be reduced to bring them more in line with realistic expectations of funding. This was the first time that any center director had been obliged to cut back his budget request in the face of likely underfunding. Some of the center directors did not believe that such underfunding would take place. Further soundings of donors, however, confirmed that contributions in 1981 would fall short of the amounts projected in the 1979 five-year plan, and when the time came to

update and extend the five-year plan to cover the period 1981 to 1985, the rate of growth for 1981 that had been projected only a year earlier had to be lowered significantly. Expressed in 1981 dollars, the amount for 1981 in the original plan would have been $156 million; in the revised plan it was lowered to $149 million, the figure used in reducing the budgets of the centers at the TAC meeting. Even this proved to be too high; pledges made in November 1980 amounted to only $138 million, and actual contributions in 1981 proved to be even less. A further round of hastily improvised budget cutting for the centers ensued, with the result that for several of them there was no real growth at all. Not only 1981 was affected; the growth estimates for all years in the five-year plan as updated and revised for 1981 to 1985 had to be lowered substantially. In current terms, the figure for 1984 was still about $260 million, but because the revised figures incorporated higher rates of inflation than originally assumed, real growth was lower. The plan still contained an item for "new priority activities under consideration and new areas of interest." In fact none of these eventuated.

The Secretariat's budget guidelines issued in December 1980 for the preparation of 1982 budgets had to be tougher still than the year before. Procedures that were fairer and more sensitive to differences among centers had to be devised—and revised quickly in the light of experience—to reduce the centers' claims on limited resources. Ironically, these constraints came at a time when the achievements of the centers and of the CGIAR itself were becoming more widely known.

Recognition, Awards, and Publicity

As the success of the high-yielding varieties of wheat and rice became recognized, public attention began to focus on the individuals and institutions that had made it possible. Norman Borlaug was the first to be honored, receiving the Nobel Peace Prize in 1970 for his work on wheat at CIMMYT. In the same year, CIMMYT and IRRI jointly received Unesco's Science Prize. Thereafter, individual scientists, particular programs of the centers, and some of the centers themselves garnered a growing number of prizes and awards. While the centers were becoming increasingly well known, particularly within the scientific and development aid communities, the Consultative Group itself attracted little attention, a situation which in the early years it did little to remedy.

In 1980, however, the CGIAR was singled out for an honor, the King Baudouin Foundation International Development Prize. To celebrate the twenty-fifth anniversary of King Baudouin's accession to the throne, the people of Belgium individually contributed to a gift, which he used to establish the King Baudouin Foundation. Part of the foundation's resources were to foster the economic development of the poorer countries, a subject in which the king had a great interest. In 1979, he decided that the income of this part of the foundation would be used to give prizes to honor "persons or organizations, irrespective of nationality, which had made a significant contribution to the development of the Third World, and also to solidarity and good relations between industrialized and developing countries and between their peoples."

It was decided that the first prize to be awarded should be shared between an organization and a person. The recipients were the CGIAR and Paulo Freire, a Brazilian educator who had spent a lifetime developing teaching methods for the elimination of illiteracy. Robert McNamara, president of the World Bank, and who—as we have seen—played a leading role in creating the CGIAR, received the prize on behalf of the Group at a ceremony in Brussels on November 15, 1980.

The award to the CGIAR was made in recognition of "its contribution to the qualitative and quantitative improvement of food production in the world." The application had noted that the CGIAR would celebrate its tenth anniversary in 1981. In its brief history, it had become a model of effective international collaboration in dealing with the single greatest problem of mankind—world hunger and malnutrition. The application highlighted the scientific breakthroughs and the unique organizational features and innovations of the system.

The prize carried with it a sum of $50,000, which the Group decided should be invested. The income would be used to award every second year a prize and a small sum in recognition of outstanding work by one of the centers; the money would be used to publicize that work. The biennial prize, to be awarded on TAC's recommendation, was called the King Baudouin International Agricultural Research Award. IRRI was the first recipient, in recognition of the continuing vitality and progress of its breeding program as illustrated by the development of IR36, which because of its early maturity and wide resistance to pests and diseases was planted by Asian farmers over more than 10 million hectares. The second award went to CIAT for the development, in collaboration with the national research system of

Guatemala, of bean varieties resistant to golden mosaic virus diseases.

The King Baudouin Prize was welcome recognition for the Group, although the award did not attract wide press coverage. The press conferences arranged by the Secretariat from time to time invariably showed that there was more interest in the scientific accomplishments of the centers than in the existence or activities of the novel form of international organization that helped make them possible. The CGIAR's lengthy name and unpronounceable acronym presumably did not add to its popular appeal. In fact, the Group did not seek the limelight. The close attention the Group gave to the press release that was always the final item on the agenda of its business meetings manifested the instinct of government officials to edit the language of any document that came to hand rather than an expectation—which would have been unfounded—that the press release would attract journalistic attention.

Nevertheless, it was gradually recognized that greater awareness of the Group among the public at large, and particularly among aid donors, was desirable. A simple brochure was prepared in the Group's early days, mainly about the programs of the few centers in the system at that time rather than about the Group itself. In 1976 a revision was issued that went a little further to present the whole operation as a coordinated effort.

There remained a need, however, to provide information more frequently, so in 1981 the Secretariat began to issue a newsletter on a quarterly basis. It was designed to meet not only the information needs of the public but also to circulate within the CGIAR system news both of general interest and about the individual centers. Communication within the system has taken on increasing importance as a way of building a sense of unity and common purpose among its far-flung and loosely coordinated components. The newsletter proved to be a popular initiative. Other programs to improve the flow of information to the public at large, to scientific or other specialized journals, and to the centers have followed, but the Secretariat's efforts at information and communication are still modest.

The Second Review of the CGIAR

The second review of the CGIAR system was a principal preoccupation of the Group during 1981. This was also a year of further adjustment by the centers, the Secretariat, and TAC to the real-

ities of continuing deterioration in the world economy. There were more cuts in public expenditure in donor countries, cuts that were particularly sharp in some countries—such as the United Kingdom—that historically were the staunchest supporters of the CGIAR. Fluctuations in the value of other national currencies against the U.S. dollar reduced the dollar value of some contributions and heightened the degree of uncertainty about funding. For many centers these developments meant virtually no growth in real terms, and for some a real reduction in their programs. This process of adjustment dominated the thinking of all centers, but it reinforced their interest in the outcome of the second systemwide review.

Adjustment to budget constraints and competition among centers for the limited resources raised new questions about the roles and functions of the various elements in the system and the relationships among them. What was the responsibility of a center's board of trustees in preparing and implementing a program and budget that had to be kept to a size commensurate with the resources likely to be available? What should be the respective roles of the CGIAR Secretariat and TAC in setting budget guidelines for centers and in reviewing their proposed programs and budgets? Were new mechanisms needed to ensure that the Group's resources were managed efficiently? It is not surprising that in considering the scope and purpose of the review, the Group placed heavy emphasis on matters of governance, resource management, organization, and accountability, even though the terms of reference of the review were written more broadly.

The second review was organized in much the same manner as the first. Once again, there was a special review committee from within the CGIAR (though this time somewhat larger) and, as its staff, a study team recruited from outside. Funding was provided by special contributions from donors. Again, an informal canvass of donors showed that most favored the idea that the chairman of the Group should be the chairman of the review committee. There were seventeen members of the committee in addition to the chairman. Although each served in his personal capacity, they were senior officials from donor countries and from developing countries, members of TAC, chairmen or other members of the boards of trustees of centers, and center directors. Because the committee was already large, the representatives of the cosponsors and the chairman of TAC were designated as ex officio observers, but participated fully in the discussions. The executive secretary of the Group and the execu-

tive secretary of TAC attended all meetings. The director of the study team was Michael H. Arnold of the Plant Breeding Institute in Cambridge, England. The other members of the study team were Bryant Kearle, vice chancellor (for academic affairs) of the University of Wisconsin, Martin Pineiro of the Inter-American Institute for Agricultural Cooperation (IICA), and William E. Tossell, dean of research at the University of Guelph in Canada.

The review committee met three times. The first meeting settled the scope of the committee's task and the program of the study team; the second concentrated on the issues identified by the team; and the last addressed the draft report and recommendations prepared by the team and instructed the team on the revisions to be made in the final version of what then became the committee's report.

The review attracted widespread interest. Many people both within the system and in developing countries were eager to give their views. Members of the study team traveled widely to consult with donors, the directors and staffs of the centers, and TAC. Special efforts were made to obtain the views of senior officials in developing countries concerned with agricultural research. Several donors volunteered to underwrite the cost of meetings or seminars with agricultural research administrators in Africa, Asia, and Latin America. Three meetings were organized: one by the government of Kenya in Nairobi, one by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) in the Philippines, and one by IICA in Costa Rica.

The report of the review committee, published in November 1981 and discussed by the Group at Centers Week later in that month, addressed a wide range of issues. It began with a survey of world food supply in relation to demand, a consideration of the need for international agricultural research, and an assessment of the value and impact of research sponsored by the CGIAR. It then turned to the place of the CGIAR system in the worldwide pattern of related activities. It identified the four main kinds of research—basic research to generate new understanding, strategic research for the solution of specific research problems, applied research to create new technology, and adaptive research to adjust the new technology to a particular set of environmental conditions. It then considered the appropriate role of the CGIAR system in relation to these different kinds of research, taking into account the research undertaken by industrial countries and by developing countries themselves and the work of

organizations providing technical assistance to developing countries. Criteria were suggested for the inclusion of activities in the CGIAR system.

The report analyzed and made recommendations on a broad array of questions of organization and management. It suggested ways to improve the participation of developing countries in the affairs of the CGIAR. It analyzed the implications of the ways in which funds were provided for the core and special project activities of the system. Finally, the report offered a strategy for the future and a new five-year indicative financial plan for the period 1983–87.

The committee made twenty-four recommendations, all but one of which were accepted by the Group in the course of the protracted discussion that occupied most of Centers Week. The recommendations affirmed that the future work of the system should continue to concentrate on food commodities and that the Group's focus should be on multidisciplinary applied research and on training. They endorsed the trend toward more collaborative networks linking IARCs with national programs. The committee recommended that the centers continue to develop appropriate lines of strategic research, both to support their own programs in applied research and to foster active links with the relevant basic and strategic research of other institutions.

Thirteen of the committee's recommendations were addressed to matters of organization and management. Some of these endorsed policies and procedures already in place, such as the review procedures originally prescribed by the Bell subcommittee; others recommended particular studies or assessments; and several proposed new policies or procedures. One of the most important of these called for a periodic management review of each center, commissioned by the CGIAR Secretariat, in addition to the array of other reviews already in place. Another—reflecting a desire on the part of donors to have a greater voice in how senior positions in units serving the Group were filled, including those financed entirely by the Bank—was that, in the future, appointment of the executive secretary of the CGIAR should be preceded by wide consultation among members of the Group, and in making the final selection the chairman should be assisted and advised by a search committee.

Three of the recommendations dealt with the boards of trustees of centers. The study team and review committee were concerned with a growing tendency to place on the boards of centers senior officials of donor governments and institutions; if this

tendency was not curbed, the objectivity of the boards might be put in question, and there would be mounting pressure to convert them into representative bodies. The report therefore recommended that members of boards—except those representing the host country—should be appointed in their personal capacities. Moreover, care should be taken to ensure that such individuals were not so closely associated with a donor agency or government that they might be seen as representing its particular interests rather than their own professional views. Another recommendation addressed the need to ensure that all board members were well informed of their responsibilities. The third recommendation was on the relationship between boards and the Group. It said:

> We consider that a board cannot escape the reality that it is ultimately dependent for its funding on the collective will of the CGIAR. It should therefore conduct its affairs as if it were accountable to the Group, even though its legal status makes no provision for such a relationship. To ignore this responsibility would be to force the Group in a direction of greater central authority. Consequently, we recommend that the boards and the Group develop mutually acceptable methods of consultation on important matters of policy, such as the appointment of the Directors General, the term of office of board members, the criteria for board membership, and other matters relating to the structure and functioning of boards in relation to their accountability to the CGIAR.

In this way, the committee attempted to deal with a particularly difficult question of accountability within the system. The thrust of this recommendation was that the boards, while legally autonomous, should recognize the need to share some of their authority with the Group. This kind of fundamental change takes time to work out, but progress has been made in such areas as the appointment of the director general and the terms of office of board members, and the board chairmen have constituted themselves into a working group to address the question of board responsibilities more systematically. (We will return to this subject in chapter 6.)

The one recommendation not accepted by the Group was a proposal to establish a budget review committee. It was that

> a Budget Review Committee be established to be chaired by the Chairman of TAC and consist of six additional members,

> two of whom would be current members of TAC appointed by its Chairman and four appointed by the Chairman of the Group to serve in their personal capacities. We propose that the Budget Review Committee, supported by the Secretariats of the CGIAR and TAC, would make recommendations on budgetary procedures, the formulation of guidelines, and the allocation of resources.

This was too radical a change for the Group. The creation of some kind of a committee whose principal function would be to review the budgets of the centers and allocate resources among them had been the single most contentious matter of debate in the review committee. The study team had exercised its imagination in devising various proposals for the committee to consider, but fault was found with each of them. Some were thought to put too much power into the hands of a small number of donors who might impart too political a color to their decisions; others, mainly review committees composed of technical experts unaffiliated with any donor or any center, were thought to be too far removed from the realities of the CGIAR funding process. The logic of TAC's argument that its indisputable responsibility for program review had to go hand in hand with that for the review of budgets appealed to many members of the committee.

The budget review committee proposal also occupied much of the attention of the Group during the Centers Week discussion. A proposal from the floor to establish a small budget committee with a rotating membership of donors failed of adoption when it became clear that most of the major donors would want a permanent seat if such a committee were established. The history of the proposal to establish a budget review committee provides insight into the relationships among the members of the Group and is considered again in chapter 7. Suffice it to say here that in the end the Group decided to continue with the existing procedures under which program and budget review was essentially a joint responsibility of TAC and the CGIAR Secretariat. Recognizing that its refusal to adopt a committee mechanism meant that the Group wished to continue to act as a "committee of the whole" on all important matters, the members agreed to meet thereafter twice a year on a regular basis to transact the growing volume of business.

Another problem on the minds of the members of the review committee and the Group was that participation in the deliberations of the Group by developing countries, other than those that were also donor members, was at best uneven and often not very

effective. Various reasons were adduced. One was that the developing countries elected at the FAO regional conferences to serve what were at that time two-year terms as members of the Group sent representatives who were inadequately briefed. Another was that they often failed to send anyone at all, presumably for lack of funds to meet the expenses of attendance. To increase the effectiveness of participation by developing countries, the review committee recommended that mechanisms be established to ensure that regional representatives were better informed about the CGIAR system; that efforts be made to increase the continuity of service of these representatives; that the FAO consider providing greater opportunities at regional meetings for discussion of relevant topics; and that the CGIAR ensure that funding was available to enable the representatives to attend its meetings. However, even though the committee correctly identified the principal problems and suggested how they might be overcome, increasing the effectiveness of developing-country participation in CGIAR meetings remains problematic. (We will return to this subject in chapter 7.)

The final chapter of the review committee's report addressed the future strategy of the Group and proposed a new five-year financial plan running through 1987. The committee's views were conservative, in keeping with the general attitude prevailing in the Group in 1981 (and continuing thereafter). The tenor can be summed up in a single sentence: "The future strategy should clearly be to encourage the productive trends already present in the System and to reinforce the value of the work without making demands on the donors that they are either unable or unwilling to meet." No growth was assumed in the existing programs of the established centers, and only a small amount was expected for starting new programs and for bringing the newer centers up to an approved level and standard of operation. Except for the latter purpose, the overall provision for growth was about 5 percent, of which 3 percent was for new research entities, none of which has in fact materialized. Only 2 percent remained for real growth in the programs of the thirteen existing centers. This amount was to be used to fund new activities at these centers on a matching basis, with half of the funds required to be provided by the centers through reductions in other activities.

The committee's five-year plan—which the Group accepted—represented a very real slowdown. In the original five-year plan adopted in 1979, the resources needed for 1984, expressed in 1980

dollars, were projected to be $184 million. Two years later, the review committee's projection for 1984, expressed in 1982 dollars, was $194 million, an increase of hardly more than 5 percent during a period when prices were increasing much more rapidly. Even so, actual contributions from donors in 1983 and 1984 were substantially less than those called for in the plan.

Once again a comprehensive review of the CGIAR had been a useful exercise, perhaps more by identifying and consolidating the areas of consensus within the Group than by developing an innovative long-term strategy for the future. The study team had originally set as its theme "the winds of change," but the prevailing mood of the review committee and the Group was that change should be evolutionary rather than revolutionary. As the review committee's report put it: "In all important aspects, the CGIAR system has the framework for doing the right things in the right ways. It is evolving in a manner that allows flexibility in responding to needs and exploiting opportunities; it fosters a highly-efficient and professional approach; it permits increasing participation by individuals in developing countries, not only in its operations but also in the management of its affairs. Moreover, . . . it provides bridges across national boundaries to bring the results of research to bear on the problems of world agriculture and, both directly and indirectly, to harness the resources of industrialized countries in support of research directed to the full needs of the developing countries." This assessment may have smacked a little of self-satisfaction, but it also expressed the confidence, genuinely felt, that the CGIAR was on the right path. Such a conviction was all-important in maintaining political and financial support, even in the face of sharp reductions in donor budgets. Thus, despite the shortfalls in funding, the CGIAR has retained its favored position in the aid programs of most of its donor members.

Stripe Analyses

In addition to its periodic reviews of the programs of individual centers, TAC undertakes occasional cross-center analyses of program components (such as training, documentation, and cropping systems research) common to several centers. These "stripe analyses" were begun on the recommendation of the first review committee; the initial topic was farming systems research at four centers—CIAT, ICRISAT, IITA, and IRRI—which had impor-

tant programs on the subject. A three-man team under the leadership of John L. Dillon of the University of New England in New South Wales, Australia was recruited for the purpose. The team's report was discussed by TAC in February 1978 and formed the basis for a workshop on farming systems held under TAC's auspices in May. Participants in the workshop included staff from all of the international centers except ILRAD, as well as scientists from developing countries. The team's report and the conclusions of the workshop were considered by the Group at its meeting in November.

Farming systems research was a good subject for the first stripe analysis. Most of the centers conducted such research, but there were important differences among them in coverage, terminology, and particularly methodology. Farming systems research was becoming more important as the new high-yielding varieties had to be fitted into the cropping systems of farms in many different countries, operating in widely varying circumstances. Indeed, some questioned the usefulness of such research because the systems actually employed by farmers depended so heavily on local circumstances. The review team recommended that research on farming systems be limited to activities likely to yield results that could be generalized and, therefore, that it should focus on principles and methods. They recommended that such research should emphasize the production aspects of farming systems and should not be broadened to include rural development. But the team had no doubt about the value of farming systems research at all the crop-oriented centers. They felt that there was an important role for farming systems research both "downstream," as a link in the research chain taking information gained from the experimental programs of the centers and placing it in the farmer's production system, and "upstream," as a way of bringing into the center's multidisciplinary research an understanding of the problems and constraints found on farms.

The Group found the stripe analysis of farming systems a commendable exercise. It brought some definition to an aspect of the research that had become increasingly important to the Group but that had not been well understood. TAC was encouraged to undertake further cross-center studies of this kind.

The next topic chosen for a stripe analysis was the so-called off-campus programs of the centers. Such programs were the principal driving force behind the expansion of the centers and hence their need for additional funds. For this study TAC

followed the same pattern as for the study on farming systems. An external team of three men headed by Robert F. Chandler was recruited. It traveled widely to learn at first hand about the various off-campus programs of a selection of centers, after which its report was discussed at a workshop. The study defined off-campus activities as all activities that were carried out by the centers at locations away from their headquarters, except for activities within the host country that were an integral part of the center's research program. The off-campus activities could be a part of the core program of a center and therefore regularly reviewed by TAC and financed by CGIAR donors, or they could be special projects, which in principle were not closely related to the center's basic mandate and were funded outside the Group-approved budget.

As in the case of farming systems, one contribution of the stripe analysis was to define, classify, and thus better understand the wide variety of activities comprised in the subject. The team found that the centers' off-campus activities could be divided into nine broad categories:

- international programs for testing under differing ecological conditions the new crop varieties developed by the centers
- research activities which, though essential to the core program of a center, were carried on outside the host country to take advantage of environmental or other circumstances
- technical assistance and support to national research programs
- regional programs involving more than one country
- collaborative programs with scientists in developing or industrial countries
- collection in the field of information about countries to which the new technology developed by a center would be transferred, about places in which the new technology was being implemented, and about other developments relevant to the center's work
- collection, preservation, and utilization of germ plasm
- training that could be done better or more cheaply abroad than at headquarters
- advisory activities similar to consultancy services.

This wide diversity of off-campus activities—some of which were an integral part of a center's mandate and some of which were less so—presented a center with almost unlimited opportunities to expand its operations, which no doubt helped to ex-

plain why these activities were absorbing an increasing proportion of a center's resources and the time of its management. The team discovered that some centers were using between a quarter and a third of their total budgets for these off-campus activities. Although, the team argued, off-campus activities were a logical development as centers became more mature, the trend should be reversed as the research capability of national systems improved to the point where they could undertake collaborative projects that did not involve staff outposted from the centers. The team and TAC warned that the centers' overall programs would become distorted if more of their resources were devoted to off-campus activities not directly part of their core programs. This became one of the main points in the Group's discussion of the team's report at its meeting in Manila in November 1980. Members of the Group found that the report helped in setting proper boundaries for the activities of the international centers. This perennial subject had caught the attention of the Group from the outset and had figured prominently in the work of the first review committee. The stripe analysis did not lay the matter to rest, however, as will be seen in chapter 7.

The stripe analyses of farming systems research and off-campus activities helped to increase the Group's understanding of the work of the centers and the similarities and differences in their various programs. The Group agreed that more should be undertaken, and in 1983 TAC began such a study of training, which is an important activity at most centers. TAC's report was presented to the Group and discussed at its June 1985 meeting, where it was well received. The substance of the training study is discussed in chapter 8.

ICIPE: Respected but Rejected

The same uncertainties about funding that affected the IARCs after 1979 were causing difficulties for other international agricultural research organizations. The International Center for Insect Physiology and Ecology (ICIPE) was one of those confronted with grave problems in seeking to maintain its program in the economically stringent times.

ICIPE developed from ideas propounded in 1967 by Thomas Odhiambo, a distinguished Kenyan entomologist. In an article in *Science*, he concluded that priorities for African research should be insect biology, human and animal tropical diseases, produc-

tivity of grain crops, new sources of energy, soil science, and oceanography. Appreciating that this was a formidable list for a continent with so few trained scientists, he suggested that the best way to proceed would be to establish a few "centers of excellence"; each center would concentrate its resources on a few problems to ensure a quick return on the investment. To illustrate this concept, he took as an example an institute devoted to research in insect biology.

This suggestion led a year later to a meeting of scientists in Boston, Massachusetts to consider establishing an institute in Africa to work on insect physiology and endocrinology (later changed to ecology). A large planning conference, attended by some eighty scientists, took place the following year, and in 1970 ICIPE was formally established in Kenya with Odhiambo as its head. It was by no means purely Kenyan or even purely African, although the focus of its research was on African problems. The directors of its programs were leading scientists from various countries who came to spend up to a year or two at ICIPE working with a small permanent staff. ICIPE soon established a reputation for high-quality scientific research. Most of its financial support came from the UNDP, but there were other important donors, most of which were also members of the CGIAR.

ICIPE was more of a basic research institution than the typical IARC. Its management and board of trustees were proud of its scientific accomplishments and were determined to maintain its independence to pursue research as it saw fit. For this reason, although it would have liked to become associated with the CGIAR, it did not initially seek to become part of the CGIAR system. The question of some relationship with the Group was first raised with TAC in 1975. TAC, however, had questions about the relevance of ICIPE's work to the IARCs and also about its governance and management, including the system of short-term tours of duty for program leaders. ICIPE was willing to make some changes to meet TAC's concerns, and in September 1975 TAC sent a mission, composed of the scientific adviser of the CGIAR Secretariat and the deputy executive secretary of the TAC Secretariat, to examine ICIPE.

The mission reported very favorably on the scientific quality of ICIPE's research. It had questions about ICIPE's plans for developing its facilities, for which the mission suggested more economical solutions. The mission felt that parts of ICIPE's program could be very important to the work of the IARCs and might appropriately be funded by direct contributions to ICIPE. TAC was

also impressed with the quality of ICIPE's scientific work, but proposed that ICIPE enter into contractual agreements with individual centers for research on their behalf, the cost to be included in the budget of the center and financed as part of its core program. This would be done for ICIPE's 1977 program, still more than a year away. The Group took this suggestion under advisement but, since no immediate action was required, postponed any decision. Actually the matter stayed in abeyance for another two years during which ICIPE reshaped its capital program to conform more closely to TAC's views and TAC reshaped its attitude toward ICIPE.

In the autumn of 1977, TAC came forward with further recommendations that the Group give direct support to part of ICIPE's program, in somewhat the same way as it funded part of WARDA's program. TAC proposed that the Group provide ICIPE a one-time contribution to cover that portion of its capital program relating to the work it would do in collaboration with the international centers. The Group would also make an annual contribution to ICIPE's core program. Moreover, in those instances where collaborative programs between ICIPE and centers were being funded outside the system by CGIAR donors, those programs should be counted as part of the core programs of the centers concerned and the funding counted as contributions to the CGIAR. TAC proposed that the part of ICIPE's program funded under these arrangements be reviewed regularly, just like the programs of other centers.

The Group, however, felt otherwise. Then concentrating on consolidation and noting that ICIPE still did not wish to become a full member of the CGIAR system, it concluded that there should be no formal relationship. Contract work carried out at ICIPE for the centers could be funded as part of the centers' core programs like any other contractual research. The Group did, however, agree that the Secretariat could provide services to ICIPE, including assistance in organizing meetings of its donors, to help provide some stability to its funding.

This was not the end of the story, however, for ICIPE's board of trustees had a change of heart. In March 1979 ICIPE applied to become a full member of the CGIAR system. At its October meeting the Group asked TAC to study the application and make its recommendations. TAC organized a full-scale mission under H. David Thurston of Cornell University. The mission, which went to Nairobi in April 1980, reported very favorably; it noted in particular that the scientific capability of ICIPE was up to the

accepted standard of the international agricultural research system.

The mission's terms of reference did not run to the question of the priority of ICIPE's research compared with that of the centers already in the system or under consideration. TAC agreed with the finding on the high quality of ICIPE's research, but nevertheless concluded that it could not recommend that ICIPE be included in the CGIAR system. It said that ICIPE's program encompassed only a limited part of the basic research needed to support the applied investigations on insect and disease management and control and dealt with only a few of the important agricultural pests in the tropics. Moreover, TAC felt that ICIPE's research ranked lower than other important fields of factor-oriented research, such as water management and plant nutrition, and some fields of commodity research, such as aquaculture and tropical vegetables. Furthermore, TAC was still dubious about using CGIAR resources for factor-oriented research. It took the position that separate factor-oriented centers were justified only when the research was of overriding importance to the Group's objectives and could not be handled appropriately by the commodity-oriented centers.

TAC's finding came as a shock to ICIPE and its sponsors within the system, who had assumed that ICIPE would have smooth sailing through TAC even if it faced some difficulties in the Group. When the matter came up for consideration in October 1980 at the Group's meeting in Manila, feelings ran high on both sides and the situation was tense. There was widespread recognition of the importance of ICIPE's research and unanimous praise for the quality of its work, the distinction of ICIPE's leadership, and the example of competence it set in a continent where national research generally was very weak. Some members of the Group, including some who were important donors to ICIPE, strongly supported its admission. Almost all those who were opposed stressed that they did so with regret. The objections were along the same lines as those set out in TAC's report. In addition, some members of the Group were concerned about the financial implications of accepting ICIPE into the system at a time when funds were short and existing programs were being scaled down. Considering the long history of TAC's discussions with ICIPE, and ICIPE's serious efforts to overcome the weaknesses perceived by TAC, there was genuine regret that when the time came for final decision there remained basic reasons to deny it admission to the system.

The ICIPE discussion put the Group's informal decisionmaking processes to its severest test. In search of a consensus, the chairman took the unusual step of asking all of the delegations, some of whom had deliberately remained silent, to express their views. Even then, some declined and others couched their views in ambiguity. The chairman said that, by his informal tally, those delegations that spoke were almost equally divided on the question of admission.[1] However, the delegations opposed accounted for about two-thirds of the funding of the CGIAR system and were largely the donors from whom increased resources for ICIPE would have to come.

In view of the closeness of the tally and the absence of any formal voting procedure, the chairman held a short closed meeting of representative members on both sides to find a workable solution. He then reported to the Group as a whole that, although there was not a strong enough consensus in favor to warrant adopting ICIPE, there was a consensus that something should be done to help. He therefore proposed a compromise. A group of donors should be established outside the CGIAR to meet regularly to secure a more stable financial base for ICIPE. The World Bank would be prepared to provide secretariat services for this group, act as its fiscal agent, and provide other assistance. There should be a thorough review by TAC of the priority to be given by the CGIAR to insect and pest management. This review should include ICIPE's program and the relevant activities of the IARCs, as well as consideration of possible CGIAR funding of specific programs of ICIPE without its becoming a member of the system. This compromise was accepted. The special group of interested donors was established outside the CGIAR and has continued to function, with the World Bank providing its secretariat.

ICIPE's protracted courtship of the Group was a difficult and unhappy experience for both of them. At first ICIPE sought the benefit of some kind of association without giving up its independence to pursue basic research in accordance with its own aims. By the time that it decided to become a full member of the CGIAR system with the obligations that such membership en-

1. The chairman, trying to keep track of the voting as it proceeded and to resolve ambiguities in the comments, stated that one more delegation had spoken in favor of admitting ICIPE than against. When the Secretariat reviewed the verbatim record, it resolved the ambiguities slightly differently; the summary of proceedings therefore stated that those who were opposed to admitting ICIPE were in a majority of one.

tailed, the Group had tightened its policies and faced financial problems of its own. The possibility of associate status had been foreclosed. The priority of research directed at increasing food production had been confirmed, as had the reluctance to support research on individual factors of production except as part of the multidisciplinary, mission-oriented research of existing centers.

The truth is that ICIPE was never a logical candidate for the CGIAR. However, as a center of excellence and an essentially African institution, as well as a potential collaborator with the international centers in the system, it had a good deal of appeal, which had led TAC and some members of the Group to lean toward some form of official relationship, especially so long as ICIPE did not seek full membership. It is understandable that TAC and many donors wished to find ways for the Group to support ICIPE, but regrettable that this benevolence tended to mask until the final moment the fact that the Group and ICIPE were not very well matched.

Research on Water Management Set Aside

The conservative attitude evident in the second review was manifested in the Group's decisions on water management. TAC had always given high priority to research on water management, which figured among the original proposals identified by the Bellagio Group before the CGIAR was founded. But it had proved extremely difficult to put together a proposal acceptable either to TAC or to the Group. Research on water management appeared repeatedly on TAC's agenda, and discussion papers on the subject were commissioned by it or prepared by others and brought to TAC's attention. Some TAC members pressed for more definitive consideration leading to a proposal that could be recommended to the Group. Others, however, felt that the subject should be dealt with in the programs of existing centers (as was being done at IRRI, for example), that the problems of water management were usually peculiar to specific localities, and that a new center for such research would be contrary to TAC's general posture that research centers confined to one or two factors of production did not belong in the CGIAR system. It was not so much that proposals were put forward and rejected as that TAC felt torn between the importance of the subject and the difficulties of coming to grips with it in the CGIAR context. The Group apparently felt somewhat the same way. It agreed with TAC that

the subject deserved high priority, but it did not press TAC to address it.

But this was not the feeling everywhere. The IDRC, particularly, took the view that the losses of irrigation water between the source of supply and the root zone of the plant were so great and the downstream degradation of soil through accumulating salts and waterlogging so damaging that research specifically addressed to water management was clearly warranted. Based on its experience in India, the Ford Foundation also took the view that increasing the efficiency with which irrigation water was used was of prime importance. In February 1978, David Hopper, then president of the IDRC, told TAC that the IDRC was undertaking a study of the problem and would be glad to share its findings. Sir Charles Pereira, a former member of TAC, led the IDRC study. Meanwhile, TAC was again considering general priorities for international agricultural research and in May 1979 presented its third priorities paper to the Group. In the past TAC had noted the importance of research on water management but had not ascribed any specific priority to it. This time it was second on the list of selected initiatives to be undertaken if additional funds were available; it was given priority immediately after research on tropical vegetables, a proposal which, as we have seen, was put aside by the Group at that May meeting.

Two months later the IDRC report was presented to TAC at its July meeting. In essence, its conclusions were that there was need for an international center where postgraduates could be taught the basic disciplines and technologies in water management and acquire a capacity for examining and addressing the causes of low efficiency and deterioration in irrigation systems. It recommended that such a center be established in a country with large-scale irrigation based on one of the four great river systems—the Ganges, the Indus, the Nile, or the Euphrates and Tigris—and that as part of the center's program there be three irrigation development teams, one posted in each of the three other river systems. Posting to these teams would offer opportunities for study and training within the reality of operating systems. TAC agreed in general with the IDRC report, but felt that the particular proposal needed clarification and elaboration. It established a subcommittee to study the IDRC recommendations in detail and to produce a proposal that TAC could recommend to the Group.

This subcommittee, assisted by advisers drawn from within the CGIAR system and outside consultants, gave its preliminary

findings to TAC at its February 1980 meeting and, after taking into account the views and suggestions of TAC members, presented its final report and recommendations to the TAC meeting in July. No one in TAC questioned the high priority of a new initiative for training and research on the management of irrigation systems. The issue in TAC was what sort of institutional mechanism would be most appropriate. After much discussion it was decided to put the subcommittee's proposal to the Group for its "serious and favorable consideration," but to do it tentatively so as to ascertain the reaction of the Group both to the idea of establishing a new center for this purpose and to the kind of institutional structure outlined. If the reaction was favorable in principle, TAC could then work up a definitive proposal taking into account the views expressed.

TAC's tentative recommendation to the Group at the October 1980 meeting was that a new international center be established consisting of a central headquarters and two or more smaller satellite units that collectively would address "the wide spectrum of irrigation water management problems of the major ecological zones of the world . . . as well as the full range of water supply, delivery, use, and disposal in each." The headquarters unit would have a core staff of twenty to twenty-five senior scientists and each satellite half as many. Although the units would not have experiment farms, they would be located where they could use existing irrigation systems as their laboratories. It was estimated that the annual operating cost of the headquarters unit would be about $5 million, and the capital cost of establishing it also about $5 million. The satellites would cost half as much.

The Group's discussion of this item on the crowded agenda of the meeting in Manila in October 1980 reached no consensus. There seemed to be general agreement on the priority of water management training and research, but the members disliked the institutional structure proposed by TAC and continued to express concerns that factor research was not appropriate for the Group, that the problems were too location-specific to be treated by a single international center, and that the research problems could just as well be handled by the existing centers. The Group did not reject out of hand the idea of a new center, but it gave the subject back to TAC for reconsideration.

TAC was disheartened by the failure of the Group to give a clear lead as to what it wanted to do and was disinclined to attack the problem again without more guidance. It was therefore decided to hold a meeting of interested donors to see how this guidance

could be given. The meeting, which took place in July 1981 under the chairmanship of Robert Cunningham of the United Kingdom, assigned the task of giving guidance to four consultants, who were to report to a steering committee of donors chaired by Werner Treitz of the Federal Republic of Germany. The consultants were engaged by TAC. The Treitz committee met twice to review their work and consider their report. The report was then examined by TAC, which put forward to the Group a specific proposal based on the consultants' recommendations. It differed from the previous proposal in that there would be no satellite units. Instead there would be a network of national programs coordinated by a new international center that could assist the national programs by posting staff to them for two to three years at a time. The consultants estimated that once the center and outpostings were fully established the operating costs would be about $4.5 million. Even at this low cost, however, TAC felt obliged to submit the proposal with some financial reservations. Although TAC was convinced a new initiative in irrigation management research was urgently needed, it was unable to recommend any new major undertaking that would be financed at the expense of the activities of the present system, some parts of which were already seriously underfunded. Thus, if the Group agreed with TAC on the need for a new center in the system, the donors would have to find additional money for it.

In introducing the subject for discussion at the Group's meeting in Paris in May 1982, the chairman said he thought the question of water management training and research had been studied as thoroughly as possible, and it was now time to decide one way or the other. A long debate ensued in which again no one disagreed with the importance of research on the management of irrigation water. But some still questioned whether such research was appropriate for the CGIAR, both because much of it would have to be specific to particular areas and because, as recommended by the second review committee, caution should be exercised in giving direct support to additional international centers that focused on a single factor of production. The main concern, however, was that funding of this new activity would encroach on the already-constrained budgets of the existing centers. In the end, this consideration proved to be decisive, and the Group reluctantly concluded that it should not take on this new activity. Nevertheless, there was widespread support for research in water management, and it was agreed that no other new activity had higher priority for financing by the Group.

A group of donors, with the Ford Foundation in the lead, had decided to meet informally to consider how to keep the initiative alive outside the CGIAR system should this prove necessary. The CGIAR agreed that if the informal group could prove in the future that incremental financing could be found that would not take resources away from ongoing activities, the proposal could be brought forward again for consideration. However, this has not yet happened. The informal group proceeded with the establishment, outside the CGIAR, of the International Irrigation Management Institute (IIMI), located in Sri Lanka. Ralph Cummings, who had retired as chairman of TAC, was recruited as a consultant to develop the proposal, and was acting director general of IIMI until Thomas Wickham was appointed to the post.

Considering the high priority everyone accorded to research on management of irrigation water, there could be no stronger commentary on the stringency of the financing problems facing the CGIAR, and on the conservative attitude of donors in response to them, than the Group's decision to put aside this initiative. Had an acceptable technical proposal come before the Group during its earlier and more bountiful years, it is more than likely that an irrigation water management research institute would now be part of the CGIAR.

Developing Country Donors

One of the most effective ways of ensuring the participation of developing countries in the business of the Group has been to bring them in as donor members. While the Group has welcomed additional donors, it saw the need—as an exception to its rule that the size of each donor's contribution was strictly a matter for the donor to decide—to set a minimum figure for new entrants. This figure was introduced in the mid-1970s at the level of $500,000. It was considered necessary in order to forestall an influx of members that would make the Group so large as to be unwieldy while adding little in the way of financial resources.

The countries that have served as hosts to individual international centers have been the principal source of developing country donor members, since they generally have been the ones most familiar with the work of the centers and whose national programs have benefited most from a close association with the centers. Nigeria was the first to become a donor; it did so in 1975,

at the time of the oil boom, and has continued to be a contributor and an active participant in the Group's affairs despite later reverses in its economic fortunes. About two-thirds of its contribution has been dedicated to IITA, but like subsequent developing country donors—and indeed all donors—it has been encouraged to support the work of a number of centers.

Iran became a donor in 1976 at the time that it was being considered as one of the host countries for ICARDA, but its membership lapsed after the revolution. The new government was not interested in providing a high-altitude site for ICARDA's work, and ICARDA's facilities were confined to Syria and Lebanon. The Philippines had been closely associated from the outset with the work of IRRI through its national university at Los Banos, and the minister of agriculture during the 1970s, Arturo Tanco, was very active in international agricultural affairs, serving, for example, as head of the World Food Council. The Philippines joined as a donor in 1980. India's association with the international centers went back to its early contacts with IRRI and CIMMYT in the 1960s. It was involved in the work of the Group, not only through its links to ICRISAT but also through the participation of its senior agricultural scientists on TAC and on the boards and staffs of the centers. It became a donor member in 1981, following a direct invitation from World Bank President McNamara to Prime Minister Indira Gandhi.

With three centers located in Latin America, it was important that this region be more actively represented also. Mexico was the host country of CIMMYT and its association with internationally supported agricultural research went back to 1943; it was therefore a logical choice. So was Brazil, which had a large research program of its own and enjoyed close relations with the IARCs in the region. As in the case of the other developing-country donor members (except Nigeria), several years of contacts and discussion preceded the decisions of Mexico and Brazil to contribute. The decisions were finally taken just as the international debt crisis reached serious proportions, and both countries have experienced difficulties in making good on their pledges.

The Group had long hoped that China—the country with the world's largest population and the highest production and consumption of food grains—would become a donor member and add its voice to the Group's deliberations. China had already made notable achievements of its own in research on high-yielding varieties. Its ties to IRRI had become very close; a Chi-

nese scientist sat on IRRI's board of trustees, and China had hosted a meeting of the board. There was an active program of scientific collaboration with IRRI, which gradually extended to many of the other centers as well. A World Bank loan to China to build a national rice research institute, for which IRRI provided advice and assistance, further solidified relations. The award of the Third World Prize to IRRI, which was made at a ceremony in Beijing in April 1983, afforded an opportunity for the chairman to repeat at first hand the invitation for China to become a donor member of the Group. It did so at Centers Week in November of that year, making a pledge for 1984.

Events of 1983 to 1985

The year 1983 was noteworthy in several other respects. It witnessed the first of the management reviews of a center. One of the recommendations of the second review committee, reflecting the Group's growing desire to ensure that the centers were effectively managed, was that the Secretariat commission "more penetrating reviews of the administration and management of the [centers]." Preferably these reviews would be conducted separately from but in conjunction with the external (quinquennial) program reviews commissioned by TAC. The first such review took place in 1983 in conjunction with the second external review of CIP. A special review team was recruited, led by Omond Solandt, an experienced Canadian research administrator who served on the boards of several of the international centers. Many of the center directors were nervous about the prospect of being subjected to a management review, but the review of CIP went well and did much to allay their concerns. The management reviews have touched on sensitive subjects, but have generally succeeded in dealing with them in a discreet but clear manner and have become an integral part of the Group's review mechanisms. Many of the recommendations have in fact been accepted, and implementation of them begun, before the reviews came to the Group, obviating the need for Group discussion.

Another innovation that took place in 1983 was the decision to establish a stabilization mechanism for better management of the Group's finances. One of the difficulties that had become aggravated during the time of financial stringency was the uncertainty caused by changes in the dollar value of nondollar contributions both from one year to the next and from the time those

contributions were pledged to their receipt. This was more than a bookkeeping problem, since a substantial part of a center's expenditure takes place in dollars. Coupled with this uncertainty were fluctuations in the dollar cost of operations arising from unexpected changes in the rate of inflation faced by the centers in the countries where they spent their money. In the past, centers had absorbed the costs resulting from these fluctuations and, if any gains accrued, were able to apply them to their programs. Sometimes technical adjustments to budget levels during the year would take account of these factors, with corresponding adjustments in the contributions from the Group. In one instance a very substantial sum was returned for reallocation to other centers following a sharp devaluation in the currency of the host country, which reduced the dollar cost of the center's program. These uncertainties, whether the end result was favorable or unfavorable, made proper management of resources problematic both for the center and for the system as a whole and underlined the need for some sort of stabilization mechanism.

Such a mechanism proved to be difficult in both its conceptual design and practical administration. (It is described at greater length in chapter 7.) It is too soon to make a judgment on its efficacy, the more so since the abatement of worldwide inflation has eased the problem somewhat.

Several other issues surfaced or became more prominent at this time. One, among those to be considered more fully in chapter 7, concerned the international status of the centers. The four original centers came into being as a result of an agreement between the Rockefeller or Ford Foundation and the host country, each of which had its special characteristics. Each of the centers subsequently established or adopted by the CGIAR tended to follow its own and somewhat original path toward acquiring a form of international status. As time went on, several of the centers found that some provisions of their charters or agreements were inadequate for their needs. Efforts to have the agreements modified or renegotiated with the host governments encountered snags, however, when the governments found anomalies in the agreements from their own point of view. During 1983–85, a substantial number of the centers were at various stages of discussion with their host countries, in some of which the chairman and Secretariat of the Group and the cosponsors were also involved, to seek clarification or change in some aspect of their international status.

It was also in 1983 that the Group decided to launch a study of the impact of the research activities it supported on agriculture

in the developing world. The initial studies of the results of the Green Revolution were by then largely out of date, and the CGIAR did not wish to rest on these laurels. Since research is a long-term enterprise requiring a commensurate commitment from its supporters, fresh evidence of what the IARCs had accomplished, and might reasonably expect to accomplish from the work in progress, was seen to be an important means of sustaining that commitment.

To carry conviction with the donor agencies, governments, and parliaments that were its ultimate audience, the impact study, as it came to be called, had not only to be objective but also to be seen to be objective. In addition to the customary practice of recruiting an outside study team—in this instance headed by Jock Anderson of the University of New England in Australia—the Group decided to have the team report to an advisory panel of distinguished scientists of international repute and without close connection with the work of the system. Frank Press, president of the National Academy of Sciences in the United States, served as chairman of the panel.

The design of the impact study proved to be difficult, and several workshops and symposiums were held to obtain advice from natural and social scientists both within and outside the system. The principal findings of the study, which were presented to the Group at Centers Week in 1985, form the main subject of chapter 8.

IBPGR and the FAO Connection

One center whose status has recently been called into question is the IBPGR. The situation of the IBPGR has always been ambivalent. It is financed by the CGIAR and has an independent board of trustees, but it is housed in the FAO, where the Secretariat has the status of an FAO division and its members, including the executive secretary, are FAO employees. The relationship, although uneasy and not free from problems, was workable in the early years, and IBPGR became an important mechanism for encouraging the worldwide collection and preservation of genetic resources.

In 1982 and 1983, circumstances began to change. The importance of preserving the world's heritage of plant life in all its variety for the benefit of present and future generations was becoming more widely recognized. Most of the varieties, both cultivated and wild, of scientific value were to be found in the

developing countries, yet many of these countries were ill equipped for the complicated and expensive task of establishing and managing reliable, useful collections. There was growing concern that as collections were built up under the control of industrial countries and autonomous institutions (including the IARCs) the interests of the developing countries would suffer. This led to consideration of ways to protect source countries' rights, which in turn raised fears that the free exchange of breeding material would be inhibited, thereby making international scientific collaboration more difficult. The FAO became the center of heated discussions as, encouraged by some of its member governments, it set out to institutionalize and systematize the collection and preservation of plant genetic resources under its own auspices. The outcome was the passage of two resolutions in 1983 by the Conference of the FAO: one adopted an "International Undertaking on Plant Genetic Resources" and the other requested the FAO Council to establish a "Commission on Plant Genetic Resources." Together, these two initiatives sought to institutionalize, through the FAO, a master system of collections of plant genetic resources and to set guidelines for establishing policies and for monitoring the collection and preservation of plants.

These proposals appeared to many members of the CGIAR to impinge on the role and work of the IBPGR and of those IARCs that maintained collections, an impression that was reinforced by some of the language of papers and statements presented to or made at the conference. At the November 1983 meeting, the Group adopted a statement to the effect that:

> The Group expressed its satisfaction with the accomplishments of IBPGR in the field of plant genetic resources. The Group reaffirmed the terms of reference of IBPGR and stated that the Board should continue as an autonomous, independent, international institution under the authority of the CGIAR working in close cooperation with FAO.

The director general of the FAO sought subsequently to allay the concerns reflected in this statement, but the issue could not be put to rest.

When the time came for the regular external reviews of the program and management of the IBPGR in 1985, this issue was very much in the forefront. Since it was important and sensitive, all parties embarked on the reviews with even more than the usual care. The customary separate reviews—one covering the

program and the other management—were combined, a management specialist being added to the review panel commissioned by TAC. The management review of IBPGR focused on three issues:

- *The role of the board of trustees.* Individual members of the board had typically been given advisory or operating tasks that at other IARCs would normally have been performed by members of the staff. The panel recommended that the board be relieved of its operational responsibilities, which should be transferred to the Secretariat. The board should then assume a policymaking role, like the boards of trustees of the other IARCs.
- *The organization of the Secretariat.* The panel found that the management burden of the executive secretary was not properly shared, and the staffing of the Secretariat was thin. It recommended the creation of a middle-management layer, the use of a more participatory management style, and a number of specific mechanisms for improving planning and internal communications.
- *Secretariat relations with the FAO.* The most serious concern of the panel was the Secretariat's lack of autonomy within the FAO. It felt that the executive secretary's dual accountability to the board and to the FAO created misunderstanding and tension. The FAO's administrative rules and procedures, although appropriate to a large organization, constrained IBPGR's operational effectiveness, as did a chronic lack of office space. In spite of efforts by the FAO management to accommodate the special needs of IBPGR, these limitations had proved intractable. They already hampered IBPGR's ability to carry out a dynamic and flexible program; they would become more severe as IBPGR's programs grew and as it attempted to attract the additional talent needed for the expanded research effort recommended by the external review.

The panel was under no illusions as to the political sensitivity of the issues it was raising. It sought to achieve two objectives that might not be easily reconciled: a close working relationship with the FAO and greater operational freedom and independence. It therefore presented two options:

- IBPGR should be reconstituted as an independent center with a liaison unit at the FAO, if an appropriate outside location for the center could be found and there was little likelihood of a major change in the present arrangements with the FAO.
- IBPGR should remain at the FAO, if a suitable location could not be found and if satisfactory changes could be made in the pres-

ent arrangements with the FAO, compatible with the conditions required for a research institution within the CGIAR.

The panel noted that it was not in a position to indicate a preference for one of those options. It therefore suggested that the CGIAR establish a special task force to resolve the uncertainties and make a final recommendation.

IBPGR itself had no difficulty in resolving the dilemma. Past experience of attempts to improve the arrangements with the FAO led it to conclude that the second option was not likely to provide the physical and managerial environment required to implement the changes recommended. In commenting on the panel's report, the IBPGR board strongly endorsed the first option, the more so since it was convinced that a suitable alternative location could be found.

TAC, upon receipt of the panel's report, was not prepared to move so quickly or decisively. It felt that it needed more information and study before it could assess the management constraints that reduced the efficiency of IBPGR or explore the issues involved with the FAO. It therefore set up a subcommittee to examine the management issues, as well as one of the scientific issues (concerning the establishment of a research capacity in IBPGR) in cooperation with IBPGR and the FAO.

The TAC subcommittee found that, despite the advantages of a functional relationship between IBPGR and the FAO, the rationale for separating the two was much stronger and more persuasive. It reasoned that "an operational unit headed by a director and controlled by its own board of trustees can hardly, either logically or functionally, be a subordinate part of the line management structure of a different organization. Equally, a board of trustees can hardly share its trusteeship with an entirely separate body, which is, in turn, controlled by its own governing council." It felt that the establishment of IBPGR as an autonomous institution could well enhance its ability to reach more effective understandings and working relations both with the FAO management and with the FAO Commission on Plant Genetic Resources.

Thus, the TAC subcommittee found compelling reasons of logic to eliminate the "anomalies" inherent in the "dichotomous structure" of the present IBPGR-FAO organization. It made several recommendations for enhancing cooperation between the FAO and IBPGR through recognition of a special relationship, adding that continuity in the location of IBPGR might avoid misunderstanding of the reasons for the proposed change in structure.

Bolstered by the subcommittee report, TAC, after further study and vigorous debate, recommended that "IBPGR be transformed into a small, autonomous nongovernmental institution within the framework of the CGIAR that would work closely with FAO, and give independent scientific and technical advice to national and international endeavors in plant genetic resource conservation." In order to maximize opportunities for collaboration, TAC recommended that the reconstituted institution remain in close proximity to the FAO and that the FAO enjoy a special relationship at the operational level. Further sensitivity to the FAO connection presumably was the reason behind an added proviso: "In case FAO should decide to provide the technical and scientific advice needed to support international germ plasm efforts, there might not be a strong case for a separate unit within the CGIAR and the situation would have to be reassessed."

The external review of the IBPGR was extensively discussed at the Group's midyear meeting in Tokyo in 1985. At the close, the chairman appointed a committee, with himself as chairman, to receive the final report of TAC (which was not ready at the time of the meeting) and to make recommendations to the Group at International Centers Week later in the year. The committee met twice. At its first meeting it "with some reluctance" accepted TAC's argument that in order to carry out its responsibilities for the policy and management of its program, IBPGR needed exclusive authority over its staff. The committee could not comprehend the logic of TAC's proviso referred to in the preceding paragraph and recorded its inability to agree with it. Nonetheless, the committee displayed its own caution in walking through the minefield of relations with the FAO. It requested its chairman to seek a meeting with the director general of the FAO "to examine with him the whole range of issues raised by the TAC proposal . . . and also to explore FAO's position on the possible improvement of present arrangements." This subsequent meeting aired the difficulties and problems on both sides, but it could not resolve them. The director general requested that the Group's views and proposals be given to him in writing, so that he could consider them and consult with his authorities.

At its second meeting, the committee decided to recommend that the Group continue its efforts to convince the FAO to change the arrangements, so as to make it possible for IBPGR to remain within the FAO. The committee also recommended, however, that steps be taken to explore what would be involved in setting up the board as an independent organization.

The issues were then debated by the Group at its meeting at the end of October 1985. Dissatisfaction was expressed with the existing situation, which was demoralizing the staff and impeding the work of IBPGR. It was decided that the chairman of the Group, in writing to the director general as the latter had requested, should make clear that changes should be made in the way IBPGR was run. The members of the board should collectively exercise oversight, but not have individual operational responsibilities. The staff should be responsible for carrying out the program and report solely to the board without receiving directions or other responsibilities from the FAO. The staff should not have to conform to the quotas, broad competitive promotion programs, or other requirements for filling positions that apply to the FAO as a whole. The members of the Group, reluctant to cut loose from the FAO, hoped that these changes could be accomplished in a way that would permit the board to remain formally part of the FAO. At the same time, however, they agreed that the possibility of reconstituting the board outside the FAO, but working in close collaboration with it, should be explored. The Group would consider at its midyear meeting in 1986 what action to take in light of the director general's reply. The last chapter of this particular story, therefore, cannot yet be written.

Troubled WARDA

WARDA has been a perennial source of concern to the Group, which has gone to considerable lengths to preserve and foster this potentially valuable attempt at West African intergovernmental cooperation on research, in the face of mounting difficulties. Whether it will succeed remains to be seen.

External scientific and management reviews of WARDA were undertaken in 1983. They concluded that WARDA had contributed substantially to the training of technicians and farmers in the basics of rice cultivation, but that its research activities were weak. Little had been accomplished in adapting technologies to the needs of the region, in part because WARDA had confined its activities to testing technologies imported from Asia rather than generating new technologies with its own applied research. The review panels found that the scientific staff was of a high caliber and able to conduct the required research, if appropriately directed. Improvements in the responsibilities, organization, management, and staffing of WARDA were recommended.

In the absence of positive action from WARDA's management, the Group at its November 1984 meeting took the unusual step of

suspending approval of WARDA's 1985 budget. The Governing Council of WARDA met the following month and decided to implement a number of the review recommendations, on the strength of which the CGIAR chairman recommended that donors approve and fund the 1985 budget.

WARDA has made progress on a number of fronts since then. The Scientific and Technical Committee (STC), reconstituted to include scientists from outside the region, has met several times. Although the role of the committee is only advisory, the Governing Council has delegated authority to it. More time is needed to ascertain whether the Governing Council will take the advice of the STC in critical areas where technical rather than political criteria should prevail.

WARDA's management, under a new acting executive secretary, has focused its program on four areas: upland rice, mangrove rice, irrigated and flooded rice, and deep-flooded rice. Establishment of an integrated research program, as recommended, has been handicapped by the fact that many donors restrict their financing to particular activities. This itself is in part a reflection of lack of confidence in WARDA's capacity to manage an integrated program effectively, but it thereby traps WARDA in a vicious circle. On other fronts, subregional offices have been closed, headquarters staff reduced, and substantial numbers of researchers transferred from headquarters into the field. Planned expenditures for 1985 have been brought into line with likely receipts. A full-time director of research and development, seconded by the Rockefeller Foundation, has strengthened WARDA's management.

Further progress in improving the effectiveness of WARDA's scientific program is seriously threatened by a financial crisis. In part this is due to the absence of a chief financial officer, despite efforts to recruit one, compounded by the resignation of a key professional staff member at the end of 1984. With its limited financial and accounting staff, WARDA is able to do little more than maintain its accounts, and even these have a substantial backlog. The principal difficulty, however, lies in a critical cash flow problem that is the result of declining support from WARDA's member states. The severity of this problem is indicated by the fact that at the time of Centers Week in October 1985 WARDA had debts of about $3 million and no credit. Payments to staff were in arrears, and all its suppliers were demanding advance payment.

WARDA's research programs are financed in their entirety by external donors, except for overhead financed through the administrative budget. Contributions from the member states are used to fund WARDA's administrative budget, which has

amounted in the past to about $3 million a year (including some funds for special projects in member states). Only two of the fifteen dues-paying members (Chad is exempt from financial contributions until 1987) were more or less current at the end of 1984. A majority of the members are delinquent in their contributions for at least two years and a considerable number are delinquent up to five years. Of the agreed 1985 contributions of $3 million, only $0.2 million had been received by the end of September.

CGIAR donors have taken various steps to shore up WARDA's finances. They have agreed to include overhead contributions in their payments for special projects. Several donors have made early payments or allowed the World Bank to advance funds against payments due later in the year. The temporary services of a financial controller have been provided. USAID has worked closely with WARDA management to reduce the time required for reimbursement under its procedures. The World Bank has offered to allow member states to use a part of appropriate loans and credits for payment of past and present membership dues, and the Bank has intimated that if member countries were to utilize this offer and clear their arrears it would consider providing a working capital grant to WARDA. To date no member countries have availed themselves of this opportunity.

These various measures have kept WARDA afloat, but its future remains clouded. At the 1985 Centers Week, it was clear that donors were becoming seriously disillusioned with the lack of support given to WARDA by its member states. Grave doubts were expressed that WARDA could continue in its present form. It was decided to approve further funding of the association for only the first half of 1986, pending action by its Governing Council to make structural changes that would give WARDA's management greater independence and action by the member states to meet their obligations. The Group planned to decide at its mid-1986 meeting whether to continue support of WARDA in its present form or to find some other way to support rice research in West Africa.

The Old Order Changes

One of the most noticeable changes taking place toward the end of the period under review was that some of those most closely involved in the affairs of the CGIAR for a good many years

were retiring from the scene. Ralph Cummings, who had been chairman of TAC for five years, retired from that position early in 1982. Michael Lejeune, who had held office for eight years as the executive secretary of the CGIAR, retired at the end of 1982, at the same time that Philippe Mahler, who had been executive secretary of TAC for five years, left to take another position in the FAO.

The way in which these vacant positions were filled says something about the evolution of the Group's procedures. The first chairman of TAC, Sir John Crawford, was designated at the time the CGIAR was established through the same process of informal agreement among the interested parties that applied to other aspects of the Group's initial organization and management. The cosponsors assumed responsibility for choosing his successor, but when they were unable to agree the matter had to be put to the Group for decision (see the discussion in chapter 3). When Cummings retired, the cosponsors agreed among themselves on the procedure they proposed to follow in seeking a replacement and then circulated the proposal to the members of the Group for their comment. In accordance with the agreed procedure, nominations were widely solicited from all parts of the system; from the long list that resulted, the cosponsors culled out a list of five candidates, which was submitted to the members for their comment. On the basis of their assessment of these comments, the cosponsors nominated Guy Camus, director general of the French Office of Scientific and Technical Research Overseas (ORSTOM, its French acronym) to be TAC's new chairman, and the Group approved. It was agreed among the cosponsors that the TAC chairman would serve for a term of three years, which could be (and was) renewed.

The three previous incumbents of the position of executive secretary of the CGIAR had all been World Bank staff members appointed by the president of the Bank without consultation. In line with the recommendations of the second review committee report, the chairman appointed a small search committee from within the system to advise and assist in his selection of a successor. The committee interviewed the most promising of the large number of applicants and gave the chairman a short list of candidates from which he selected Curtis Farrar, who at the time was deputy assistant senior administrator for science and technology, USAID. The director general of the FAO had previously appointed the executive secretary of TAC from within the FAO staff and without prior consultation, even though the other two cosponsors shared in the costs of the TAC Secretariat, but on this

occasion he followed a similar procedure to that used for the executive secretary of the CGIAR, with the chairman of TAC serving on the advisory group. Alexander von der Osten, a staff member of ISNAR, was chosen to be the new executive secretary of TAC. A similar procedure was followed when von der Osten left to become the director general of ISNAR in 1985, and John Monyo became his replacement.

The first and second chairmen of the Group were World Bank officials designated by the Bank's president, who informed the cosponsors and the membership as a whole of his decision. At the end of 1983, I stepped down as chairman. In announcing my decision to the Group, I observed that there were no rules applying to the chairman's term of service, but I felt that ten years was as long as one individual should serve in such a capacity. My successor, S. Shahid Husain, also a World Bank vice president, was nominated by the president of the Bank after consultation with the other cosponsors, and the members were informed of the president's intention before the appointment was finalized. Through these evolving procedures the Group managed, in its informal way, to combine the need for consultation with the need for the responsible authorities to make decisions. In 1984, two other individuals who had long served the Group, in this case as representatives of the cosponsoring agencies—William T. Mashler of the UNDP and Montague Yudelman of the World Bank—also retired. Dieter Bommer of the FAO, the last of the long-serving triumvirate of cosponsors' representatives, retired a year later.

These were not the only changes. Many another old-timer among the donor representatives had reached retirement age or was about to do so. With so many changes entailing the transfer of responsibility into new hands, there was a widespread feeling that one era had come to a close and a new one was beginning. While this occasioned moments of nostalgia, the fact was that the Group had come of age. The small, personalized network of "old boys" on whom the Group had heavily depended in its early years had been outgrown. In its stead, the Group had forged the institutions, procedures, and broad base of multilateral and multinational support that would ensure its ability to function effectively in the years ahead.

6

Organization, Management, and Governance: How the System Works

THE CGIAR SYSTEM has essentially two components: the international agricultural research centers or institutes; and what might collectively be called the Consultative Group, consisting of the members of the Group itself (donors, cosponsors, and developing country representatives), the Technical Advisory Committee, and the two secretariats that provide services to the Consultative Group and to TAC. The centers are, of course, the heart of the system and its reason for being. The original centers predate the formation of the CGIAR in 1971. IRRI, generally acknowledged to be the first of the IARCs, celebrated its twenty-fifth anniversary in 1985. But IRRI should share some of the honor with CIMMYT, since IRRI's concept drew heavily on the experience of the Rockefeller-Mexico collaborative program of agricultural research, which was the antecedent of CIMMYT. The circumstances resulting in the creation of these two "flagship" centers, and the somewhat uneven path leading to the establishment or adoption of the remainder of the thirteen centers now under the aegis of the CGIAR, have been detailed in earlier chapters.

The Centers

The label of "international agricultural research center" accurately describes most of the thirteen organizations, but for some it fits loosely, if at all. Although all are international in character,

a few do not have research as their primary function, and one or two could probably not meet a strict definition of a center. I shall nevertheless continue, for convenience, the practice followed by the CGIAR of referring to the thirteen as "institutes" or "centers."

Coverage and Mandates

Eight of the thirteen centers (CIAT, CIMMYT, CIP, ICARDA, ICRISAT, IITA, IRRI, and WARDA) are directly concerned with plant breeding to develop higher-yielding varieties of crops and better ways of cultivating them. CIAT, through its work on pastures, and ICARDA are also concerned with livestock. Of the remaining centers, ILCA is concerned solely with livestock and does research on production systems, just as the others study farming systems. ILRAD alone is engaged almost wholly in strategic or basic research, in this case focused on inducing immunity to two important diseases of livestock in Africa. The other three institutes are more in the nature of service organizations. IFPRI does research and analysis on world food problems and policies for the benefit of members of the Group, centers, developing countries, and the world at large, while ISNAR has the mandate of assisting developing countries to plan, organize, and manage their national research programs more effectively.[1] IBPGR, as its name suggests, is more a "board" than a "center," although it has a secretariat staff; it does not carry out research or collect genetic materials itself, but provides stimulus and funding for research and other projects that promote the collection, documentation, evaluation, conservation, and utilization of genetic resources of important species. Unlike the other centers, WARDA is an intergovernmental association (of sixteen West African countries), and as a consequence its organization and management differ markedly from the rest.

Although the objectives of the CGIAR, as adopted at the founding meeting in 1971, refer broadly to international and regional agricultural research, they make it clear that special efforts should be directed to "critical subject sectors unlikely otherwise to be adequately covered by existing research facilities." At the very beginning the Group decided to give priority to food pro-

1. ISNAR does a small amount of research on how developing countries should conduct agricultural research.

duction—or more precisely to increasing the quantity and improving the quality of food supplies in developing countries—and has not deviated from that decision in subsequent years. Not only has the Group declined to engage in research on nonfood agricultural activities (such as cotton growing or forestry), but among the food crops it has chosen to concentrate its research on those both produced *and* consumed in the developing countries, to the exclusion of crops (such as coconuts or sugar cane) used primarily for export, even though they may also be in need of more and better research.

The Group has also, as we have seen, been reluctant to sponsor centers (such as ICIPE and IFDC) that do research only on a factor of production. The Group's policy, as it has evolved pragmatically over the years, is that it supports research on individual factors of production when the research is done at one of the existing international centers as part of a multidisciplinary crop improvement program or a farming systems research program. But it believes that research on individual factors is on the whole being done adequately, often by the industries concerned with manufacturing the product, and need not be pursued separately at the international level under its aegis. It also tends to believe that many of the problems of how to use individual factors of production are specific to limited ecological areas and therefore not amenable to research at the international level. This policy has not been without controversy; there are definitional questions, and some have argued that several of the existing centers are primarily engaged in what might be interpreted as factor-oriented research. (We will return to this subject in the next chapter.)

Through its combination of commodity-based and geographically oriented centers, the system has achieved comprehensive coverage of the basic food crops. Priority has been given to research on cereals, cassava, potatoes, certain pulses, soybeans, and livestock; together these account for about 75 percent of the food consumption (as measured by calorie intake) in the developing countries.

Cereals are the most important source of food for people in the developing countries. Preeminent among the cereals are rice, wheat, and maize, which together provide a large proportion of the total supply of calories and are major crops within the CGIAR system. In addition, priority is given to research on sorghum and millet, which constitute the almost exclusive source of calories for some of the poorest countries of the semiarid tropics,

particularly in the Indian subcontinent and in the Sahel region of Africa. Moreover, there has been much less research on sorghum and millet than on rice, wheat, and maize. Because barley is somewhat more tolerant of drought than wheat, it is not excluded from the system's research, but it is clearly of secondary importance.

Important as the cereals are in feeding the large populations of developing countries, there are other crops which, in the humid tropics of Africa and Latin America and the higher and cooler tropical regions, are the staple food. Cassava, yams, potatoes, other roots and tubers, and such crops as bananas and plantains, fall into this group. Much less effort has been put into research on them in the past, in part because they are difficult crops to work with. Most of them are vegetatively propagated and so are more difficult to breed than cereals; also, they often have more persistent pest and disease problems. Moreover, root crops are more bulky and perishable than grains and consequently more difficult to store, to transport, and to market. Because so many people are dependent on cassava as a staple food, the Rockefeller and Ford Foundations, in establishing CIAT and IITA, gave cassava research high priority in their programs, a decision that the Group has sustained.[2] The Group also supports a strong research effort on the potato through CIP.

Because they are important sources of protein and certain essential amino acids that are deficient in cereal grains, pulses (dry beans, cowpeas and chickpeas, pigeon peas, broad beans, and lentils) have been included. Important as they are nutritionally, however, they cannot compare with the cereals in economic significance, and few pulse species are grown over a wide area. These differences have caused TAC some uncertainty about their place in the international research system.

If somewhat dubious about pulses, the Group has been distinctly ambivalent about vegetables. TAC has repeatedly emphasized the importance of vegetables in the diets of people in the developing countries. After protracted and difficult consideration of the subject, it recommended that the Group add vegetable research to its program. The Group, however, even more than TAC, has found this a difficult question, clouded in the early days by politics and more recently by a shortage of funds. Members of

2. The 1984 external program review of CIAT raised questions concerning the priority of cassava in its program.

the Group were also concerned that, although vegetables collectively were important worldwide, many vegetable species and varieties were of only local importance; the Group found it hard to identify what sort of international role a vegetable research center could play. Leguminous oil seeds have fared better. Support is given to a soybean research program at IITA and to groundnuts research at ICRISAT.

The priority to be given to research related to animals and animal products has, in the eyes of the Group's donor members, been less clear than the priority to research on food plants. In some countries cattle raising is a principal way of life, and economic development depends upon making it more productive; but in others, where land is scarce and population dense, livestock may compete with humans for available food. While livestock as part of farming systems comes under study at ICARDA and forage improvement on acid soils is an important program at CIAT, it is in Africa that the Group's main effort on animal research is taking place. Not only are cattle of overwhelming importance in many parts of Africa, but they would dominate the economies of many other areas in Africa were it not for the presence of trypanosomiasis (sleeping sickness), which closes vast, otherwise suitable areas to them.

The centers' mandates also cover all of the main geographical and ecological zones of the developing world. This is not obvious from their physical locations, since some of the centers (CIMMYT, CIP, IRRI) have a worldwide mandate for their crops, while others serve only one geographical region (WARDA), and still others (CIAT, ICARDA, ICRISAT, IITA) have regional responsibility for some crops and global responsibility for others. ILCA is concerned with livestock production only in Africa, and ILRAD with two livestock diseases prevalent in Africa although its work has relevance elsewhere.

Within the major geographical and ecological zones there are, of course, important differences in agricultural conditions, which affect the amount and kinds of food that can be grown. IRRI initially focused its research on irrigated rice, where the opportunities for substantial increases in production from the combined use of water, improved seeds, and fertilizer were greatest. It has now shifted more of its attention to upland and other rainfed areas, where the research problems are more difficult but where the farmers are poorer. Other centers are also giving more attention to research on the food production problems of resource-poor areas and on the crops grown in these

areas. This increasing emphasis on poverty-related research is most clearly evident in the Group's activities in Africa. Not only are four of the thirteen centers located in Africa, but all of the centers are working in that continent and ICRISAT has recently established a subcenter in the Sahel. Nevertheless, more could be done, as I will argue in the next chapter.

Characteristics

INTERNATIONAL STATUS. Despite their diversity, most of the IARCs share a number of common features that define their character as international centers. (The exceptions—WARDA and in some respects IBPGR—have already been mentioned and will not be repeated in each instance.) The first of these features is international status. In addition to their global or regional mandates already described, the centers are governed by autonomous boards of trustees drawn from many countries and are served by international staffs. These points will be elaborated upon below.

Each of the centers also has a particular legal relationship with its host country. The precise legal status differs from case to case, and a number of the centers have encountered problems in connection with their international status that will be discussed further in the next chapter. In general, they are incorporated under the laws of their host countries, and by virtue of these laws or by negotiated agreement they enjoy certain privileges and immunities. Typically, these provide that the center itself shall be immune from legal process, its premises and property shall be free from search or confiscation, its archives shall be inviolable, it shall be allowed to move funds in and out of the country without restriction, and it shall be exempt from direct taxes, customs duties, and import or export restrictions. Moreover, the host government normally undertakes to facilitate the expeditious issuance of visas and clearance for entry into the country of board members, staff, trainees, and official visitors to the center and to allow unrestricted movement of genetic materials into and out of the country, subject only to appropriate quarantine regulations to prevent the import or export of harmful diseases or pests. In some instances the right of the center to establish employment policies and conditions for staff on an international basis without discrimination as to nationality or origin or any consideration other than qualification, merit, and experience is specifically guaranteed, but in others it is not. The right of the center to

publish internationally the results of its research may be explicitly provided.

The trustees and staff of the center also typically enjoy certain privileges and immunities. They are usually exempt from legal process with respect to acts performed by them in the exercise of their official functions, except when the center waives this immunity. Foreigners normally are exempt from paying tax to the host country on their income from the center and are free to import without duty their personal household effects when joining the staff of the center.

Thus, the IARCs have many of the attributes of international organizations. They are not, however, international in the sense of being institutions that have been created under international treaty.

Whatever their legal status, all the centers have a special relationship with their host countries. In the case of crop or livestock research institutions requiring land for their field experiments and for their laboratories, the host country normally has acquired the land and either granted it to the center or leased it at a nominal rent. In most instances there is a close association between the research institutions of the host country and the international center, and several of the centers were intentionally located adjacent to national universities or national research facilities. While a center may have collaborative programs with many countries, collaboration with the host country is usually particularly close and has remained so through successive changes of government. The relationship is not always an easy one, however. The large disparities between international and national scientists in salaries and living conditions, and often in research facilities, have generated problems, as has on occasion the attribution of credit for scientific findings resulting from collaborative programs. (The latter is one reason why the IARCs no longer give their names to varieties released by them and which enter national programs.)

INTERNATIONAL BOARD OF TRUSTEES. The international character of the center is further safeguarded through an autonomous, largely self-perpetuating board of trustees whose members, drawn from different countries, generally serve in their individual capacities. In this and other respects of their organization and management, the centers have been patterned on the model of autonomous, nonprofit educational, scientific, and charitable organizations traditional in the United States and commonly found in Canada and Great Britain.

Responsibility for management of the center is vested in the board of trustees. Typically, once a board of trustees has been established, about two-thirds of the trustees (or board members) are elected by the board itself and in this sense it is self-perpetuating (although each board, under its bylaws or by custom, limits the service of any individual member to a maximum of two or three consecutive terms, as recommended by the second CGIAR review committee, and thus ensures a regular renewal of its membership). In all cases the director, or director general, of the center is a member of the board ex officio. One or two, and occasionally more, seats are filled by persons designated by the host country. These are usually senior government officials concerned with agriculture or agricultural research (such as the minister or deputy minister of agriculture or the head of the national research organization). Typically, about three other seats are also reserved. The Ford and Rockefeller Foundations were represented ex officio on the boards of the four centers created by them before the CGIAR was established, but these seats have now been relinquished. In virtually all of the centers, three seats are now reserved for persons designated by the Consultative Group. The chairman is selected by the board, generally from among its members. Boards have recognized that it would not be appropriate to have the chairman come from the host country, but it is not uncommon for the vice chairman to be a national of that country.

However they may have been appointed, all members of the board, except possibly those representing the host government, serve in principle in their individual capacities, receive no instructions, and are not required to make reports. Donors vary as to whether they seek to have persons from their organizations appointed to the boards of centers in which they have an interest. As a matter of policy, some of the larger donors prohibit members of their organizations from serving on the boards of institutions to which they contribute funds, to avoid any suggestion of a conflict of interest. (They may, however, regularly send observers to attend board meetings.) Other donors allow members of their organizations to serve on boards if invited to do so. By and large, however, not many of the members of the boards of centers are members of the staffs of donor organizations, and the majority of members of each board are individuals unconnected with either the host country or the donors.

Taking the boards as a whole, about half of their members

come from developing countries. This has been a deliberate policy in most instances, to provide for effective participation of developing countries in the management of the center's affairs. Most of the board members—whether from industrial or developing countries—are scientists or research administrators chosen for their particular competence. Not many of them are likely to have had firsthand knowledge about the CGIAR before joining the board.

There is a common selection process for the seats reserved for designation by the Group. It is administered by the Group's Secretariat in conjunction with the board of the center, or its nominating committee if there is one. Candidates for these seats are suggested by both the members of the Group and the board; a short list of candidates acceptable to the board is arrived at through consultation; and candidates selected from this short list by the board are put to the Group for its approval, after which the persons selected are appointed to the board. (The full process, which includes more steps than those summarized above, takes approximately six months.) The individuals selected through this process have had a variety of experience, have come from developing as well as industrial countries, and have had administrative, financial, or scientific backgrounds. The purpose of selecting three members of a board in this way is to help ensure that the board's membership is balanced, widely informed, objective, and of high quality, rather than to provide representation of the Group as such.

The board of a center is responsible for establishing its policies and guiding the director general in its management. One of the most important functions of the board is to select and appoint the director. In the early years of the CGIAR this was sometimes an informal process; now procedures are more formal, and the consultation with all interested parties more thorough. Usually the board appoints a search committee of its members, which advertizes the post internationally, solicits suggestions of candidates from persons within and outside the system, reviews credentials, interviews the most promising candidates, and then makes its recommendation to the full board for a decision.

Boards meet only occasionally, most only once a year and few more than twice. But committees of the board may meet in between board meetings, and most boards have an executive committee that is empowered to act for the board between meetings. Normally there is a program committee, a budget or finance

committee, and possibly an audit committee, as well as certain other standing committees such as a nominating committee for proposing new members of the board.

IS AUTONOMY AN ANOMALY? The sense in which the boards of trustees can be said to be autonomous or independent deserves closer scrutiny. The Ford and Rockefeller Foundations, in introducing the concept of international centers, clearly intended that the boards of trustees would be independent of host government control so that they would be free to serve all developing countries within their mandate. This has been accomplished. The foundations also intended that the centers be managed as objective, scientific, and apolitical entities, and this too has been accomplished. But it should be recognized that in the early years following their establishment, the four original centers were very much under the influence, if not control, of the foundations. The board chairman was likely to have been selected by the foundations or to be a foundation official. Seats on the board were reserved for representatives of the foundations. The center director and some of the senior staff were also likely to have been selected by the foundations and to be regular staff members or under contract to them. Last but by no means least, the foundations provided most or all of the funds and held a close rein on the purse strings.

The close involvement of the foundations in the management of the centers was undoubtedly crucial to their successful launching. Whether the situation would have changed with the passage of time is impossible to say, since the formation of the CGIAR created a new set of circumstances. The Group, for the same reason as the foundations, has prized the autonomy and scientific integrity of the management of the centers. It has recognized and accepted that the centers must be free from interference by donors in the pursuit of their scientific objectives. But as financial resources for the system as a whole have become strained, the Group's concern that the centers manage these resources efficiently and in the collective interest of the system as a whole has mounted. It has given rise both to the panoply of reviews described later and to a tightening of the Group's grip on the purse strings through a more comprehensive process of budgetary allocation and review.

In the last analysis, there can be no question that the independence of the boards of trustees is circumscribed by their need to be accountable to the Group which provides their funding. If a center were to lose the confidence of a significant number of its

donors, it could not long survive. This point has been made—quietly and behind the scenes—by the chairman or executive secretary of the CGIAR on those very infrequent occasions when a problem emerged at a center that appeared to threaten the broader interests of the Group. It has been possible in each instance promptly to work out a satisfactory solution.

A few (but by no means all) of the center boards were slow to recognize and accept the need to reconcile autonomy with accountability. Hence the subject was covered at length in the second review of the CGIAR system, which recommended that each board "should therefore conduct its affairs as if it were accountable to the Group, even though its legal status makes no provision for this relationship."

Within the inescapable constraints of limited resources and the need for accountability in the use of public funds, the Group in practice exercises its influence lightly. It has prized the spirit of independence and resourcefulness shown by most center managers. In fact, if there is a problem, it is less that of undue CGIAR interference than of a certain parochialism on the part of a few boards and their need for a greater appreciation of their center's role as an integral part of a wider system under the auspices of an international group. That such a problem might exist is not too surprising, in view of the infrequency of board meetings, the initial lack of familiarity of many trustees with the system, and the board chairman's physical remoteness from the day-to-day activities of the center. Reserving seats for members selected by the Group has helped to strengthen the boards. Without sacrificing their independence, the group-appointed board members could be assisted by the Group and its services to foster within the boards a greater awareness of their role within the system. Better briefing of new trustees—whether Group-appointed or not—would also help to this end. A briefing paper on board responsibilities prepared by Lowell Hardin and formally adopted by the Group at its meeting in November 1984 is helping to serve this purpose.

Although the center directors have from the beginning met together regularly to discuss common problems, for many years the board chairmen confined themselves to a ritualistic dinner at the time of Centers Week, attended by the cosponsors and heads of the Group's services, that did little more than reestablish acquaintances and make new ones. This situation has improved markedly since the issuance of the report of the second review committee. The board chairmen are meeting together more fre-

quently and dealing systematically and constructively with a wide range of common issues.

Directors and Staff

The center director occupies the key position in the management of the center and hence is critical to the effective working of the system as a whole. Although appointed by and responsible to the board of trustees, the director customarily enjoys a high degree of autonomy in managing the center, a task that calls for a rare combination of skills. The center director must be

- the manager of a large, far-flung enterprise
- the scientific leader of a complex research program
- a diplomat adept in dealing with the host country and other developing countries
- an entrepreneur in promoting the support of donor countries
- an expert in public relations to deal with the media and the public at large.

Such paragons are not easy to locate, and the larger centers have found it desirable to complement—or supplement—the director with one or more deputies in charge, for example, of research or administration. Most of the directors come from industrial countries, but in 1985 three came from developing countries (the Gambia, India, and Sudan). As in the case of the board chairman, no center director has been a national of the host (developing) country. On the whole, the Group has been very well served by center directors of high calibre.

Basic to the concept of an "international" center is that in recruiting its professional staff the center should be able to attract high-quality talent from a large number of countries, providing them with favorable salary and working conditions. This has been the practice in all cases. The larger, "mature" centers have some sixty to eighty senior or high-level professional staff working on their core programs. Some sixty nationalities—divided roughly equally between industrial and developing countries—are represented among these staff, which total 600 for the system as a whole and 775 if staff working on special projects are included. Support staff—secretaries, farm workers, maintenance staff, and so forth—are generally recruited locally. Their numbers are harder to come by, but it is estimated that there are about 6,000 of them throughout the system. In host countries with large national research programs (such as India, Mexico,

and the Philippines), some of the professional scientists may also be recruited locally. This has some advantages, but the disparities in salary and research facilities between them and their colleagues in the national program can present problems.

Centers of Excellence

The original centers were designed by the foundations to be "centers of excellence."This concept was readily adopted by the founders of the CGIAR and closely followed in the establishment and operation of centers under its auspices. Several ingredients of the formula for excellence—international status, independence of management, and international recruitment of the director and senior staff—have already been mentioned. Assured of long-term support from the international aid community, the centers are equipped to modern standards and generally conduct their research at the forefront of the state of the art. Their ability to bring together the basic research coming from academic and other institutions in the more advanced countries with the practical experience of fieldwork in developing countries imparts a synergism that enhances the effectiveness of the centers' research programs.

The centers are also designed to have a large "critical mass" of scientists and equipment that enables them to carry out research on a larger scale—and hence to achieve results more quickly—than is possible in the national programs of most developing countries. Thus, CIMMYT undertakes 13,000 crosses annually as part of its wheat-breeding program, in comparison with a range of 200 to 500 crosses in typical national programs.

Their international character makes it possible for the centers to enlist the cooperation of many developing countries and to establish collaborative programs with them that are an integral part of the process of accelerating the development and transfer of new technology. Scientists at the centers are generally organized into multidisciplinary teams; plant breeders, agronomists, entomologists, soil scientists, plant pathologists, and others work together on mission-oriented research projects aimed at solving problems that have been identified in the countries that the centers are serving. The emphasis throughout is on applied research to develop new technologies that can be adapted to the needs of developing countries and—through the further and complementary work of the national research and extension programs—adopted by their farmers.

Finally, most of the research findings and technology that the centers produce and the services they provide are made available without charge. This is in keeping with their character as institutions providing a public service and receiving their support from governments, international institutions, or charitable foundations. The readiness of the developing countries to draw on the services of the international centers and to collaborate with them is no doubt enhanced by the fact that they can do so at little cost. This arrangement in turn helps to ensure that the resources provided by the members of the CGIAR are put to effective use.

This formula for "centers of excellence" has underlaid much of the success of the CGIAR, as will be argued in chapter 8. As some of the research gaps have begun to be filled and as national programs in developing countries have been strengthened, the emphasis has shifted somewhat toward "networking," in which the IARCs act as the hub of a collaborative network that radiates out to many developing countries. Networking is discussed more fully in the next chapter.

Basic Functions

The functions of the majority of centers (those concerned with crop research) can be divided into four categories: research on plant varieties and farming systems; dissemination of information on research findings; training of researchers from developing countries; and collection, conservation, evaluation, and documentation of genetic resources. To carry out these activities, these centers have annual expenditures ranging up to $23 million, of which a relatively small amount ($1 million to $2 million) is typically for new capital items and the remainder for operations, maintenance, and renewal or replacement of plant and equipment. It is not possible to separate the budget into the four categories listed above, but another classification roughly indicates the allocation of resources: 60 percent of a center's budget is for salaries, 24 percent for supplies and maintenance, 6 percent for travel, and 10 percent for other activities. In addition to these core activities basic to their mandates, the centers carry out special projects of research or technical assistance, funded separately by donors, that have already been mentioned and will be discussed more fully in chapter 7.

RESEARCH PROGRAMS. First among the activities of the centers, and fundamental to their mission, is the breeding and test-

ing of genetic materials. The centers' breeding programs are largely carried out in experimental plots on the centers' campuses. Their goal is to increase or stabilize the yield of plants, and to improve their quality, by raising their resistance to diseases or pests, their insensitivity to day length, their responsiveness to fertilizers, and their nutritive value.

The breeding and, to an even greater degree, the testing and validating of experimental materials under the various environmental conditions in which they may eventually be grown also involve the centers in collaborative exchanges with national research programs in many developing countries. Thus, institutions in over a hundred countries participate in CIMMYT's international nursery networks, and some 700 scientists in seventy-five countries worldwide participate in IRRI's international rice-testing program. ICRISAT coordinates the International Sorghum Variety Adaptation Trials in which thirty-seven countries participate, and CIAT is at the center of the International Bean Yield and Adaptation Nursery in which thirty-nine countries participate.

Research on agronomic practices and farming systems is also carried out by most of the centers. A few centers, most notably CIP, have contracted parts of their core research program to other institutions, usually universities or other basic research organizations. For most centers, contacts with academic institutions conducting research relevant to their work are less formal.

INFORMATION DISSEMINATION. Facilitating the transfer of technology through the dissemination of new knowledge is a principal function in its own right. Operating as they do on a regional or worldwide scale, and forming a link between basic and strategic research (which is done for the most part in the developed countries) and applied research carried out by national research institutions throughout the developing world, the centers have an important role in getting information on new technology into the hands of national institutions where further work can be done to adapt the technology to local circumstances. All of the centers sponsor or arrange conferences, seminars, symposiums, and workshops for the exchange of information and the dissemination of their own and other research findings. All also have various forms of publications, ranging from periodic newsletters to major books and reports.

TRAINING. In most developing countries, a shortage of well-trained scientists is a critical obstacle to the success of their na-

tional research efforts. Furthermore, successful collaboration on research and the eventual transfer of the new technology require that scientists in the developing countries be capable of working closely with their counterparts at the international centers. So from the beginning it was planned that the centers would take in scientists and other research workers from developing countries to learn at first hand the centers' methods and techniques. The training needs of developing country scientists are too large to be met fully in this way, but by careful focus of the training programs and selection of the trainees, the centers can increase the efficacy of the collaborative programs and facilitate the transfer of new technology.

Most training courses range in duration from one week to six months (individual courses for scientists and technicians, which are sometimes linked to university degree programs, can take up to several years). In any year, up to 500 people from developing countries are likely to be trained at each of the larger IARCs. Typically at least 10 percent of a center's budget is devoted to training, but this is not the full measure, for it is customary for program leaders and other center scientists to travel widely in the countries with which the center has collaborative programs. These visits afford them useful opportunities to share their ideas and experience with their local counterparts and to encourage local efforts, thus providing a valuable supplement to the formal training programs. The centers also accept a limited number of candidates from both industrial and developing countries for doctoral or postdoctoral work.

GENETIC CONSERVATION. Germ plasm contains the genes that transmit heritable characteristics. It is therefore the basis of all plant breeding. Research on improved varieties depends on having readily at hand the genetic material of many different but related varieties which, by crossing, can be used to develop characteristics better suited to withstanding stress and increasing yield. Each of the centers involved in plant breeding maintains its own stock of the seeds or other genetic material needed for its breeding programs.

There is, beyond this, a broader need to preserve from extinction the thousands of varieties, domestic and wild, that might have characteristics useful in developing improved varieties in the future. Not only must the varieties be saved from extinction through disuse or unendurable stress or destruction as a result of land development, but their genetic material must be kept under controlled conditions of moisture and temperature to ensure

they will germinate when used years later. Moreover, these thousands of varieties need to be defined and their characteristics catalogued in a way that will make them useful to scientists. The crop research centers have a vital function of collecting, conserving, cataloguing, and evaluating plant varieties as part of the worldwide network of gene banks being established or coordinated by the IBPGR and others. IRRI, for example, has in its gene bank 80,000 of the world's estimated 150,000–200,000 rice varieties and is adding to the collection at the rate of about 5,000 accessions annually.

How staff is organized to carry out the four basic functions just described differs from center to center and hardly lends itself to generalization. Basically, two kinds of organization are possible. One is to organize according to function or discipline—plant breeding in one department, plant pathology in another, and agronomy in a third, for example. Economic research and research on farming systems may be separate departments, too. However, most of the research in the centers is multidisciplinary, and most centers have chosen to organize their work in individual, multidisciplinary programs according to the crop or problem being researched, bringing into each program the scientists and support staff necessary for its full development. Certain activities, such as library, information, genetic resources, and laboratory services, are normally centralized.

Intercenter Relations

The thirteen centers share common interests and, to a limited extent, common programs. When two or more centers are engaged in research on the same crop, they sometimes have a formal understanding on the division of responsibility. CIMMYT's and ICARDA's sharing of responsibility for work on different kinds of wheat is an example. Sometimes a center will carry out research on behalf of another or in close coordination with it. For this kind of cooperation there are various arrangements. ICRISAT has major responsibility for research on chickpeas, but ICARDA has a program on the particular type grown widely in the Middle East. Two ICRISAT staff members are posted to ICARDA for work on this shared program. At the other extreme, a center may do no more than act as host as a convenience for staff members from another center who happen to be working in its geographical area.

Problems of coordination and of securing an appropriate division of labor have arisen from time to time, however, when two or more centers have had responsibility for a particular crop (typically one center with a global mandate and one or more with regional mandates, such as CIAT and IITA in the case of cassava). While recognizing that a certain amount of competition may be healthy, the Group has been concerned about possible duplication of facilities and effort. The sharing of responsibility for rice research between IRRI, CIAT, IITA, and WARDA is a case in point. The issue was finally resolved when the four centers involved reached agreement among themselves on what their respective responsibilities would be. Even more contentious proved to be the question of how CIMMYT and ICARDA would divide responsibility for research on durum wheat and barley, a question that TAC and the Group deliberately left unresolved when ICARDA was formed. TAC's efforts over a period of years to use its good offices to bring about a mutually acceptable compromise did not bear fruit. The Group's impatience mounted, and with the issue raised once more in the quinquennial review of CIMMYT, the two center directors concerned reached an accommodation in 1983 in the form of a detailed agreement on the sharing of responsibility in accordance with each center's comparative advantage.

The center directors meet regularly as a body twice a year to discuss matters of common interest (such as staff compensation policy and ways of ensuring equitable sharing of the limited funds available to the CGIAR) or joint projects (such as a study of pension arrangements and a proposal on an interconnected electronic data transfer system). The chairmen of the centers' boards are now meeting more regularly to discuss policy questions affecting all centers. Both groups usually meet during the annual meeting of the CGIAR and use the occasion to talk collectively with the chairman of the Group, the chairman of TAC, and the heads of the Group's and TAC's Secretariats.

The Consultative Group

Origins and Functions

Just as the original international agricultural research centers preceded the foundation of the CGIAR, so did the other underlying concept—that of a consultative group. A score of such groups had been formed under the leadership of the World Bank to coor-

dinate the aid provided by donors to individual countries. The original two groups were called consortiums and had the task of coordinating annually the development aid provided by many donors to India and Pakistan. The Bank supplied from its staff a chairman of each consortium and, as part of its regular activities, undertook the staff work necessary to provide the basis for the donors to agree on the amount and type of aid to be provided to India or Pakistan over the coming year.

Later, the Bank established a series of consultative groups that functioned like the India and Pakistan consortiums, exchanging views within the group and with the country in question, except that they did not make formal commitments as to the amount of aid they would provide. Over the years, however, the distinction between a consortium and a consultative group has faded, inasmuch as the members of a consortium are no longer expected to make firm commitments.

Thus, when the CGIAR was being organized, a useful precedent existed for mobilizing and coordinating aid in the form of the consultative group. Two important things were added. First, in a manner more akin to the original consortiums, the CGIAR was designed to be a body in which the members at regular intervals made pledges—or at least statements of intent—with respect to the funds they would provide to meet the requirements of the research institutions. Second, whereas staff work for the original country consortiums and consultative groups was done as part of the Bank's regular program of work, the Group was equipped with its own advisory and staff services. One was a Technical Advisory Committee of scientific experts meeting from time to time, and the other was a full-time Secretariat provided by the World Bank and the FAO (later to become two separate Secretariats). With these added elements, a whole new enterprise, a new international entity was created—flexible, informal, egalitarian, almost amorphous—but nevertheless with a definite objective and some clear and simple underlying concepts and principles.

The original objectives of the CGIAR were set out in an annex to the Summary of Proceedings of the first meeting of the Group held in May 1971 (the annex is presented as an appendix to chapter 3). This brief statement has stood the test of time—perhaps because it is brief and inclusive. During the second review of the CGIAR, the study team and review committee made several attempts to revise the statement in order to introduce shifts of emphasis (such as the focus on food and the need to address

resource-poor farmers) that had occurred in the intervening years. In the end, however, it was concluded that the Statement of Objectives in its original form still served the Group's interests and that the prudent course of action was to leave well enough alone.

The Consultative Group today has four main functions. The first is to establish overall policy with respect to the character, size, and composition of the system that the Group supports. Decisions on research strategy and priorities come under this heading; for example, the emphasis to be given to research on food, or to commodity-oriented as distinct from factor-oriented research, or to farming systems research, or to training. The Group must also keep under review the overall dimensions of the system (as occasionally embodied in five-year plans) and determine how relations with organizations and activities outside the system should be conducted.

The second function, closely related to and following from the first, is to decide whether a proposed initiative falls within the ambit of the CGIAR and, if so, to ensure its implementation. Looking back on the history of the CGIAR as traced in the preceding three chapters, it is striking how much of the Group's attention has been devoted to consideration of whether or not to take on a new activity. In those instances—increasingly infrequent—that an affirmative decision was reached, the Group has overseen its implementation through the work of subcommittees and an executing agency (usually selected from among its members).

The third function is to review and coordinate the provision of funds in relation to the needs of the system and to deal with certain other regularly recurring matters that lie within the responsibility of the Group. The highlight of International Centers Week has traditionally been the pledging session at which individual donors announce their proposed contributions for the forthcoming year. As funds have become tighter and the need for accurate planning of the centers' resources for the year ahead has become more urgent, the Secretariat has kept abreast of donors' intentions during the year and informed the Group of the probable orders of magnitude. The pledging session has thus become something of a formality—albeit an important one since it places each donor publicly in juxtaposition with all other donors—and attention has shifted to the need to maintain a balance between expected contributions and the aggregated programs and budgets of the centers. The Group also is formally responsible for the appointment or reappointment of the chairman of the Tech-

nical Advisory Committee and of the other members of TAC, and for endorsing the appointment or reappointment of those members of a center's board of trustees who are designated by the CGIAR.

The fourth principal function is to monitor and review the performance of the centers being supported by the Group and, indeed, to review the performance of the Group itself. This review process takes a number of forms that have already been referred to and will be described more fully later in this chapter. In brief, TAC and the CGIAR Secretariat review the program and budget of each center annually (or in some instances biennially) and organize reviews of the scientific program of each center and of its management at roughly five-year intervals. Their comments and recommendations are given to the Group for its consideration, as are those of special committees established to review the Consultative Group enterprise as a whole.

Membership

DONORS. Members of the Consultative Group are of two kinds: donor members (officially described as "continuing members") and members selected for fixed terms to represent countries in the five regions of the developing world. The CGIAR is primarily a group of donors, and it is unique among international organizations in the variety of its donor members. A list of the donors as of the end of 1985, with the amount of their individual contributions, is given in table 6-1.

The twenty-three countries providing grants through their external assistance programs include virtually all of the major industrial countries (outside of the Soviet bloc) and five developing countries (China, India, Mexico, Nigeria, and the Philippines).[3] The eight international organizations include parts of the United Nations (the United Nations Development Programme), specialized agencies of the United Nations (the World Bank), a regional development bank (the Inter-American), and such disparate but important organizations as the International Fund for Agricultural Development, the Commission of the European Communities, the OPEC and Arab Funds, and Canada's International Development Research Centre. The Asian Development

3. Brazil and Saudi Arabia did not contribute in 1985. Austria has joined the Group, but its first contribution will be in 1986.

Table 6-1. CGIAR *Core Contributions, 1985*
(millions of units)

Source	*National currency*	*Equivalent U.S. dollars*[a]
Contributors in national currency		
Australia ($A)	5.55	4.18
Belgium (BF)	92.30	1.96
Canada (Can$)	13.50	9.82
Commission of the European Communities (ECU)	7.06	6.58
Denmark (DKr)	12.70	1.12
Finland (Fmk)	3.70	0.62
France (F)	11.35	1.21
Germany, Federal Republic of (DM)	17.75	6.04
International Development Research Centre (Can$)	1.50	1.57
Ireland (£)	0.42	0.40
Italy (Lit)	11,220.00	6.51
Japan (Y)	2,685.98	11.01
Netherlands (f.)	12.96	3.89
Nigeria (N)	0.75	0.87
Norway (NKr)	20.00	2.27
Sweden (SKr)	28.00	3.09
Switzerland (Sw F)	7.04	2.68
United Kingdom (£)	4.94	6.35
Total	—	70.17
Contributors in U.S. dollars		
Arab Fund		0.34
China		0.50
Ford Foundation		0.90
India		0.50
Inter-American Development Bank		7.96
International Fund for Agricultural Development		3.15
Leverhulme Trust		0.60
Mexico		0.37
New Zealand		0.01
OPEC Fund		0.96
Philippines		0.25
Rockefeller Foundation		0.80
Spain		0.50
Switzerland		2.52
United Nations Development Programme		7.61
United States		45.00
World Bank		28.10
Total		100.07
Total contributions		170.24

a. Valued at exchange rates prevailing at the time the contributions were disbursed by the contributor.

Bank has been an intermittent contributor, primarily to special projects; the United Nations Environment Programme has been a modest contributor in most years; and the Food and Agriculture Organization is a cosponsor and provides a variety of services, although it is not strictly a donor. In addition to the Ford and Rockefeller Foundations, there is one other private foundation, the Leverhulme Trust in the United Kingdom (the Kellogg Foundation in the United States, usually a contributor, is not so recorded in 1985).

No formality attaches to membership as a donor. Any country or organization, public or private, that shares the objectives of the Group and is prepared to contribute regularly to its support can become a member. (As mentioned in chapter 5, the Group established in the mid-1970s a minimum subscription of $500,000 for new members.)Another important feature is the absence of any formula for assessing the amount of individual contributions, sometimes referred to as a "burden-sharing" formula. This is consistent with the customary role of a consultative group in aid coordination, but the CGIAR has special characteristics and needs, and its absence must presumably be attributable to the wide diversity of members. Formulas employed by international organizations for sharing the aid burden among governments by determining the size of their contributions or subscriptions usually rely on some economic measure (such as a country's gross national product) or combination of such measures. But what kind of formula would apply appropriately, for example, to the World Bank, the Arab Fund for Economic and Social Development, and the Rockefeller Foundation?

In practice many governments contribute through more than one channel, a fact that would further complicate any efforts at burden sharing. Thus, a European country might contribute in its own right as well as through its membership in (and subscription to) the Commission of the European Communities, the World Bank, a regional bank, the several United Nations agencies, and IFAD.

While each donor is free to determine the amount of its contribution, the fact that pledges are announced publicly and circulated in various CGIAR documents undoubtedly exercises some political or moral suasion. Prospective donors closely scan the list of contributors to find an appropriate basis of comparison. Two of the major donors do, however, have voluntary aid formulas of their own, which impart an important degree of predictability to the funding of the system. The United States has,

consistently and from the beginning, provided 25 percent of the estimated contributions to the thirteen centers. During the 1970s the World Bank provided up to 10 percent of the estimated requirements. The percentage has been raised and stands in 1985 at close to 15 percent. Thus, nearly 40 percent of the contributions can be estimated with some degree of reliability. Moreover, other major donors keep the Secretariat informed of their intentions and seldom make abrupt changes between one year and the next.

The Ford and Rockefeller Foundations each fixed a ceiling of $3 million for its contribution when the CGIAR was established, and they have not exceeded this level of commitment (though in the first two or three years actual receipts, including carryovers from earlier years, were somewhat higher). As the Group has matured, and new donors entered the scene, the foundations have gradually reduced their contributions, which in recent years have usually been in the $500,000 to $1.0 million range.

Each donor is free to determine not only the amount of its contribution but also the way in which the contribution is allocated among centers and even among programs within a center. Donors have their special interests, which become evident in the choice of centers to which they contribute and in the character of their support. Some donors, constitutionally or as a matter of policy, contribute to centers only in certain geographical areas. The Inter-American Development Bank only supports centers with headquarters in Latin America, even though centers headquartered elsewhere, such as IRRI and ISNAR, carry out programs of importance to agricultural development in Latin America. Similarly, the Asian Development Bank has for the most part confined its assistance to special projects with the two centers located in Asia—IRRI and ICRISAT. While the larger donors contribute to most of the centers in the system, smaller donors are more selective. Some show a preference for centers whose programs are directed at farmers in the areas with least resources, such as the semiarid tropics, while others prefer centers working on crops with which their own scientists are familiar or which have relevance for their own agriculture. (Examples would be wheat or rice or potatoes, in preference to cassava or sorghum or millet.) Some donors prefer to contribute to construction projects at the centers, while others require that their funds be used only for research.

Donors differ also in the degree of freedom they grant to a center in making use of the funds they provide. Some grant complete freedom within the approved core program and budget

of the center. Others restrict their contributions to particular activities within the center's program—to training, for example, or research on the biological fixation of nitrogen—a practice that may be useful to the donor but that, as discussed in chapter 7, tends to reduce the flexible use of the total resources available to the center. Of even greater concern is a growing tendency of some donors to tie part of their aid to use of scientists or equipment from their own country.

The advantage of this system of laissez-faire is that, while each donor is free to decide the size and allocation of its contribution, its decisions are made with full knowledge of the financial requirements of the system as a whole and in the certainty that the facts about its contribution will be made available to all members of the Group. The system's disadvantage is the risk that, with no central control of funds, contributions to the various centers might not match their budgeted requirements as approved in principle by the Group. This danger has so far been reduced—but not eliminated—in several ways: the larger donors contribute to most or all of the centers, although not in equal proportions; some donors seek the guidance of the Secretariat in deciding how to allocate their funds; and the World Bank, acting as donor of last resort, distributes its grants so as to even things out and bring all of the centers as close as possible to the Group's collective intention when approving budgets at its Annual Meeting. This means, incidentally, that not even a large donor can influence the ultimate level of funds received by a center that it favors (or disfavors) by making a very large contribution (or withholding all funds); it can do so only by persuading the Group to change its overall budgetary priorities among the centers.

DEVELOPING COUNTRIES. Participation by developing countries in the deliberations of the Group is important to the Group's understanding of the circumstances and problems of the countries it exists to help. That is why it was arranged at the beginning that there would be ten developing countries elected as fixed-term members representing the five principal regions of the developing world. The five regions are those established by the FAO in its regional conferences: Asia, Africa, Latin America, the Near East, and Southern and Eastern Europe. Two countries from each region are elected for a term that was originally two years but has been raised recently to four years. A country may be reelected, but in most regions the custom is to rotate membership.

In general, this arrangement has not worked well. Sometimes

the persons attending Group meetings as representatives of the elected countries have made valuable contributions to the Group's discussions, but more often the elected countries fail to send representatives or send persons who are not well informed, or do not take an active part. No effective mechanism has been established whereby the individuals designated to attend can receive information or opinions from the countries in the region that they represent. It is significant that the five developing countries that are donor members and one that has been a donor (Brazil), having made a financial commitment, are better represented than the elected members. Even with the greater participation of these six countries, however, the Group continues to be preoccupied with ensuring that the countries of the developing world, as well as the donors, have a part in shaping its policies. (We will turn to this issue in the next chapter.)

Cosponsors

The three cosponsors of the Group—the World Bank, the FAO, and the UNDP—played an active part in establishing the CGIAR and in imparting a legitimacy and an assurance of continuity to the fledgling enterprise, which had (and still has) no legal status of its own. The latter role continues; on occasion one or more of the cosponsors have put their imprimatur on the charter of a new center as a way of authenticating its international character and acceptance by the Group, and they have been involved in varying degrees in helping to clarify or enhance the international status of existing centers (see chapter 7).

The three cosponsors also have certain specific responsibilities in the exercise of which they act on behalf of the membership as a whole. Among them they provide the staff and budget for the CGIAR Secretariat and TAC and its Secretariat. The World Bank finances the chairman of the Group and its Secretariat, and the three institutions share the cost of the TAC Secretariat and the emoluments and expenses of the chairman and members of TAC.[4] The cosponsors have a collective responsibility to nominate to the Group candidates to be appointed members of TAC (who have always been approved by mail on a "no objection" basis) and to designate—in consultation with the members of the Group—the

4. During the period that Sir John Crawford was chairman of TAC, Australia volunteered a contribution to the expenses of the TAC Secretariat.

chairman of TAC. The representatives of the cosponsors are senior staff members of their respective agencies. They meet two or three times a year, usually in conjunction with the meetings of the Group or of one of its committees, under the chairmanship of the chairman of the Group.

Although their special status among the membership of the CGIAR gives the cosponsors a degree of influence, it does not give them a dominant voice in the deliberations of the CGIAR nor confer upon them the role of an "executive committee" in the Group's decisionmaking process. In all that they do, the cosponsors keep a low profile; they are not, and the Group does not expect them to be, a separate layer of management.

Chairman

A particular feature of the CGIAR system is that it is expected to operate coherently without having its authority vested in a single body or person. There is no overall board of directors, no chief executive officer. Authority rests with the individual centers and the individual members of the Group. If the system is to work effectively without any executive structure, the chairman must play a pivotal role. Each chairman has brought his own qualities, strengths, and weaknesses to the position, so it is best described as its terms of reference might be written. As such, the chairman's duties are:

- To provide leadership to the Group in defining strategy, reviewing progress, identifying problems and issues, and proposing solutions. In doing so, the chairman does not "manage" the Group nor impose a personal point of view—or that of the World Bank—on it.
- To preside over the Group's meetings. In this capacity, the chairman must help to shape a consensus while preserving the informality and collegial spirit that characterize the meetings.
- To take overall responsibility for fund-raising activities. Regular contacts with donors are maintained by the Secretariat, but the chairman is personally involved in recruiting new members and in occasional visits to the principal donors. The president and other senior officials of the World Bank have sometimes been enlisted in these fund-raising efforts.
- To assist in solving problems in any part of the system. Preferably, the chairman works behind the scenes and as unobtrusively as possible.

- To represent the Group before the public and the information media. Characteristically, however, the chairman and other officers of the Group have avoided the limelight, leaving it to the center directors and senior scientists to carry the CGIAR message to the public.

In all of these capacities, the chairman must act—and must be perceived as acting—in the interests of the Group as a whole. The three persons designated by the president of the World Bank to serve as chairman of the CGIAR have been senior Bank officials with extensive development experience. They have had other duties in the Bank and have devoted one-fourth to one-third of their time to CGIAR matters. It is important to recognize, however, that the chairman, although a Bank official, does not represent the Bank in the Group. This is done by another official, usually the director of the Agriculture Department. That the Bank is represented in the Group's deliberations by one official and provides another to be its impartial chairman is somewhat anomalous, the more so since within the Bank's hierarchy the director of the Agriculture Department reports to the vice president, Operations Policy—the position held by the present chairman and his predecessor. In practice, however, this arrangement has worked well. The Bank has expressed its views through its representative, and the chairman has stood aside from them. Even when the Bank's views were failing to gain acceptance (as when it strongly urged the Group to add a new center to the system for research on water management), the chairman maintained impartiality in formulating the Group's consensus.

Business Meetings

TIME, PLACE, AGENDA. The Group now meets twice a year, once in the spring and once in the autumn. Before the Group was formed, in the years when the Rockefeller and Ford Foundations were the main source of funds for the four original centers, there was a meeting each year at which the directors of the centers described to the two foundations and any other donors their programs, progress made over the past year, plans for the future, and need for funds. This occasion, two or three days in duration, was known as International Centers Week. Enlarged to accommodate all the members of the Group and an increasing number of centers, International Centers Week was continued under the Group's auspices. It took place in the summer, with the focus

almost entirely on presentations by the centers. A second meeting was held in the autumn as the annual business session of the Group, two of the main items of business being the approval of the levels of funding for the centers and the announcement of donors' intended contributions for the ensuing year.

After several years, the close juxtaposition of the two meetings proved to be inconvenient, particularly for donors who had to travel long distances. The Group therefore decided to combine the two meetings into one, in the autumn, for both presentations by the centers and discussion of the Group's business. But then, beginning in 1982, it was decided to reinstitute a second or "mid-term" meeting to take place in the spring, usually in May. This came about for two reasons: the increasing workload as the Group and the number of centers in the system grew; and the Group's decision, following its consideration of the report of the second review committee, that it should meet more often rather than delegate some of its decisionmaking responsibilities to a budget committee.

In general the autumn meeting is considered to be the annual meeting of the Group and the May meeting an interim one, although many items fall on the agenda of one meeting or the other according to their state of preparation. The spring meeting takes two or three days and is not attended by representatives of the centers unless they figure in business on the agenda (such as the external review of a center). The autumn meeting, usually in late October or early November, still bears the name of International Centers Week. The first two days are normally given over to presentations by the center directors, traditionally introduced by their board chairmen, of the year's scientific accomplishments and any major program and budget issues. There follow questions and discussions from the floor. In some years, different amounts of time have been devoted to individual centers depending on whether they were scheduled to make a "short" or a "long" presentation in that year (for example, forty-five minutes for the former, seventy-five minutes for the latter, including discussion time). The four sessions (one each morning and one each afternoon) are chaired by the chairman of the Group or the representatives of the three cosponsors. These arrangements are flexible and are modified to fit the needs of a particular meeting. Thus, in 1985 the first two days were devoted to a seminar on the impact study, and there were no center presentations.

The business meeting of the Group itself begins on the third day and occupies the remainder of the week. Two matters are

customarily reserved to this meeting. One is the Group's formal consideration of the programs and budgets of the individual centers, based on the recommendations of TAC and the CGIAR Secretariat. This cannot take place earlier, given the time required for the completion of reports on the results of the previous fiscal year (which is the calendar year); the preparation of program and budget documents, and their review by TAC and the Secretariat, sometimes at more than one meeting. The other is the pledging session of the Group's donors. The two items take place in the order indicated, but in the (unlikely) event that the pledging session resulted in some unpleasant surprises it would be necessary to qualify the Group's approval of the programs and budgets until further adjustments in them could be made.

International Centers Week, originally of two days' duration, is now virtually a fortnight in length. This is because the week of meetings is preceded or followed by meetings of TAC, the cosponsors, the chairmen of center boards, and the center directors. A number of centers use the occasion to hold meetings of their boards or committees. Other international centers not members of the Group (such as ICIPE and the International Irrigation Management Institute) take advantage of the presence of many common donors to hold meetings as well.

As the Group has become larger—and up to 200 persons are present during International Centers Week—the need to formalize a policy on the location of its meetings has become more pressing. In 1982 it was decided that normally (but not invariably) International Centers Week would be held at the World Bank's headquarters in Washington, D.C., which are well equipped to accommodate a meeting of this size. Conversely, the spring meeting would normally (but not invariably) be held abroad, including in developing countries. Most of these meetings have been held at the World Bank's office in Paris, but the most recent two have been held at FAO headquarters in Rome and as guests of the Ministry of Foreign Affairs in Tokyo.

The Group as a whole has never met more than twice a year, but from time to time it has established special committees that have met on a schedule of their own. Some members of the Group have found it advantageous to hold brief, informal meetings for the exchange of views in between the regular meetings of the Group. This was particularly true during the period when the Group was meeting only once a year. Thus, for several years, the members of the Group in North America, together with some others (such as Mexico and Australia) met informally dur-

ing the summer or early autumn. Also, about the time the Commission of the European Communities (EC) joined the Group, the European countries, together with the EC, began to meet in the spring. This was done partly to ensure that the EC understood the independent interests of its various members who were also members of the Group, and partly so that there would be within the Group, which in the early days was perceived by some as an American or at best an "Anglo-Saxon" club, a more effective European voice.

These smaller, informal gatherings are generally attended by the executive secretary of the CGIAR and the chairman and executive secretary of TAC, and sometimes by the chairman of the Group. They afford an opportunity for more intimate discussion of matters that will subsequently be coming up to the full meeting of the CGIAR; they are not intended to be, nor have they become, occasions for making decisions about policies or actions of the Group. Although the meetings have undoubtedly been useful, as the Group's membership has expanded and become more pluralistic they have become somewhat anachronistic and are being held less often.

MAKING DECISIONS. Decisionmaking in the Consultative Group is characterized by informality. Some decisions, such as approval of appointments to TAC or of the CGIAR designees to the centers' boards of trustees, are made by circulating nominations to the members by mail to obtain their views, usually with the stipulation that no response will be taken to mean no objection. Most matters, however, are reserved for the Group's meetings. Deliberations are facilitated by the preparation of a staff paper that outlines the background and analyzes the issues. If the issues are complex or likely to be controversial, the staff paper will present several options; otherwise it will recommend a single course of action. The staff work is normally carried out by one of the Group's two Secretariats, but occasionally an expert (or a team of experts) or a subcommittee of the Group may be specially commissioned to prepare a study and make recommendations.

After as much discussion as the members of the Group feel necessary—and the style that the Group has adopted eschews long speeches or debates—decisions are reached by consensus. There is no agreed formula for voting. To be sure, a weighted voting system could readily be devised on the basis of the size of individual donor contributions, but such a system would be inconsistent with the character of a consultative group and, more

important, with the egalitarian spirit in which the CGIAR conducts its affairs. It would also present the problems of whether and how to weight the votes of the developing country representatives and of how to ensure that international organizations (such as the World Bank, the UNDP, or the IFAD) voted in accordance with the views of a majority of their members. Conversely, to adopt a formal unitary voting procedure would disregard the fact that in the last analysis all donors are not equal—at least in the size of their contributions: the United States contributes 25 percent of the funds, while a number of donors contribute less than 1 percent. In the face of this dilemma, the Group, without ever bringing the subject up for debate, has relied on the common sense and goodwill of the members to proceed by consensus.

In the process of arriving at consensus and giving expression to it, the chairman of the Group perforce plays a central role. It is his function to sum up the discussion, to assess the extent of agreement, and to formulate a consensus for the Group's approval. If it is to work well, this procedure calls for objectivity on the part of the chairman and restraint on the part of the minority among the members whose views may differ significantly from the consensus as expressed.

Sometimes when the speakers on one side or the other of an issue seem close to being equally divided, the chairman may have to canvass all the members of the Group informally, as a guide in determining on which side of the issue the weight of opinion may lie. Occasionally, when issues have an important funding aspect, the chairman may implicitly have to take account of differences among the particular donors concerned. But the difficulty or delicacy of this process should not be exaggerated. There is a strong spirit of egalitarianism in the Group; the larger donors refrain from trying to push their own views ahead of those of others; on most issues a few opinion leaders among the members set the tone and the rest of the Group falls in line; and the consensus as formulated by the chairman has seldom—if ever—been challenged by the Group.

Just as there is no official voting procedure, so there are no formal minutes of the meetings that would require Group approval. There is instead an informal report of the proceedings prepared by the Secretariat, from a verbatim record, which briefly summarizes the discussion on each issue and sets out the consensus and any action taken. This summary becomes, in conjunction with the agenda for the meeting, the record of the meet-

ing. In those cases where a decision may have been made by canvassing the members of the Group by mail, the Secretariat issues a note recording the outcome.

Some matters are brought before the Group for information rather than decision. Reports on scientific advances in areas of interest to the CGIAR are an example. Another is reports of current developments in matters germane to the operations of the CGIAR system, such as techniques for estimating the rate of return on agricultural research or on the significance of genetic engineering for plant breeding. Or there might be more mundane reports, such as a compendium of all the off-campus activities of the international centers or a report on the source and application of all contributions through the CGIAR since its inception.

It is difficult to convey in writing the spirit that pervades the Group's meetings. In the early days most of those attending the meetings were bound together in a network of old acquaintanceships, many of them stemming from prior associations with the Rockefeller and Ford Foundations or even from university days. As the Group has greatly expanded, it has continued to be a fraternity of professional people, whether specializing in research or in development aid, and the original spirit of all being part of an extended family persists. The atmosphere at Group meetings is singularly congenial. It is very much to the Group's credit that it has been able to maintain this atmosphere even as it has evolved from being, as it were, a protectorate of the two foundations to being a self-sufficient international entity. Meetings of the Group can be stimulating occasions during which the interaction between members of the Group, the senior staff of the centers, members of TAC, and the staff of the Secretariats in the meetings—and, no less important, in the corridors and discussions over mid-morning or mid-afternoon coffee—can engender and maintain high morale in the whole enterprise. More than one veteran meeting-attender has remarked that this is the one international gathering that he or she looks forward to.

The CGIAR Secretariat

As in any informal association meeting only twice a year, the efficient conduct of the CGIAR's business depends to a large degree on its staff services. The Group has two services—the CGIAR Secretariat and the TAC Secretariat—for which provision was made at the first meeting of the Group in May 1971. At that time

the CGIAR Secretariat and the TAC Secretariat were conceived of as a single entity. It had earlier been proposed that this Secretariat be located in Washington, with the secretary of TAC seconded from the FAO, but the summary of proceedings of the first meeting provided instead that "arrangements will be worked out to ensure liaison and collaboration between the two wings of the Secretariat." It was not long before each of the secretaries acquired several assistants and the two "wings" evolved into two separate Secretariats, one at the World Bank in Washington and the other at the FAO in Rome.

The CGIAR Secretariat serves as the staff arm of the Group for dealing with all matters except those in the purview of TAC. It is in effect the central, full-time coordinator of the Group's affairs. The loose organization of the CGIAR and its informal way of doing business do not lend themselves to direct management. The Group operates on goodwill and good faith, but its effectiveness depends upon a large measure of common understanding and coordination of effort. The Secretariat, under the broad guidance of the chairman and in close liaison with the chairman and Secretariat of TAC, stands at the middle, facilitating coordination and maintaining communication among all elements of the system. The Secretariat, accordingly, has a wide array of functions, ranging from involvement in long-term planning and policymaking to arranging the administrative details of meetings—their time, place, and facilities.

One of the most important functions of the Secretariat is to oversee the financial affairs of the Group. This has several dimensions. For several years, the Secretariat prepared and periodically updated a long-term financial plan for the Group's approval, matching requirements to the likely availability of funds, but such long-term planning was abandoned because of the unpredictability of donor behavior and, more important, the fluctuations in the dollar value of contributions in other currencies. For the nearer term, estimates of the level of funding in the year ahead are made and translated, in consultation with TAC, into guidelines to the centers for the preparation of their annual budget submissions. Review of these submissions is a joint responsibility of TAC and the Secretariat, as described more fully below. The budget submissions of the individual centers need to be reasonably uniform in scope and content to facilitate comparison among them and to enable judgments to be made on the relative priority of their programs. The Secretariat is responsible for designing the appropriate reporting system for this purpose

and for obtaining compliance with it—not an easy task given the individualistic tendencies of the centers. These activities bring the Secretariat into frequent contact with both the donors and the centers, and fund raising with the former on behalf of the latter becomes an important activity in its own right.

Facilitating the making of policy is another major function of the CGIAR Secretariat. It does not itself make policy, but it is responsible for identifying policy issues, analyzing them, setting out the options for action, and bringing them forward to the Group for its decision. TAC is, of course, responsible for presenting to the Group the policy issues within its mandate, but wherever responsibility may lie the CGIAR Secretariat must see to it that all important policy issues are brought to the Group for decision. It must also arrange for the implementation of the policy decisions made by the Group. To this end it may need to issue instructions on the Group's behalf, or alternatively bring the Group's decision to the attention of those responsible, or it may itself have to take action.

An obvious duty of the Secretariat is to provide administrative support for meetings of the Group and of its committees. (Not quite so obvious, but becoming more important, is administrative support for the various meetings that take place on the same occasion as meetings of the Group itself.) For the Group, the Secretariat is responsible for the content of the meetings. In consultation with the chairman it draws up the agenda for the meeting, drafts or commissions the drafting of the documents, attends to their circulation well ahead of the meeting, and makes administrative arrangements for the meeting itself. Following the meeting, it prepares the report of main conclusions reached and decisions made. The Secretariat also acts as staff for the cosponsors and for the chairman of the Group in the exercise of their functions.

The Secretariat keeps in close touch with the centers. Members of the Secretariat visit them regularly and attend meetings of their boards. One of the two scientific advisers in the Secretariat normally participates in the periodic external reviews of centers, and the management adviser is closely involved in the organization and conduct of the management reviews. The Secretariat also offers its good offices to help the centers in various ways. Its staff can provide advice in matters within their competence (typically advice on management, budgetary, and financial matters), or the Secretariat may help centers to procure specialized equipment or expert advice (for example, in reorganiz-

ing their accounting and management information systems or improving pension plans). It can support the centers, or mediate for them, in their negotiations with host countries on privileges and immunities. Or it can facilitate the coordination of activities common to all centers, such as information services and publication programs. Often it is asked to help in the search for candidates to fill vacant positions.

The CGIAR system needs the goodwill and understanding not only of those immediately involved, but of a much wider audience in both industrial and developing countries. As the importance of their work gains more worldwide recognition, the centers have established information programs to meet the needs of this larger audience. In addition to what the centers are doing in the area of public information and communication, there is a need to explain the role of the Consultative Group itself—which is perhaps a more difficult task, but one that is critical to maintaining or increasing the support of those who authorize the expenditure of money on CGIAR programs. It falls to the CGIAR Secretariat to be responsive to the need for better internal communication within the CGIAR system and for public information for those outside who are or should be interested. This is an important function, not yet as fully developed as it should be.

For administrative purposes the Secretariat is a department of the World Bank, which appoints its staff and pays all the costs of its operation. Given its unique purpose and character, the Secretariat is subject only to oversight by the chairman of the Group and does not report to the Bank's management. The management has, however, been responsive to the Group's budgetary requests with respect to the size and composition of the staff of the Secretariat and to the need for consultation with others in the CGIAR system on the selection of the executive secretary. Since the executive secretary, like the other members of the Secretariat, is a Bank staff member, the Bank has final responsibility for the appointment. Bank management has also, on request, assisted the chairman and Secretariat in their fund-raising efforts.

Staff of the Secretariat are drawn largely from the permanent staff of the World Bank, but some specialists, such as its scientific advisers, may be recruited from outside for initial assignment to the Secretariat. After a tour of duty in the Secretariat, staff serving in it normally go on to other assignments in the Bank.

Considering the size and complexity of the CGIAR system, the Secretariat is small. It is headed by the executive secretary, who is one of the senior officials in the system and plays a key role, if

not in "managing" the system, at least in helping to ensure that it operates effectively. In addition, in 1985 there were nine professional staff, comprising a deputy executive secretary, two scientific advisers, a senior program officer, a management adviser, a senior financial officer, a financial officer, an information officer, and an administrative officer. A concomitant number of staff assistants, secretaries and other support staff, and consultants round out the Secretariat.

The existence of two separate and independent Secretariats—one serving the Group and the other serving TAC—is something of an anomaly which, as indicated earlier, the Group did not originally intend. Serving different masters and separated by considerable distance, the two Secretariats have not always found it easy to work together. The study team for the first review committee was struck by the obvious inconvenience of having separate staffs. However, their consolidation into one Secretariat was clearly not a matter on which the three cosponsors, or all of the donors, could be expected to agree, and the review committee decided not to pursue it. The Group did, however, accept the study team and review committee's recommendations with respect to strengthening the staff of the two Secretariats and ensuring their independence from the managements of the World Bank and the FAO. This marked something of a watershed, and in succeeding years the two Secretariats have come to work together closely and effectively. This collaboration has been particularly important—and evident—in their shared responsibilities for the annual review of the programs and budgets of the centers.

The Technical Advisory Committee

FUNCTIONS. The need to have a group of scientists of international stature to advise on research programs and priorities was identified early in the deliberations leading to the establishment of the CGIAR. The terms of reference of a Technical Advisory Committee were laid down in an annex to the Summary of Proceedings of the first meeting of the Group. Noting that TAC would be composed of twelve "distinguished international experts from developed and developing countries," the terms of reference went on to s[illegible]

> TAC will, acting [illegible] n reference from the Consultative Group or [illegible] initiative:

(i) advise the Consultative Group on the main gaps and priorities in agricultural research related to the problems of the developing countries, both in the technical and socio-economic fields, based on a continuing review of existing national, regional and international research activities;
(ii) recommend to the Consultative Group feasibility studies designed to explore in depth how best to organize and conduct agricultural research on priority problems, particularly those calling for international or regional effort;
(iii) examine the results of these or other feasibility studies and present its views and recommendations for action for the guidance of the Consultative Group;
(iv) advise the Consultative Group on the effectiveness of specific existing international research programs; and
(v) in other ways encourage the creation of an international network of research institutions and the effective interchange of information among them.

Since 1971, TAC's role has evolved as the CGIAR system that it serves has grown and changed. TAC's main functions today are described in the following paragraphs.

First, as envisaged in its terms of reference, TAC is responsible for advising the Consultative Group on priorities in international agricultural research. This activity has engaged TAC's attention from the outset. It has resulted in the preparation of four major reports to the Group; the fourth, bearing the ambitious title of "Strategic Considerations," was presented to the Group in 1985. TAC has also provided information for the two review committees' consideration of priorities. To perform this task calls for continuing efforts to review national, regional, and international research activities and to keep abreast of scientific developments. It has also led to the commissioning of special studies as the basis for TAC's deliberations and recommendations to the Group. These range from studies on plant nutrition, farming systems, or the training functions of IARCs to investigations of the need for new research programs (such as the study led by Skilbeck which analyzed the need for research on crops and farming systems of the dry areas of North Africa and the Middle East, or the study led by Tribe which provided the basis for TAC's recommendation on the priority of research on livestock production in Africa). The suitability of the Group's strategy and priorities is considered further in the next chapter.

Closely related to its review of priorities is TAC's function to recommend to the Group what new areas of research should be brought under its auspices. When the CGIAR was established, this was thought to be TAC's principal role. TAC was to review existing national, regional, and international research activities, to examine the needs of the developing countries, and to identify gaps in research that could appropriately be filled by institutions and programs supported by the CGIAR. As new institutions have been added to the CGIAR system, most of the major gaps in research on food crops consumed in the developing countries have been filled. In recent years of financial stringency, it has been increasingly difficult to add new activities—or even to consider adding them. Accordingly, TAC's attention has shifted to monitoring priorities of research already being supported by the Group and reviewing the effectiveness of the system to enhance the impact it can make with existing resources.

Another TAC function is to monitor and review, from a technical and scientific point of view, major program changes proposed by a center before they are incorporated into the center's approved program. This requires that TAC be kept well informed by each center of its intentions and the trend of its programs, so that TAC may recommend appropriate action on the proposals to the center and, if necessary, to the Group—a process that is taking time to accomplish.

A fourth TAC function derives from the Group's policy that periodic external assessment be made of the relevance, scientific quality, and effectiveness of the programs of each center funded by the Group, and of the continuing need for its activities. Responsibility for the implementation of this policy in the form of quinquennial reviews (now called external program reviews) rests with TAC. As discussed in more detail below, TAC arranges for the reviews—convening for this purpose teams of experts—considers the report of each team, and makes its own recommendations to the Group. TAC also undertakes studies of activities common to more than one center (though separately undertaken by them) to help the Group maintain an overview of the work of the system as a whole, to rationalize overlapping activities (as in rice research), and to give the centers an opportunity to compare their programs with those of others.

Most recent in time, but close to the top in terms of importance, is TAC's role in the annual review of the programs and budgets of the centers. This was not originally seen as a TAC function—indeed, the first TAC chairman, Sir John Crawford, was strongly opposed to TAC's becoming so involved—and in the

years of financial abundance the annual commentary on the program and budget of each center was prepared by the CGIAR Secretariat, with occasional inputs from the TAC Secretariat. As financial stringency set in, TAC found that it could not divorce its long-term program interest (the time horizon for which was progressively shortened) from what was happening on the budgetary front. As previously discussed, TAC's role in the budget review process was the subject of intensive debate at the time of the second review of the system. The Group was reluctant to confide responsibility for annual program and budget review to TAC, correctly surmising that this would divert attention from more strategic issues. But in the end the Group could not deny the logic of the position of TAC's chairman (Ralph Cummings at the time) that program and budget issues were intimately linked, nor did it find some form of budget committee a preferred solution.

In common with others who are responsible for this onerous and thankless task, TAC has found that budgetary review is as much an art as a science (and a primitive art form at that!). At the urging of the centers, it has avoided uniform, across-the-board cuts in the budgets of all the centers as a way of bringing program requests into line with the expected availability of funds. But TAC has not found the task easy, nor has it been able to establish scientific criteria that would remove the need for subjective judgment. How, for example, can one compare the relative merits of hiring an additional training officer in one center or two research assistants for socioeconomic studies at another?

Faced with these inherent problems, TAC has done the sensible thing: it has focused on changes at the margin (such as how each center would deal with a 10 percent increase or decrease in funding), relying on the informed judgment of its experienced scientists and recognizing that rough justice is all that can be served. It has sought to devise, together with the CGIAR Secretariat, a budgetary procedure that would guarantee each center a minimum level of funding (at, for example, 90 percent of its past year's program) to avoid the uncertainty that center directors consider to be their chief problem in managing their research programs. The review process has been time- and energy-consuming, however, and even with more frequent and longer TAC meetings it has undoubtedly interfered with the committee's work on other matters.

The concept of a technical advisory committee added a new dimension of scientific competence and authority to the rudi-

mentary structure of the customary consultative group. Fulfilling, and perhaps even exceeding, the expectations of its founders, TAC has played a central and indispensable role in the activities of the CGIAR. The Group has valued TAC's advice and relied heavily on its judgments on strategic issues such as what kinds of research to support, as well as on technical matters such as the quality of the scientific programs of the centers. The Group has not felt bound to follow TAC's recommendations, especially when matters of tactics were involved or when new activities were proposed that would have increased the cost of the system at a time when most donors were hard pressed financially. But the great majority of TAC's recommendations and assessments have been accepted by the Group.

MEMBERSHIP. TAC consisted of thirteen members, including its chairman, until mid-1985 when two more members were added. The expansion to fifteen was done to include a specialist in the new biotechnology; the desirability of having more nationals of donor countries serving as TAC members was presumably also a factor. For TAC's chairman, the Group has been fortunate to have obtained the services of three scientists of long experience and international stature: Sir John Crawford of Australia, Ralph Cummings of the United States, and Guy Camus of France. Each has served with distinction—and imparted a distinctive style to the management of TAC's affairs. Sir John was designated at the time the CGIAR was formed; Cummings was selected by the Group (on the recommendation of an ad hoc committee appointed by the chairman when the three cosponsors were unable to agree on a single choice); and Camus was selected by the cosponsors following a process of consultation with the members of the Group. The chairman of TAC is not only its presiding officer, but is also the committee's spokesman at the meetings of the Group and has continuing responsibility for TAC's operations. In the early days the chairman probably spent a quarter of his time on TAC affairs, but today, with the greatly increased number and size of programs supported by the Group and the added responsibilities conferred on TAC, the chairman serves virtually full time and has no other responsibilities.

Of the remaining members of TAC, six (now seven) have generally come from developing countries and an equal number from industrial countries. The initial term of service, except for the chairman, is two years. A member may serve a second or sometimes a third term. Terms of members are staggered to preserve

continuity. The period of service of the chairman has been more flexible and tailored to his particular situation. The present chairman originally served a three-year term, which was recently renewed for three years.

Each year the cosponsors inform the members of the Group of forthcoming retirements from TAC and ask them to suggest persons to fill the prospective vacancies. From among these suggestions, and others that may come to their attention, the cosponsors recommend a single candidate for each vacancy to the Group for its approval, which has been granted as a matter of course. In selecting candidates, the cosponsors seek to ensure that TAC will consist of highly qualified persons in the agricultural and social sciences (agronomists, entomologists, soil scientists, economists, veterinarians, and so forth). Most are expected to be familiar with the problems of agriculture in developing countries and experienced in the management of research. In choosing developing country members, attention has been paid to the need for experience covering all of the principal regions of the developing world. There is no national quota for the TAC members from developed countries and an effort is made to appoint nationals from small as well as large countries; but in choosing among fully qualified candidates for a particular vacancy the cosponsors have sometimes had to be conscious of the desirability of providing nationals from the principal donor countries an opportunity to serve.

TAC meets two or three times a year, for a week to ten days each time. Subcommittees are formed to consider specific topics, and outside experts are frequently called upon, notably for external reviews of centers and special studies. Except for the chairman, TAC is only a part-time activity for its members, most of whom hold full-time responsibilities at universities or research institutions. But TAC does, nevertheless, occupy a good deal of their time, in preparing for and attending up to three meetings a year, and often in additional subcommittee assignments. Despite this substantial commitment, it is indicative of the high reputation enjoyed by TAC that most of the persons asked to serve agree to do so. TAC regularly supplies the Group with a detailed record of its deliberations, containing its views and actions taken on all matters coming before it.

THE TAC SECRETARIAT. TAC is served by a full-time Secretariat based at the FAO in Rome. The TAC Secretariat performs staff functions analogous to those of the CGIAR Secretariat, including, for example, identification and analysis of scientific policy issues, recruitment of experts for external review teams and

other missions, and documentation and administration of TAC meetings and other TAC activities. The TAC Secretariat also participates in the annual process of reviewing the programs and budgets of centers. A staff member of the TAC Secretariat is normally assigned as the secretary of each external review team. Members of the TAC Secretariat, like members of the CGIAR Secretariat, regularly visit centers and attend center board meetings as observers.

The staff of the TAC Secretariat is provided by the FAO. The authorized staff is small, but TAC and the FAO have preferred to keep it that way: four higher-level professional staff (the executive secretary, deputy executive secretary, and two senior agricultural research officers) and three general services staff, all with the status of FAO employees. Its budget is administered by the FAO, but the cost of TAC's operations, including the cost of the members of the Secretariat and the emoluments of TAC members and other expenses, is shared equally by the three cosponsors. Occasionally an activity of TAC, such as a special workshop organized on a particular subject, may be funded by some other donor. The cost of the external review of a center is charged to the center and thus is funded by the donors to it.

The executive secretary of TAC is appointed by the director general of the FAO. When the position had to be filled in 1983, a three-man selection committee (consisting of the assistant director general of the FAO for agriculture, the chairman of TAC, and a center director) was formed to receive nominations from all parts of the CGIAR system, to interview the most promising candidates, and to advise the director general on a selection. A similar procedure was followed when a new executive secretary was appointed at the end of 1985.

There is close liaison between TAC (and its Secretariat) and the Group's Secretariat. The chairman and executive secretary of TAC and the executive secretary of the CGIAR are in frequent contact, as are the members of their staffs. Members of the CGIAR Secretariat attend all meetings of TAC, and TAC's review of the programs and budgets of the centers is done jointly with the CGIAR Secretariat.

Reviews

Research systems everywhere have procedures for periodically reviewing progress and assessing performance. In the CGIAR system such reviews are particularly important, both to keep the donors well informed and to maintain standards in a

system in which the institutes carrying out the research are autonomous and the sources of funding diffuse. Donors need to be satisfied that the funds they provide are being used for the purposes intended, that the research programs are effective, and that the institutions are operating efficiently. At the same time, each of the institutes has its own internal review process. Members of the Group have generally recognized that the central review procedures that they employ must not detract from the research institutes' freedom to formulate and execute their programs, within the constraints of available finance, and must not unduly encumber the time of the directors and staffs of the centers. Achieving the right balance is not easy, particularly when there are so many donors, each with its own interests and needs to be satisfied.

Although no donor is precluded from making its own review of a center, and a few of the larger ones do so, most members rely upon reviews carried out under procedures established by the Group collectively and, in large part, conducted by its services. There are several different kinds of reviews regularly performed within the CGIAR system, so many in fact that questions are sometimes raised as to whether, taken together, they do not put an undue burden on the management and staff of centers.

From time to time, the Group has considered the adequacy and appropriateness of its system of reviews and has made changes in it. The first attempt to establish a policy on reviews was in November 1972 when the Group held a discussion based on a paper, "Review Procedures," prepared by the CGIAR Secretariat. The question was taken up again at International Centers Week in 1973, when it was decided to establish a small committee, or "subcommittee" as it came to be known, under the chairmanship of David Bell of the Ford Foundation. The Bell report was approved by the Group in 1974 and became the basis of most of the review procedures still in place. As of 1985, the review function comprises

- annual consideration of the program and budget of each center
- periodic internal reviews by the centers themselves
- periodic external reviews, both scientific and management, mounted by the Group
- periodic reviews of the CGIAR system as a whole
- ad hoc studies of activities common to more than one center (often referred to as "stripe" analyses)
- an annual report by the CGIAR Secretariat.

ANNUAL REVIEW OF PROGRAM AND BUDGET. For consideration by its board and by the Group, each center prepares annually (or in some cases biennially) a program and budget paper constructed in accordance with guidelines issued by the CGIAR Secretariat in consultation with TAC and designed to reflect the expected availability of funds. The paper gives a general description and justification of each program being carried out by the center; a more detailed description and justification of any new activity the center proposes to undertake; and details of the cost, in both money and staff, of all the center's activities. The program and budget paper in final form constitutes the center's request for funding by donors through the mechanism of the CGIAR. It is mainly concerned with the center's core program, though it also describes those activities lying outside the core program for which special additional funding will be sought. The program and budget paper is initially prepared in draft so that it may subsequently take into account the decisions of the board and the views of TAC and the CGIAR Secretariat.

The draft program and budget papers are produced by the centers by the end of March for the fiscal year starting the following January. In the summer, TAC and the CGIAR Secretariat meet to review in detail the program and budget of each center with the participation of the center director concerned. (Some aspects of this budgetary review process have been described earlier.) In the light of the review, TAC and the CGIAR Secretariat formulate their recommendations to the Group on the appropriate level of funding for each center. At its annual meeting in the autumn, the Group has before it both the final version of the center's program and budget paper and a memorandum from the CGIAR Secretariat briefly outlining the center's program, identifying any issues outstanding, and giving the joint recommendation of TAC and the Secretariat on funding and any program matters of importance. The Group will also have the minutes of the TAC meeting at which its review took place, giving its conclusions with respect to each center. One of the items on the agenda of the annual meeting is approval of the budgets of the centers. In practice, the Group's primary interest has been in the overall balance of resources and expenditures, and it has always accepted the TAC-Secretariat recommendations on the program and budget of individual centers.

INTERNAL REVIEWS. Centers themselves undertake internal reviews of their programs. Typically, the management and the

program directors of a center spend up to a week each year reviewing the results of ongoing programs and discussing plans for the future. Members of the program committee of the board are likely to take part. Some donors send representatives to attend these reviews, and staff of the Secretariats may also attend. Outside experts are sometimes invited to participate, especially when there is an in-depth review of one of the programs. On such an occasion, research leaders from the developing countries in which the center operates may also participate. Sometimes, particularly when field trips to inspect research on site are involved, the internal review may take as much as two weeks. Another, but not typical, procedure is for a center to hold a full-dress planning conference in which its program, or part of its program, is examined and discussed in depth by a number of the best-informed leaders from industrial and developing countries in addition to the center's own staff. Centers also have used the tenth or twentieth anniversary—in IRRI's case the twenty-fifth also—of their founding as an occasion for taking stock of their accomplishments and planning their programs for the years ahead. Whatever the type of internal review, the findings help to shape the overall program and budget of the center as it is eventually presented to the Group.

EXTERNAL REVIEWS. The Bell subcommittee thought it probable that the internal review carried out by a center for its own purposes would be adequate also for the purposes of the Group, but the subcommittee also said that TAC, if it thought necessary, could arrange for a separate assessment. In the event, such special assessments have become the way of conducting reviews for the Group. As suggested by the Bell subcommittee, TAC has arranged an in-depth external review of each center every five years. About two of these quinquennial reviews, now called external program reviews, have been done each year so that by 1984 all but the newest centers had been reviewed twice. In the future, the span between external reviews may deviate slightly from the five-year pattern to fit with the timing of the development of the center's long-term plans.

Beginning in 1983, as recommended by the second review committee of the CGIAR, a periodic external review of each center's organization and procedures for internal management was also established. These management reviews are the responsibility of the CGIAR Secretariat, but for practical reasons they have been timed, in most instances, to coincide with the external program reviews, so that the two aspects of a center's operations, which may well overlap, could be examined together.

The external review of the scientific programs of a center has been a major undertaking. TAC has appointed a team leader, sometimes but not necessarily from its membership, who has been joined by a team comprising from five to ten specialists, including staff from the two Secretariats. Typically the team visits the principal off-campus research sites, including those in other countries, and pays an extended visit to the center's headquarters; in total the team is likely to spend a month in the field, at the end of which time a rough first draft of its report has been prepared and is discussed with the center's management. The team report is reviewed closely by TAC, which may make extensive comments of its own in transmitting the report to the Group. The review is no less a major event for the center, which will have spent many months of staff time in preparing documents for the team's visit.

The Group's procedure for discussing the quinquennial reports reflects the importance that it attaches to them. The report is introduced by the team leader of the external program review, and then of the management review if there is one. The chairman of TAC gives TAC's views on the program review, followed by comments of the executive secretary on the management review. The chairman of the center's board and the center director will then give their views on the reports, indicating areas of agreement or disagreement and the actions that they have taken, or intend to take, on the principal recommendations. The floor is then open for discussion. This is a time-consuming process, taking several hours, a good part of which is devoted to the series of formal presentations, and thought is being given to simplifying the procedure to leave more time for group discussion.

In most instances, the external scientific reviews have given the centers a relatively clean bill of health. In fact, there was initially some criticism on the part of donors that the reports were too bland. Scientists on the review teams tended to laud the work of their center colleagues and to recommend an expansion of their programs, while showing reluctance to make criticisms. To an extent this reluctance may be understandable, since critical comments might appear to prejudice a center's prospects for obtaining funding from the Group. Over time, however, the reports have become more rigorous, frank, and, where necessary, fault-finding. In some situations, however, more has been accomplished by behind-the-scenes discussions between the team and center management; the latter has then undertaken the necessary changes on its own initiative and often before the matter formally came to the Group. This has been even more the case

with the management reviews, which have tended to raise sensitive issues of personality, management style, and methods of organization sometimes best handled without undue publicity. The management reviews, which have generally been carried out by a team of two to four persons, were controversial in the beginning, but by and large they have been handled diplomatically and are now perceived to serve the interests both of the Group and of the centers.

The external review process has been invaluable, but it has also been costly in time and manpower for all parties concerned. Now that the older centers have all been reviewed twice, the question has been raised whether less frequent reviews, or reviews on a more modest scale, would not adequately serve the Group's purposes. Accordingly, the Group has decided to undertake a review of the review process itself.

SYSTEM REVIEWS. The other major review procedure stemming from the recommendations of the Bell subcommittee is the periodic review of the CGIAR system as a whole, including the Group itself. Two such reviews have taken place, one after the first five years of the CGIAR's existence and the second at the end of ten years. (A third, scheduled for 1986, is now on the drawing board.) The procedure in both cases was the same. The Group established a special committee of some fifteen to eighteen members (plus representatives of the cosponsors) drawn from among the donors, beneficiary countries, the centers, and TAC to undertake the review, assisted by a small study team drawn from outside the system. The study team acted as staff for the review committee. It made the necessary investigations, collected data, identified and analyzed issues, and prepared a draft report for consideration by the committee and, after the committee's revisions, for submission to the Group in final form. The chairman of the Group acted as chairman of the review committee.

The terms of reference for both reviews, as approved by the Group, were broadly the same. Those for the second review stated that the purpose of the review was to examine the CGIAR system so as to recommend a strategy for the next decade and a plan for the years immediately ahead. The review was also to make recommendations respecting the organization and procedures needed to implement the strategy effectively and to ensure the efficient functioning of the system. It was to develop a plan for the next five years indicating the rate of growth in activities supported and the resources required from donors. The

committee was asked to examine relations between the CGIAR system and developing countries and to recommend ways of improving the participation of the latter in the deliberations of the Group. (More details on the terms of reference of the two reviews have been provided in chapters 3 and 5.)

For both reviews the study teams went to great lengths to canvass the views of all interested parts of the system. They visited the centers and the donors and met with groups of representatives of the developing countries making use of the centers' services. They met with the cosponsors, TAC, the Secretariats, and the chairman of the Group.

These far-reaching reviews have been taken very seriously by the Group. The review committees, and the study teams working for them, devoted much time to considering the various issues and formulating recommendations to the Group. The Group, in turn, on each occasion spent several days out of a week-long meeting discussing the committee's recommendations and, in the case of the second review, devoted part of a second meeting to considering ways to implement the recommendations. The committee reports, together with short summaries of the Group's discussions and decisions, were circulated widely within the CGIAR system. In both instances, but perhaps more forcefully in the second, the Secretariat, on behalf of the Group, kept track of the steps taken by the various elements of the system to implement the Group's decisions and periodically submitted reports to the Group on progress made and problems remaining.

The reviews in practice concerned themselves less with strategic issues for the future than the terms of reference called for and than some donors wished, and they tended for the most part to reaffirm the Group's policies and practices. But they did introduce some innovations and orient some activities in new directions. No less important, the fact that they took place, and the seriousness with which they were considered, reinforced the consensus within the Group in the pursuit of its objectives and the confidence of the donors in giving it their support.

STRIPE REVIEWS. Studies of activities common to more than one center have been, as noted, one of the functions of TAC. The report of the first review committee recommended that periodic stripe analyses across centers of certain program components such as training, documentation, or cropping systems research, should be continued. These reviews have helped the Group to maintain an overview of the system as a whole and to rationalize the use of its resources. The stripe analyses have also helped the

centers to compare their programs with those of others and, by learning from each other, to make improvements.

INTEGRATIVE AND ANNUAL REPORTS. Each year the CGIAR Secretariat produces a report on the Consultative Group and the international agricultural research it supports. This annual report originated in a recommendation of the Bell subcommittee that the Secretariat should prepare each year, in advance of International Centers Week, an "integrative paper" placing in a single framework the existing programs for which the Group had accepted responsibility and any proposed programs that were under consideration, projecting financial costs and availabilities for several years into the future, and identifying program and financial issues that should be addressed by the Group. The Secretariat's integrative reports have closely followed this recommendation, while expanding it in one respect: it became the Secretariat's custom to include in each year's report a section in which a topic of interest or concern to the Group was analyzed in some detail. The section might describe, for example, some scientific development that might eventually have repercussions on the research supported by the Group (such as genetic engineering) or it might highlight a particular issue that the Secretariat thought should be brought before the Group for consideration and possible action (such as the need for forward financial planning for the CGIAR system as a whole). Although the Secretariat's integrative report did not constitute a review in the same sense as those described above, it did attempt to give each year an overview of the system and to put before the Group matters that deserved its attention.

In 1985 the integrative report was retitled the annual report and redesigned to address a broader audience, including those outside the system. It did not contain any special topic, but among other things reviewed highlights and accomplishments of the system during the preceding year and summarized the impact study, which was completed in that year.

7

Some Policy Issues Revisited

A FEW POLICY ISSUES are hardy perennials, having figured in the deliberations of the Group from the beginning. Some others are of more recent origin. Together they comprise an agenda of issues that promise to command the Group's attention for some time to come. It may therefore be useful to consider them in more detail—how much more depending on how extensively they have already been discussed here. The issues that will be considered are: research priorities; centers, networks, and boundaries; funding the system; participation of developing countries; international status; and management by committees.

Research Priorities

Establishing priorities for the research conducted by the centers is one of the principal and continuing functions of the CGIAR. To some extent priorities have changed with circumstances, and a central issue for the Group is whether its current priorities are appropriate for the circumstances likely to face it over the next decade or two.

Underlying Concepts

The IARCS were created to help fill what was seen at the time as a serious and growing "food gap" in the developing countries. Underlying the foundations' planning was the concept that wide-

spread inadequate intake of food could be overcome, or at least relieved, by increasing food production, especially through higher yields, in the countries and regions where people were not getting enough to eat. If farmers could be provided with improved technology that would produce more food, people would not go hungry. It was a simple concept; perhaps in retrospect too simple, for later it became more apparent that often people went hungry because they could not afford to buy food even when it was available in the country. Too little weight was given to the importance of increasing the incomes and purchasing power of the poor, as well as the availability of food. Nevertheless, even if oversimple, the concept provided the starting point for endeavors that brought about large increases in production that, even if not fully solving the problem of underconsumption by the poor, have brought much relief (see chapter 8).

Certain priorities followed logically from this basic concept:

- Overall, research should focus on developing the technology to grow more food of better quality on available land.
- Within this focus, research should concentrate on basic food crops and livestock and on farming systems and economics.
- Within research on basic food crops, first priority should be given to cereals, roots, and tubers to provide calories and second priority to food legumes, along with livestock, to provide protein for a balanced diet.
- Within research on the cereals, first attention should be given to rice to increase food supplies in the humid tropics (especially in the populous countries of Asia) and to wheat and maize. Research on rice grown under irrigation, because it would yield quicker results, should be given priority over research on rainfed rice.

A second concept was that the varieties and related technology developed by the international centers should be general in character and capable of adaptation to the particular environments of developing countries in different parts of the world. This led to

- breeding new, high yielding varieties with broad adaptability
- developing collaborative networks with national research programs for testing the experimental varieties and agronomic practices developed at the centers and reporting the results to plant breeders and other scientists
- providing training and information to facilitate the transfer of the new technology to developing countries and to strengthen national research programs

- preserving and expanding the supply of germ plasm for use in plant breeding experiments.

A third concept was that the research envisaged for the IARCs, in addition to focusing on food crops raised in many parts of the world, should also attack the agricultural production problems of particular agroecological zones. The following resulted:

- Some centers were established to investigate not specific crops but geographical areas—for example, the tropics of Latin America and the humid and subhumid tropics of Africa.
- At any single center, research embraced a multiplicity of crops and also emphasized the farming systems within which the improved crops could be incorporated.
- This broad approach created complexities for the centers in fixing priorities, in avoiding the dissipation of resources on fragmented research efforts, and in effectively administering programs for intercontinental zones, which required work far away from headquarters.

When the Group was founded, it inherited these basic concepts and their corollaries. It took them as its own not only in supporting the institutes already established or planned, but as it expanded the scope of the system in the early years to fill perceived research gaps. The adoption of CIP and the creation of IBPGR, ICRISAT, ICARDA, and to a degree ILCA were all consistent with the basic concepts. Later, some of the concepts began to be questioned or revised as attention became more sharply focused on helping the poor and on particular regions and as national research in some developing countries grew stronger.

The Role of TAC

TAC has been the principal instrument for articulating research priorities for the Group. As mentioned earlier, TAC has given its recommendations on priorities in a series of papers, each one more pointed than the last. Each paper has reflected changes in the climate affecting the Group's operations: the slowing down and eventual halting of the growth in real resources provided by donors; increasing concern within the international aid community that its help be directed mainly toward improving the lot of the poorest segments of the population and that the benefits of investments made with aid funds be equitably distributed; and, as funds became more scarce, an increasing desire on the part of donors to be assured that the funds provided were being used

efficiently and effectively. Over the years, TAC's reports and recommendations on priorities have become more operational, particularly since TAC has begun to function as budget committee for the Group. Its latest recommendations (its 1985 report on priorities and strategic considerations) make specific proposals for the allocation of resources to various categories of programs and activities.

Nevertheless, viewed in the broad there has been little significant change in TAC's formulation of priorities. Agricultural research is a long-term endeavor, and even after fifteen years the changes TAC suggests differ only marginally from its initial recommendations. In recent years, too, there has been little scope for change through new initiatives because funds have not been available. Thus, although the process for arriving at priorities may have become more rigorous, some important issues still have not been addressed conclusively.

The 1985 TAC paper on priorities and strategies was considered at International Centers Week in October, but only in a preliminary fashion. Partly under the stimulus of the impact study, which was also on the agenda and received greater attention, the Group decided to consider its strategy in a broader context and longer time frame. These wide-ranging deliberations will undoubtedly take time. One issue that will figure prominently in the deliberations is the potential for the new techniques of genetic engineering (such as molecular genetics, cell biology, and tissue culture) and other tools of biotechnology. These techniques are likely to give the centers the opportunity to do more pioneering work within their own programs and to involve them in closer contact with institutions and laboratories in industrial countries.

Efficiency versus Equity

A principal issue that will remain on the agenda is the proper balance between research aimed at increasing food production by raising farm productivity in areas and on crops of high potential and research aimed at directly increasing the quantity and quality of food produced and consumed by the poor, an issue of efficiency versus equity. Although any increase in productivity benefits the economy in general, not every increase benefits the poor. Over the last dozen years it has become clear that increases in food production, whether from higher productivity or otherwise, do not necessarily mean that the poor will have more to eat

and that increases in the amount and quality of protein in the food produced do not necessarily mean that the food eaten by the poor will be more nutritious. At the lowest economic levels family incomes are so meager that people cannot afford to buy as much or as good food as they need (of the two, the quantity of food intake is generally more important). To be sure, the poor as consumers—in both urban and rural areas—receive important benefits to the extent that increased production lowers the price of food, on which a large part of their income is spent. But some poor producers of food may be worse off, if the reduced income from the lower prices they receive is not more than offset by an increase in production. Subsistence farmers who consume all that they produce will only benefit to the extent that they are able to increase their production.

Increasing the food consumption of the poor ultimately requires increasing their incomes and purchasing power, and doing so raises issues of national economic and agricultural policy that transcend research. But research can help—and help more—in two ways: by emphasizing those crops produced and consumed primarily by the poor and by emphasizing the agricultural products that increase the income of poor producers, even if they are nonfood or cash crops outside the present mandates of the centers. But there may be a difficult choice to be made, for increased attention to research aimed directly at production by the poor could well be at the expense of increased overall production of food.

One change that would give more weight to equity concerns would be to emphasize food production in food-deficit areas where people, including food producers themselves, are not getting enough to eat. Such a strategy means more research on

- increasing production in areas of poor soil, difficult terrain, or unfavorable climate and rainfall
- increasing production with a minimum of purchased inputs
- increasing production of crops grown by farmers in subsistence agriculture.

This is not to say that the international centers are not already giving considerable attention to this "poor-farmer" agriculture. Crops produced and consumed by the poor—sorghum, millet, beans, and cowpeas, among others—figure prominently in the work of the centers and have from the early days of the system. IRRI's shift of research emphasis from irrigated to upland rice is an illustration of changing priorities. But, considering the im-

portance of alleviating poverty, in my view more of the Group's resources should be devoted to poor-farmer agriculture.

Another and more radical change would be to focus research on agricultural production of any kind that will raise the incomes of the poor and increase their purchasing power. This implies supporting research on cash crops that have not been tackled by the CGIAR system, whether food crops or otherwise, and whether grown as a monoculture or as part of a multicrop farming system. It could include research on fiber crops, on cereals or roots and tubers sold for animal feed, and on tree crops, which also play an important role in protecting the soils of high rainfall areas from erosion.

Expanding into research on cash crops, particularly nonfood crops, would have to be weighed carefully in each case. Often, especially for plantation crops, adequate research has already been done with the support of the industry itself. The Rubber Research Institute of Malaysia is an example of a center of excellence whose programs and achievements are comparable to those of the IARCs. But not all nonfood crops are well catered to and not all of the research is oriented toward tropical agriculture. Even if there is adequate research for large-scale production, it does not follow that there is enough attention to production of the same crop by small-scale farmers. The question is whether international research on such crops would have the same comparative advantage as that enjoyed by the IARCs working on staple food crops. If the Group were to decide to give higher priority to cash crops of economic importance to small-scale farmers in developing countries, it should take a serious look at research on the following topics:

- tropical vegetables, including those grown to supply nearby urban markets
- some fibers, such as cotton and possibly jute and kenaf
- aquaculture, especially the production of fresh water fish, but also, possibly, seafood produced in seaside lagoons under controlled conditions
- tree crops, including coconut and oil palm, and agroforestry
- animals, particularly ruminants, in Asia (especially China) and Latin America; more research might be needed in Africa as well
- beverage crops—especially cocoa, and possibly tea and coffee.

TAC has already drawn attention to many of these possibilities. In its latest report on priorities, TAC recommends once again that the Group support vegetable research and proposes, for the first

time, that the Group expand its system to include research on coconuts and aquaculture. It also recommends some increase in research on ruminants, especially cattle, sheep, and goats.

It is difficult to be innovative when resources are static. But if the donors to the Group wish to help ensure that the poorest of the poor are better fed, they should direct some of their effort—preferably in the form of augmented resources—toward the support of more research on the subsistence and cash crops that are grown, or could be grown, by the poorest farmers.

Factors of Production

Another perennial and important issue for the Group is whether to support more research on factors of agricultural production (other than seeds and other genetic materials, which is already its main activity). Studies on how to ensure adequate and timely plant nutrients and water are obvious examples, but there are many others. At an early stage the Group adopted the policy that research on such factors of production, if supported at all, would best be handled as part of the multidisciplinary, applied research on commodities falling within the system's ambit. Some factor-oriented research is taking place at individual centers on this basis, but the Group has eschewed separate research on individual factors of production and has declined to adopt or create institutions for that purpose (except as one might consider that ILRAD's work on animal diseases and IBPGR's on germ plasm are factor-oriented). Three have been proposed (IFDC, ICIPE, and a water management institute) and rejected. Research on fertilizer, water management, and certain insect pests was at least considered, but none on soils or the control of plant diseases, pests (other than ICIPE's program), or weeds ever came before the Group.

Has the Group been too doctrinaire in its rejection of research specifically on the principal factors of production? No one has questioned their fundamental importance in increasing production, and although the Group's policy was cited to justify rejecting the three proposals that came to it, there were other contributory reasons. The value of both IFDC's and ICIPE's research was recognized, but in both cases it was thought, among other things, that their particular research niches were too narrow to be appropriate for the Group. It is more difficult to understand why the water management institute was rejected. Research on water management had always been very high on

TAC's list of priorities, a judgment with which the Group appeared to agree. It seems likely that the rejection was more an accident of timing, for the proposal came before the Group at a point when it was particularly exercised about the shortage of funds. However, while this concern may have been overriding to the Group collectively, it did not deter some of the donor members individually, for they promptly arranged a separate funding group which has successfully launched the institute outside the CGIAR. Moreover, both IFDC and ICIPE continue to attract contributions from some members of the Group, also outside the CGIAR.

At the level of applied research that was envisaged for the international centers at the time of their creation, there may not be an appropriate place for research of a universal character on single factors of production. Since those days, however, the concept of strategic research (for solving specific research problems) has evolved, and at that level there is a stronger case. As the individual centers, and the system as a whole, devote more effort to strategic research, the Group could well reconsider giving support to factor-oriented research conducted by a center or through some other mechanism.

Africa

The impetus for creating the first international agricultural research center was the immensity and urgency of the need to fill the food gap in the populous countries of Asia, combined with the favorable circumstance that a single cereal—rice—was overwhelmingly the main food in most Asian countries. Thus, research sharply focused on rice could have great impact. It was, in a way, fortuitous that research on wheat, which had been going on in Mexico for many years, could also be directed to helping solve the food gap in certain parts of Asia.

The problems of tropical Africa are now the most urgent. Neither rice nor wheat is of prime importance in tropical Africa, where people rely on maize, sorghum, millet, cassava, sweet potatoes, and yams. Research on all these, except maize, got a late start. Moreover, much less effort was put into research on roots and tubers than on cereals. In part, this is because root crops are difficult to work with. Many of them are vegetatively propagated and so are more difficult to breed and multiply than cereals, which grow from seeds. The propagated roots and tubers harbor many pests and diseases, which thus are handed down from generation to generation. The presence of such pests

and diseases not only interferes with experimentation but also can lead to restrictions on international shipment, which further inhibits research. But in part these crops were ignored because they are poor-farmer crops, grown under shifting cultivation as part of cropping systems and not entering much into trade and commerce.

These difficulties of getting research started have been compounded by tropical Africa's particularly difficult circumstances. In much of it the soils are infertile, hard to work with, and fragile. With a few exceptions—such as the Sudan and part of Egypt—there is very little irrigation. Most farmers have inadequate access to purchased inputs, and, under tribal custom, land tenure is insecure. National research in most countries is weak.

The consequence is that the Green Revolution has by-passed Africa, and yet Africa desperately needs improved technology. Over the last two decades, per capita production of cereals, roots, and tubers—the mainstays of life—has declined; in 1983 it was less than 80 percent of the 1961–65 average. Land is becoming degraded.

The CGIAR has not neglected research on food crops important in Africa but, except for maize, there was not much experience to build on and, because almost all agriculture in Africa is rainfed, quick results have not been possible. It has been estimated that about 35 percent of the IARCS' senior scientists devote full time to research and other programs specific to Africa, and that overall Africa absorbs about 40 percent of the Group's resources. But of the four IARCS based in Africa, ILRAD is very specialized and WARDA deals only with rice in the West African region. IITA is concerned with a wider range of crops but also has limited ecological coverage. ICRISAT, in contrast, has a large and well-established program, which is tailored to the vast semiarid tropical zone.

In addition to the four centers located in Africa, eight others have staff members stationed there as part of outreach programs, while the remaining center—ISNAR—has worked with seven African countries to assess their research needs. Some of these centers, however, are not yet in Africa on a significant scale, although all are giving increasing attention to Africa's problems. Agroforestry is an activity of particular importance to Africa and should be added to the research agenda.

Though the number of people living in tropical Africa is not large compared with the populations of Asia, their problems are enormous: extreme poverty, eroding natural resources, lack of

new technology, weak institutions, inappropriate policies, and rapidly increasing population. In retrospect, it looks as if the CGIAR has not accorded Africa high enough priority. Now that the world aid community is becoming increasingly aware of Africa's problems, the Group and the IARCs are moving to redress that imbalance.

African agriculture is in danger of deteriorating too fast for any great improvement in living standards to be expected in the near future. But even stemming this deterioration commands high priority in human terms. Problems demanding urgent attention are everywhere. Among them are the needs for strengthening national research institutions, for training many more scientists and technicians, and for research on conserving the resource base.

The extent to which the Group can shift more of its present resources to Africa without unduly sacrificing the interests of the larger numbers of people still in poverty in other regions such as Asia may be limited. There is thus all the more reason for the Group to consider new approaches and special measures to deal with Africa's urgent problems.

China

China became a donor member of the Group in 1983. Even before then it had begun to work with several of the centers and had particularly close relations with IRRI. Its contacts with the system are expanding. As knowledge of what the system can offer increases and becomes more widespread, China can be expected to become a larger client; the issues for the Group are how much larger and how soon.

Since the founding of the People's Republic, China has given high priority to the development of agriculture. As a result, agriculture in China is in some respects more advanced than in most other developing countries, though still a long way from reaching the levels in the richer countries. In its drive for self-sufficiency in food, China has made particularly strong advances in the production of rice and wheat. For example, it released semi-dwarf improved rice varieties in 1959, seven years before IRRI released IR8. In the 1970s it was the first country to develop and cultivate hybrid rice on a significant scale. It has successfully developed high-yielding, disease-resistant varieties of wheat.

Nevertheless, production has barely kept pace with increasing population. If incomes increase as planned, the demand for food, especially meat, fruit, vegetables, and vegetable oils, will

rise even more rapidly in the future. Additional production will have to be achieved without an increase in the area devoted to crops, for land reclaimed and brought under new irrigation will be offset by land converted to other uses.

Agriculture in China is already intensive. With only 7 percent of the world's arable land, it has to feed 22 percent of the world's population. Irrigation systems serve about half its arable land, but many of them are old and in need of rehabilitation, and water distribution at the field level is often inefficient. To realize the potential of irrigation, large investments will have to be made in the existing irrigation systems, and research will need to be greatly expanded and improved. For years agricultural research suffered from China's isolation from scientific developments in other countries, and during the Cultural Revolution much of the research capacity was dismantled. It has begun to recover only recently. Raising productivity in both the irrigated and rainfed areas to keep up with rising demand for food will put a heavy strain on China's limited research capacity. What does this portend for China's relationship with the CGIAR? How much will China wish to draw on the scientific resources of the system? It has done well without making much use of them, but it is determined to forge ahead more rapidly. In deciding the kinds of research to support and in allocating resources, what priority should the Group give to China?

Considering the vast needs and opportunities in China, the initiatives taken so far by the IARCs are, with the exception of IRRI's programs, little more than tentative and exploratory. Should China decide to exploit the potential of the CGIAR system, there is some risk that activities could expand so rapidly as to absorb an undue proportion of the system's resources and distort the character of its programs. So far these issues have been addressed by the centers individually, but such a fragmented approach may in time become inadequate. The Group needs to consider the implications of the system's growing involvement with China. There are several possible scenarios:

- It can accept that, with programs and resources as they are, it can play only a marginal role in China's agricultural development.
- It can gear up for a significant effort, making the changes in program and lining up the larger resources this would entail.
- It can move ahead positively but selectively, choosing a few initiatives that could have significant impact in particular fields and which, though requiring some increase in the Group's re-

sources and change in their use, would not claim so much as to distort the overall program.

Relations between the Group and China are at an early stage. The CGIAR system can play a significant role in helping China to meet its goals and at the same time can profit from collaboration with Chinese scientists. The Group needs to give more thought to how much attention should be devoted to China, consistent with the availability of resources and China's desire for assistance.

Centers, Networks, and Boundaries

Centers of Excellence

The cornerstone of the CGIAR system is the "center of excellence." The original model, designed by Hill and Harrar for IRRI in 1960, has been followed, with only minor exceptions, for all the crop-oriented centers established under the CGIAR's auspices. The two principal features of a center of excellence are independence in the pursuit of its scientific mission and an international character. The latter feature has enabled the centers to deal with problems on a regional or global scale; to collaborate and interact with national and regional research programs in industrial and developing countries alike; to draw financial support from a wide range of donors; and to attract first-class managerial and scientific staff from many parts of the world. Staff have been organized into interdisciplinary teams working with modern research facilities. Research effort has been sharply focused on applied research and the development of technology related to the problems of increasing food production in the developing countries. The economies of scale inherent in this approach have enabled the centers to achieve a "critical mass" that would have been beyond the reach of any national research program.

The center of excellence was clearly the right idea for its time and place. The concentrated effort of highly qualified and well-equipped teams of scientists, and their freedom of scientific exchange, facilitated the early breakthroughs that brought the centers to international attention. Success bred success, as the growing reputation of the centers enabled them to attract the financial support and skilled professionals to continue their pathbreaking efforts. But much has happened to agricultural

research, at both the national and international levels, in the intervening years, and further changes are in the offing. Is the concept still valid today? What changes have been, or will be necessary in the light of changing circumstances, and how do they affect the boundary lines separating the IARCs from national research centers in both developing and industrial countries?

The first review of the CGIAR looked closely into the organization and functions of the centers five years after the CGIAR came into being. The study team and review committee concluded the following:

> In summary the centers have already demonstrated their capacity for success and have identified areas in which they are uniquely successful. It is our judgment that this uniqueness applies particularly to commodity or systems oriented centers whose forte is the interdisciplinary team approach. It is less clear that these characteristics could apply to factor or discipline oriented centers that are more comparable to traditional developed country research approaches. Therefore, we conclude that the center approach has much merit and is uniquely fitted to the character of the CGIAR.

Five years later, the second review reached a similar conclusion, but added a qualification and proviso:

> The Study Team found general agreement that this model has been effective in providing excellent facilities for the high quality research that has established the reputation of the System . . . There was wide support for the Centre model as the basic framework for the CGIAR system in the future . . . We conclude that the standard Centre model has been a successful one and provides a firm foundation for future research and training programmes of the System. At the same time we conclude that new centres on the original model should be added only after careful consideration of other possibilities. This is not to say that the basic concept of the Centre is no longer supported, but that variations of the basic concept should be kept in mind when planning new activities . . . We also conclude that the present Centres, with their excellent central facilities, provide a basis for expansion of activities in the System, if the concept of collaborative research networks is developed.

Centers or Networks?

It was never thought that the centers would work in isolation, but rather as intermediate links in a chain extending from the basic research activities conducted primarily in industrial countries to the adaptive research characteristic of the national programs of developing countries. This relationship has evolved over time; in particular, networks have developed linking the centers and national research programs in closer and more collaborative efforts.

As a way of organizing collaborative research, networks have a long history that predates the formation of the CGIAR. Some of the centers in the CGIAR system are essentially networks (WARDA and, in a sense, IBPGR), and ICARDA grew out of the Ford Foundation's Arid Lands Agricultural Development (ALAD) program, which was primarily a network for testing germ plasm of cereals and pulses, as well as for improving sheep productivity. The research programs for export crops organized in Africa by Great Britain and France during the colonial era linked stations in several countries working on the same commodity.

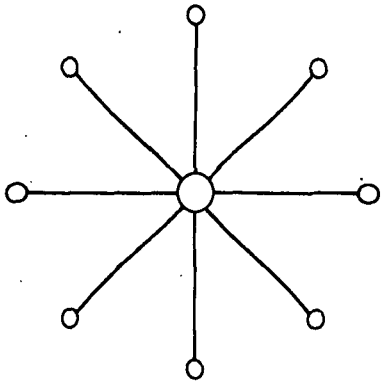
At one time the network model was viewed by some as a rival to the center of excellence; the preference of the French government for the former approach was a factor in its early resistance to the establishment of the CGIAR. In fact, the CGIAR has shown that the two approaches can be compatible—or rather, starting from the model of the center of excellence, the CGIAR has combined elements of both into a blend that is evolving as national research programs become stronger and thus more equal partners in the research and development effort.

In their broadest sense, networks link individuals or institutions with a shared purpose into some form of collaborative effort. The integrative report for 1983, which featured networks as its special topic, identified three kinds of networks. As illustrated in figure 7-1, in the simplest form of network, information and materials flow from the central hub along spokes to the nodes (part A). In part B, the participating nodes are not just recipients but more active partners in planning and implementing the program. Information flows back and forth between the hub and the nodes, as well as along the rim connecting the participants. In some of the more advanced networks, nodes may establish subnetworks to tackle that portion of the task that has been assumed by them (part C).

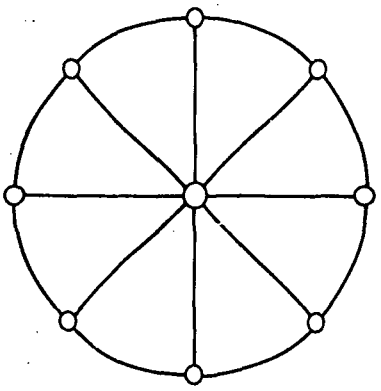
The relationship between the IARCs and national programs has tended to progress from simple to more advanced types of net-

Figure 7-1. *Types of Networks*

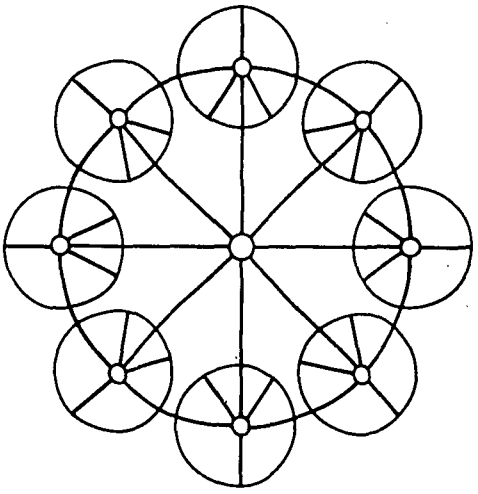
A



B



C



working. At first most of the centers concentrated their research efforts at their headquarters or campuses, but their plant breeding activities soon led them to establish contact with national programs. The technique of plant breeding involves the gathering of germ plasm from diverse regions, recombining it in many different ways, and then testing the resulting crosses for yield, stability, pest and disease tolerance, and so forth over a wide range of contrasting environments, involving many countries. The early networks thus were organized around international nurseries. IRRI, for example, initiated the first international rice nursery in 1963. In 1964, CIMMYT organized an international spring wheat nursery by merging two regional programs that dated from 1960 and 1962.

In nursery networks—the simplest form of network—national programs receive and evaluate set groups of genetic materials. The logistical problems of operating a nursery are formidable, and the centers naturally found themselves in the position of leaders or hubs in the networks. With the passage of time and the strengthening of national programs, the relationship has become more collaborative and collegial. Developing countries have played a more active role in designing and implementing the exchange programs, and nationally developed varieties have become an important source of materials for international testing. Thus, rice varieties provided by the national programs in India and Indonesia have been released to farmers in Nepal, Mali, Burma, and the Philippines.

The number of networks has grown; CIMMYT, for example, contributes to at least nine international nurseries, and CIP is involved in separate regional research networks for potatoes in the Andean countries, Central Africa, Central America and the Caribbean, and South Asia. Furthermore, other types of networks involving the IARCs have developed to deal with more specialized or complex problems, such as the rational use of crop by-products, livestock diseases, cropping and farming systems, regional economics, farm machinery, factor-oriented research, and information outreach. Training courses and information services have also strengthened the growing links between centers and national programs.

Pros and Cons of Networks

Networking has a number of attractive features and also some drawbacks. One advantage frequently cited for the network

model is its cost-effectiveness. By relying on existing institutions, costly expenditures on new central facilities can be avoided. This point may be valid in some situations, where the need for additional investment can be reduced by making better use of existing facilities and staff. But it can also be misleading; networking requires the existence of strong collaborative institutions, which presumably were the beneficiaries of capital development programs in the past. The key role that the IARCs have played in the networks with which they have been associated would not have been possible had they not been developed as centers of excellence.

The second review committee considered the network model at length. It noted several advantages:

- Beneficiary countries are fully involved in programme planning and in setting priorities. The network encourages partnership between Centres and developing countries. It is, therefore, a model suited to assisting in the evolution of strong national programmes. When national programmes have reached a position of strength, such as in India and Brazil, the model is admirably suited to a continuing arrangement for collaborative research programmes drawing, through the Centres, on a wider range of scientific knowledge.
- The network has a catalytic role in bringing together resources to focus systematically on an important research topic and thus establish a critical mass of scientific activity at relatively low marginal cost.
- Flexibility is maintained in the use of resources in that programmes can be increased, reduced or terminated relatively easily.
- The network provides a mechanism to link the research of Centres to that funded by the donors through other channels. It may strengthen the basis of requests from countries for bilateral funding, in that the resources would be used as part of a major integrated international research activity.

Problems were also noted:

Management is difficult in that the scientists belong to independent organizations. Time and substantial funding are needed for communication and travel. Research progress may not be rapid and may be variable. Consequently, choice of the network approach may lengthen the time needed for

meeting research goals, in comparison with a system where all the resources are under the control of one agency. In addition, the level of development of national programmes determines the kinds of activity that can be undertaken in that some activities may impose too heavy a burden on national resources.

The history of networking is therefore replete with both successes and failures. The list of conditions for success drawn up by the second review committee is a long one:

- The activity must be well-defined and sharply focused.
- The network should be confined to a specified geographical region to define a topic of common interest and ease problems of communication.
- Formal arrangements for participation should be made with the research institution and the government.
- Participating institutions should be involved as equal partners, and each institution should feel strongly that it will gain from the association.
- A participating institution must have access to the resources needed for participation.
- The lead institution that provides support and continuity for the network must have the research capacity to provide a strong scientific input.
- Sufficient funding must be available to bring the network participants together for planning, information, and training purposes.
- The network leader must be committed to the concept of the network approach and have sufficient experience to develop a partnership relationship with scientists in national programmes.

The more extensive review of networking in the 1983 integrative report generally supported these findings. In particular, it stressed the need to focus on a problem that needs solution, to build on the comparative advantage of each of the participants, and to ensure that self-interest—the driving force behind successful networks—is present.

Most IARCs are by now heavily involved in networking, and as national research capabilities increase networking is likely to become even more extensive and varied in form. These developments should be viewed, however, not as an invalidation of the "center" approach or an alternative to it, but rather as a logical

extension that is wholly compatible with it. The role of the centers, and the degree of leadership they exercise, will have to be planned carefully in the light of national goals, capabilities, and sensitivities. In the critical area of germ plasm work, the IARCs are likely to do less breeding of finished varieties; they will concentrate instead on providing evaluated germ plasm and superior parental lines to national programs.[1] But the cost and logistics of handling and coordinating international nurseries dictate that the IARCs will continue to be heavily involved.

Boundaries Downstream

By bringing the centers into closer working relationships with the national institutions in collaborative and mutually supporting programs, networking is redefining the boundaries of legitimate center activity. Nonetheless, the need to demarcate these boundaries clearly—and to ensure that they are respected—remains. The centers are under great pressure to provide what amounts to technical assistance to individual national programs—a task distinct from developing and transferring technology for the benefit of a number of developing countries. Some of this pressure comes from the donor members of the Group who see the centers as useful agents to supplement their bilateral efforts in support of particular national programs, but most of it comes from the developing countries, who have sought an ever-widening range of services from the international centers as the centers' programs have become better known.

The centers have been disposed to respond positively to these requests for a variety of reasons, not the least of them being a recognition that strong national programs are essential if the centers' mandates are to be effectively translated into increased production. But the need for direct support to national programs is potentially so great that centers could be drawn into a virtually bottomless pit. When and how centers should respond to requests to support national programs without dissipating their limited resources or being diverted from their main tasks and responsibilities are difficult questions that have confronted TAC

1. Nyle Brady, former director general of IRRI and now a senior USAID official, mentioned during International Centers Week in 1985 that most of the "winners" in IRRI's international rice-testing program now originate in national programs rather than the center.

from the very beginning and figured prominently in both the first and second system reviews.

The first review committee recognized that cooperation with national programs, sometimes referred to as outreach, was an important and necessary component of the research programs of the centers. It also recognized both the need to define the appropriate boundaries to such cooperation and the difficulty of doing so. Its statement of the problem is unexceptionable:

> In any analysis of the problem it is obvious that the technology available in international research centers is far ahead of that currently practiced in the developing world and that there is an urgent need to raise the achievement distributions of the small farmers in these countries. The centers are very conscious of this need and are anxious to help in strengthening national programs and in particular to see their technology used. However, the general strengthening of national programs requires major changes in national administrative procedures, to forge effective links between research and training research workers. Many other kinds of research in addition to that engaged in by centers are required to strengthen national programs. Moreover, the dimensions of the problem throughout the developing world far exceed the capacity of the centers to respond. If they tried to respond they could readily be swamped with a volume of requests that would divert them from their principal and essential mandate.
>
> Thus the problem for the centers is not the existence of this need or their obvious desire to help, but the magnitude of the effort required to bridge this gap. In approaching this problem we believe that centers should be receptive and responsive to opportunities to assist with this task, provided funds are available and their boards of trustees approve. At the same time they should be mindful of the areas in which they are adept and in which they have a comparative advantage. The extent of their involvement in cooperative programs should also be determined by the need to avoid distorting their central research thrust, the need to maintain a balanced program, and not to overreach their managerial capacity.

The thrust of its conclusion was clear, but the application of that conclusion called for flexibility and nuance.

> We conclude that cooperation with national programs is a vital component to the research activities of all centers. As a general rule the primary purpose of such cooperation should be research to advance the central mission of the center. However, centers should be alert and responsive to opportunities for additional cooperation with national programs, provided extra-core funds are available, the project is appropriate, it does not distort their central research thrust or place an undue burden on the center's administrative personnel, and the review procedures enunciated [elsewhere] are met. If the project does not conform to these guidelines, the center should question its involvement and suggest that the requests for assistance be channeled to another donor or agency.

More substance was given to these observations by a listing of the range of possible activities with national programs, presented here as table 7-1.

The Group debated and accepted this formulation. Its desire to insulate the centers against excessive pressures to devote their attention to strengthening national research programs was a principal consideration in the decision to establish ISNAR as a CGIAR-supported activity for this specific (and exclusive) purpose.

Between the first and second reviews, the growth of networking placed the issue of the relationship between the centers and national programs in a more collaborative light. The second study team was more disposed than its predecessor to think in systemic terms. It saw the international centers as evolving, together with research institutions in developing and industrial countries, toward a "coherent" system of institutions with "integrated" aims. In this holistic view, the allocation of functions would follow the socialist principle: "The stronger institutions, whether national or international, constitute the nodes in a larger network of institutions, each contributing ideas and material to the network according to its ability, and taking from it according to its needs."

The second report went further in appearing to distance itself from the analysis of the first report.

> Our approach to the analysis of problems of the scope and boundaries of Centre activities in relation to national programmes in the developing countries, goes beyond that

Table 7-1. *The First Review Committee's Recommendations on Appropriateness of Activities between* CGIAR *Centers and National Programs*

Appropriate	*Sometimes appropriate*	*Inappropriate*
Participation in national research programs to further the centers' research mandate and to assist in the development of the national research capacity. Such activities include: Evaluation of promising new breeding material for adaptation, productivity, and pest tolerance Two-way exchange of superior breeding lines from international and local testing programs On-site evaluation of biological and socioeconomic constraints to farm production and studies of the consequences of new technology Testing of key components of farming systems and evaluating farm machines suited to the needs of small farmers Identification of potential trainees and training trainers in research and production at regional centers or in conjunction with country programs Staff visits and sponsorship of workshops and conferences at regional and country centers to disseminate results and technical information	On-farm trials to demonstrate the applicability of a center's new technology In-country training of production personnel and advice on production systems Consultation on problems relating to regional or country production problems Assistance in the development of a national research institute involved in research and extension in a commodity or technology of direct revelance to the center Advice on research organization, staff recruitment, personnel policies, and equipment	Management of national research organizations Participation in full-time extension and delivery activities Management of national agricultural production programs Responsibility for general technical assistance projects Making of recommendations to national governments on agricultural economic policy and related issues

> presented in the 1977 Review, which did not discuss the mechanisms for research co-ordination that are already established in most developing countries. Rather than recommending guidelines for restricting collaboration with national programmes, we conclude that it is more profitable to examine the principles for successful co-operation in order to maximize the benefits both for the Centres and for the national programmes. Centres need to co-operate closely with national programmes in order to develop widely applicable technology, to validate their research findings and to foster the synergistic effects of bringing scientists together to work on common problems. Likewise national programmes can derive the greatest benefits from Centre activities by co-operative association with them. Even where national programmes are very weak, both the Centre and the country can benefit from the association.

The difference in philosophical approach between the two reports should not be exaggerated. Although the second report emphasized the positive aspects of collaboration between the centers and national programs within an integrated international research system, the study team was not unmindful of the risks. Thus, "the Centres are at risk of being used by donors, international organizations, technical assistance agencies and even the developing countries themselves, for activities that they are not well qualified to perform, for which they were not originally intended and which may divert them from their central mandate." And further: "It seems probable that the pressures on the Centres to respond to these different needs have led to some diversity in the ways in which they operate. But it is clear that they must not allow themselves to be pulled in too many different directions, otherwise their efforts will become too dispersed for significant achievement."

The principal instrument through which the centers tend to be pulled in too many different directions is the "special project" funded by an individual donor (or donors) outside the core program of the center. The second review went into this problem at some length and drew up its own tabulation of "acceptable" and "not acceptable" extra-core funded activities (see table 7-2).

The second review summarized the issue of special projects (extra-core funding) very well.

> We consider that extra-core funding can be a valuable means of increasing the ability of Institutions to respond

Table 7-2. *The Second Review Committee's Recommendations on Acceptability of Activities from Extra-Core Funding*

	Funds from members of the Group		
Type of activity	*Not part of CGIAR pledge by donor's decision*	*Not part of CGIAR pledge for technical reasons*	*Funds from nonmembers*
Expansion of core activities, capital equipment, etc.	Not acceptable	Acceptable	Acceptable
Long-term activities within the mandate but not yet approved by the CGIAR	Not acceptable	Not acceptable	Not acceptable
Maintenance of core activities that the Group had decided to phase out for policy reasons	Not acceptable	Not acceptable	Not acceptable
New long-term activities outside the mandate	Not acceptable	Not acceptable	Not acceptable
Special project directly concerned with national programs	Sometimes acceptable	Sometimes acceptable	Sometimes acceptable
Fixed-term activities directly related to the mandate	Acceptable	Acceptable	Acceptable

quickly to new opportunities; it should not be used, however, to circumvent the allocative procedures established by the Group nor to divert the Institution from its central mandate. If the Institutions are to be accountable for their actions to the Group then the donors must respect the collective wishes of the Group regarding the allocation of what have become scarce financial resources. These conclu-

sions are consistent with those of the 1977 Review Committee. We also endorse its view that for review purposes the programmes of an Institution should be regarded as an integrated whole, regardless of the type of funding.

Despite the warnings of the two reviews, extra-core funding of special projects continued at the level of just under $30 million a year in the three years 1982–84 and increased substantially in 1985. Special projects, as has been seen, can be useful. Nonetheless, the danger that short-run or parochial interests will prevent the system from operating with full effectiveness remains real. To avoid or minimize that danger calls for discretion and respect for the common interest on the part of individual donors and careful judgment on the part of individual center managers.

The impact study team went into the question of relations between the centers and national research programs at even greater length than the review committees. It did not address the "boundaries" issue as such, but, as described more fully in the next chapter, it found that the centers had on the whole played a very constructive role in helping to develop and strengthen national research programs in a variety of ways, of which direct technical assistance was a relatively minor one.

Boundaries Upstream

The upstream boundaries on the appropriate activities of the centers have been much less a matter of controversy; in fact, they have probably received less attention than they deserve. The second review provided the useful taxonomy of types of research activity that has been employed throughout this text. It also gave specific examples of each category:

- *basic research*—that designed to generate new understanding (e.g., how the partitioning of assimilates is influenced by plant height)
- *strategic research*—that designed for the solution of specific research problems (e.g., a technique for directing dwarfing genes in wheat seedlings)
- *applied research*—that designed to create new technology (e.g., breeding new varieties of dwarf wheat that can respond to high levels of nitrogen without lodging)
- *adaptive research*—that designed to adjust technology to the specific needs of a particular set of environmental conditions (e.g., incorporating dwarf wheats into farming sys-

tems of the rainfed areas of the Pampean Region of Argentina).

It has generally been agreed that the fundamental role of the IARCs is the generation of new technology—that is, applied research. But this requires an adequate supply of the results of strategic research, which in turn draws on the results of basic research. IRRI and CIMMYT were able to take advantage of a large amount of basic and strategic research related to the commodities within their mandates. The same is not true for millet, cassava, and other crops in the mandates of the newer centers. Even with respect to rice and wheat, as center scientists tackle new or more difficult "second generation" research problems, they can no longer rely on the existence of a body of relevant knowledge in the industrial countries, the more so since research efforts in the industrial countries have generally been directed toward problems of temperate rather than tropical agriculture. In the long run, new knowledge discovered by basic research will be needed to raise the technical ceiling—the yields theoretically possible under optimal conditions—on all the crops with which the IARCs are concerned.

Centers are therefore by necessity becoming more closely involved in strategic and basic research to maintain the flow of new knowledge needed for their applied research functions. They have been doing so in two ways: by building their own capacity for strategic and, to a very limited extent, basic research and by forging closer links with institutions in industrial countries that are primarily engaged in such research. The advantages of the former approach are threefold: greater control of the research program to orient it to the center's specific needs; improved access, in some instances, to the material, sites, and personnel required for a specific task; and greater stimulus to the center's scientific staff that involvement in such pioneering research provides. All of the centers are now engaged to some degree in strategic research; research on the biological fixation of nitrogen, for example, is going on at CIAT, ICARDA, ICRISAT, IITA, IRRI, and WARDA. The impact study found that in 1984 virtually none of the centers' efforts were devoted to basic research "conducted purely to build up knowledge with no clear idea of how that might be used to increase food production." On the other hand, 10 to 15 percent of the time of the senior staff of the production-oriented centers was used for strategic research "where the purpose is the solution of specific research problems, but the product of which is far from being an immediately applicable technology."

The IARCs cannot be expected to develop and maintain the scientific competence necessary for a multidisciplinary approach to a wide range of strategic research problems, nor would it be cost-effective for them to do so. This observation is even more true of basic research. But, if basic research is not appropriate for the IARCs, they must be able to rely on other institutions. The problem is how to ensure significant advances in understanding and in the discovery of new knowledge (about such things as how cells resist disease, insects, and salinity) in time to meet the needs of the IARCs ten or twenty years in the future. Scientists engaged in basic research are not attempting to solve today's problems and, though probably mindful of the pressing need to raise living standards in the developing countries, are not necessarily directing their research to this end. So can they be relied upon to keep abreast of the centers' needs?

Two questions emerge:

- If basic research can be expected to be conducted at an adequate level, are any special measures needed to ensure that the IARCs are aware of everything relevant to their work and that they have prompt access to the results?
- If basic research of future importance to the IARCs cannot be expected without some inducement, what inducement can the CGIAR provide?

The first is a matter of communication and should be relatively easy to handle. There is already an informal but extensive network of communication between scientists at the centers and basic researchers at the universities, which is probably adequate for near-term needs. This network, however, depends in part on the happenstance of personal acquaintance. As a consequence, the coverage may be thinner than it should be. Some more systematic process would be beneficial. A few industrial countries have for many years had special organizations linked with research institutions in developing countries. The number of such public or quasi-public organizations is growing rapidly, and they now exist in Australia, Canada, France, Germany, the Netherlands, Sweden, the United Kingdom, and the United States. The potential of this relatively new development remains to be fully exploited.

The second question is more difficult to respond to satisfactorily. There first has to be a judgment as to what avenues of research need to be explored to meet the CGIAR system's future needs, and then there has to be a plan or course of action to ensure that exploration is adequate. The plan or course of action

might well involve the award of fellowships to individuals, or contracts to institutions, to pursue particular lines of research. Some institutions in developing countries have the scientific capability to carry out basic research of the kind in question.

The development of basic knowledge that will be appropriate well into the future in molecular genetics and similar fields and the assured access to such knowledge are fundamental to the long-term success of the system as it moves both into more difficult areas of applied research and upstream to strategic research. To some extent, basic research, by its very nature, is something that cannot be planned—but only fostered. Although the individual centers are promoting closer relations with sources of basic research that interests them, the Group has not yet addressed the issue of how to ensure the adequacy of basic research for the CGIAR system years hence. It should do so soon.

TO SUM UP, the concept of an IARC and the definition of its role have changed considerably during the relatively brief period that the centers have been in existence. The central focus is and will continue to be on applied research to develop new technology. But the centers can be expected to continue to forge closer and more collaborative links with national research programs in developing countries and to widen the scope of their research activities to embrace more strategic and basic research issues. These developments are salutary, and they are likely to take place gradually as the IARCs seek the best ways to serve the developing countries whose capabilities and needs are also changing over time.

Funding the System

As has been suggested throughout the text and will be demonstrated more fully in the next chapter, the work of the international centers has proved useful and effective. The developing countries find it increasingly valuable. Donors to the CGIAR continue to find it worthy. Since returns to investment in agricultural research are high compared with returns to other investments, and there are still many research needs unsatisfied, there is a compelling case for strengthening and expanding the CGIAR program. It is, therefore, ironic that in less than ten years from the formation of the CGIAR, the rate of increase in the annual amount contributed by its donor members slowed significantly. This slowing is seen in the following figures for the nominal and real percentage changes in contributions to core programs:

	Nominal	*Real*
1973	20	12
1974	39	22
1975	38	24
1976	32	22
1977	23	13
1978	10	3
1979	17	7
1980	20	7
1981	10	–
1982	10	2
1983	15	9
1984	5	1
1985	−2	−6

Between 1972 and 1977, contributions rose from about $21 million to about $77 million (see table 7-3), an average increase of just over 30 percent a year, or nearly 19 percent a year in real terms. Between 1977 and 1980, when contributions reached almost $120 million, the annual increase was close to 16 percent, but in real terms it had dropped to under 6 percent. Between 1980 and 1985, when contributions were $170 million, the yearly increase averaged almost 7.5 percent, but in real terms it dropped to barely over 1 percent; in 1985 contributions for the first time fell in current terms by over 2 percent, or almost 6 percent in real terms. Actually, the decline over the period was sharper than these figures indicate because in 1983 special projects worth $9 million were transferred into the core programs of centers, thereby adding to total contributions in an accounting sense, but not in reality. The inevitable result has been that in the aggregate the programs supported by the Group have ceased to grow and no new major program has been added since the beginning of 1980.

This stagnation in funding has become the principal constraint to the operations of the system, and at times its overriding concern. It is due in considerable part to extraneous circumstances. One of the most important of these in recent years has been the strength of the U.S. dollar compared with the other currencies in which some 40 percent of contributions are made. In part, this is only an apparent "loss," arising from the fact that the CGIAR's accounts are kept in dollars. But some part of these other currencies has to be converted to meet dollar expenses, and to this extent their value to the IARCs has been reduced as the dollar appreciated. The effect of currency variations can be strikingly illustrated by the contribution of France. In terms of French francs, it grew from 3.2 million to 9.6 million between 1979 and 1984, or by about 25 percent annually, as part of a government

Table 7-3. *Contributions to* CGIAR *Core Programs, by Source, 1972–85*
(millions of U.S. dollars)

Donor	*1972*	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*
Countries														
Australia	—	0.01	1.02	1.22	1.75	1.79	2.58	2.65	2.96	3.30	3.77	4.06	4.00	4.18
Belgium	0.14	0.60	0.38	0.62	1.74	2.25	2.72	3.09	3.27	2.37	1.82	1.88	1.62	1.96
Brazil	—	—	—	—	—	—	—	—	—	—	—	—	1.00	—
Canada	1.16	1.78	4.70	4.34	5.39	6.80	7.37	7.54	6.88	7.55	8.29	9.95	10.02	9.82
China	—	—	—	—	—	—	—	—	—	—	—	—	0.50	0.50
Denmark	0.25	0.23	0.37	0.40	0.46	0.62	0.76	1.05	1.21	1.05	0.95	0.94	1.24	1.12
Finland	—	—	—	—	—	—	—	—	—	—	—	—	0.50	0.62
France	—	—	0.13	0.41	0.51	0.42	0.36	0.68	0.86	0.84	0.89	1.00	0.88	1.21
Germany, Fed. Rep.	—	1.81	3.04	3.94	4.48	5.35	6.76	8.48	10.10	8.37	7.92	7.89	6.65	6.04
India	—	—	—	—	—	—	—	—	—	0.50	0.49	0.50	0.50	0.50
Iran	—	—	—	—	1.98	2.00	1.00	—	—	—	—	—	—	—
Ireland	—	—	—	—	—	—	—	—	0.20	0.18	0.21	0.32	0.41	0.40
Italy	—	—	—	—	0.10	0.03	0.10	0.10	0.70	0.97	1.58	6.10	6.61	6.51
Japan	0.11	0.23	0.27	0.68	1.20	2.50	3.50	4.85	7.00	8.40	8.85	9.08	9.70	11.01
Mexico	—	—	—	—	—	—	—	—	0.50	0.95	—	0.15	1.22	0.37
Netherlands	0.38	0.43	0.56	1.24	1.50	1.72	1.79	2.43	2.60	3.00	3.21	3.53	3.28	3.89
New Zealand	—	—	—	—	0.11	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01
Nigeria	—	—	—	0.65	0.65	0.62	0.79	0.83	1.98	1.14	1.21	1.00	1.00	0.87
Norway	0.75	0.19	0.46	0.81	1.12	1.51	1.88	1.98	2.00	1.90	1.87	2.18	1.92	2.27
Philippines	—	—	—	—	—	—	—	—	0.15	0.50	0.50	0.36	0.32	0.25
Saudi Arabia	—	—	—	—	1.00	1.00	—	—	—	—	—	1.50	1.50	—
Spain	—	—	—	—	—	—	—	—	—	0.50	0.50	0.50	0.50	0.50
Sweden	1.00	0.15	1.49	2.29	2.26	2.24	2.73	3.12	3.39	3.32	3.17	3.05	3.07	3.09
Switzerland	—	0.41	0.14	0.46	0.86	1.21	1.33	1.85	2.45	2.61	2.75	4.89	6.82	5.20
United Kingdom	0.69	1.11	1.92	2.41	2.89	3.52	4.77	6.40	6.79	6.03	6.34	5.91	5.66	6.35
United States	3.77	5.39	6.81	10.76	14.87	18.14	21.15	24.80	29.00	35.00	40.79	44.55	45.25	45.00
Total	8.25	12.34	21.29	30.23	42.87	51.75	59.62	69.88	82.07	88.50	95.13	109.36	114.19	111.67

Foundations														
Ford	5.31	3.68	3.00	2.80	2.00	1.60	1.00	1.00	1.30	1.30	1.00	1.29	1.03	0.90
Kellogg	0.16	0.29	0.28	0.29	0.30	0.31	0.32	—	—	—	—	0.64	0.60	—
Kresge	0.75	—	—	—	—	—	—	—	—	—	—	—	—	—
Leverhulme	—	—	—	—	—	—	—	—	0.49	0.59	0.65	0.75	0.81	0.60
Rockefeller	3.99	4.55	3.50	2.89	2.17	1.60	1.25	1.22	1.60	1.00	0.80	0.52	0.51	0.80
Total	10.21	8.52	6.78	5.98	4.47	3.51	2.57	2.22	3.39	2.89	2.45	3.20	2.95	2.30
International organizations														
AFDB[a]	—	—	—	—	—	—	0.03	0.03	0.04	0.05	0.05	—	—	—
Arab Fund	—	—	—	—	—	0.31	0.31	—	0.26	0.24	0.24	0.23	0.23	0.34
ADB[b]	—	—	—	0.30	—	0.50	—	0.70	—	—	—	—	—	—
EC[c]	—	—	—	—	—	2.50	2.24	3.79	4.55	4.30	4.72	5.16	4.72	6.58
IADB[d]	—	—	2.03	4.12	5.00	5.70	6.19	6.20	6.70	7.40	8.10	8.16	8.73	7.96
IDRC[e]	0.18	0.35	0.65	0.99	1.78	1.31	1.05	0.82	1.53	0.97	1.06	1.96	1.02	1.57
IFAD[f]	—	—	—	—	—	—	—	1.55	3.57	5.93	5.94	8.37	7.02	3.15
OPEC Fund	—	—	—	—	—	—	—	—	0.90	1.00	3.55	2.23	2.49	0.96
UNDP[g]	0.85	1.00	1.47	2.17	1.93	3.50	4.40	4.00	4.62	5.07	6.09	6.85	7.93	7.61
UNEP[h]	—	—	—	0.60	0.34	0.34	—	0.15	—	—	0.18	0.13	0.03	—
World Bank	1.26	2.78	2.38	3.20	6.53	7.85	8.68	10.20	12.00	14.60	16.30	19.00	24.10	28.10
Total	2.29	4.13	6.53	11.38	15.58	22.01	22.90	27.44	34.17	39.56	46.23	52.09	56.27	56.27
Total from all sources	20.75	24.99	34.60	47.59	62.92	77.27	85.09	99.54	119.63	130.95	143.81	164.65[i]	173.41	170.24

a. African Development Bank.
b. Asian Development Bank.
c. Commission of the European Communities.
d. Inter-American Development Bank.
e. International Development Research Centre.
f. International Fund for Agricultural Development.
g. United Nations Development Programme.
h. United Nations Environment Programme.
i. $9 million of the increase in 1983 is attributable to the transfer to the core programs of centers of certain special projects or activities and their funding. These projects continued to be counted as part of core programs in subsequent years.

program to increase substantially its support of the CGIAR. In terms of U.S. dollars, however, the increase was only about 5.5 percent a year.

Price increases in the countries where the centers operate, if not offset by devaluation of the local currency, increase the operating costs of the centers. This was a significant factor during the latter part of the 1970s, when rapid inflation in a number of the host countries was not matched by devaluation of their currencies; as a result, the purchasing power of the foreign exchange contributed by donors was reduced in terms of local currency. Some of the host countries that are also donor members of the Group have on occasion not increased their (local currency) contributions at a rate equal to their rate of inflation, compounding the financial problems of the centers in those countries.

In part, the stagnation of contributions reflects the fact that the centers have by now acquired the plant and staff for their present level of operation (though almost all are confident they could put more to good use). But mainly it is caused by the "donor fatigue" affecting all aid programs. Data collected by the impact study indicate that from 1973 to 1981 official development assistance, expressed in nominal terms, increased by about 300 percent and the portion of this aid allocated to agriculture rose by 400 percent. These rates of increase are well above the rate of increase in prices during these years. Over the same period, support for the Group increased by about 425 percent, so it enjoyed some priority within assistance programs. The Group continued to enjoy a degree of priority during the first half of the 1980s: although official development assistance was cut back in many instances, contributions to the CGIAR remained high enough to permit it to continue to operate without serious reduction in its programs, even though there was little room for growth.

Despite the preferential status accorded to the CGIAR, the combination of extraneous circumstances and donor fatigue has presented the IARCs with difficult financial problems and raises three issues for the Group. These are how to remove restrictions on the use of funds, how to stabilize funds, and how to mobilize more funds.

Restricted Funding

For their own statutory or policy reasons, some donors restrict the use of their funds to particular programs or parts of programs of a center, whereas other donors allow their funds to be

used freely for any activity within a center's authorized budget. In the early years, the trend was for contributions increasingly to be made without restriction, but unfortunately the tide has turned. In 1979, of total contributions for the core programs of the centers, 15 percent was restricted, but by 1984, this proportion had risen to 32 percent. For IRRI, it rose to 43 percent and for ICRISAT, to 54 percent. In consequence, centers have had difficulty in fitting contributions into their authorized programs, and they have been under pressure to alter their priorities to accommodate the wishes of those donors that restrict the use of their funds. Moreover, if the authorized core program has to be cut to accommodate a shortfall in contributions, those parts of it to which some of the contributions are restricted become favored.

Some donors reserve a part of their contribution for funding collaboration with their own scientists. If this kind of collaboration does not fit readily into a center's program, the center is faced with the unhappy choice of distorting its program or losing that part of the contribution.

Special projects are also a form of restriction, and their financial implications can be significant. Not only are the funds for a special project tied to a particular, often fairly short-term, activity that the center is contractually obligated to carry out, but the project is guaranteed funding and manpower in times of underfunding when other activities that are part of the core program may go short. When funds for special projects are included in total contributions, the restricted proportion increases to 44 percent and, for IRRI and ICRISAT, to 59 and 63 percent, respectively.

In addition to their potentially unfavorable effects on the centers' programs, restricted contributions and special projects impose added administrative and accounting burdens on the center director and his administrative staff, thereby distracting them from the center's main tasks. It is hard for a research institution to do its best work beset with the rigidities introduced by restricted funding. It needs flexibility in the use of its resources. There is a pressing need for donors that restrict all or part of their contributions to exercise voluntary restraint and free their contributions to the extent possible under their statutes.

Stability of Funding

A second issue is how to stabilize funding—how to avoid the uncertainty arising from year-to-year fluctuations in the funds

actually accruing to a center. The centers' programs are long-term and require continuity in staffing. Moreover, in recruiting senior staff in the international market, the centers are obliged to offer scientists more security than might be necessary in a domestic market. Quick reductions in staff are not practicable. For both scientific and administrative reasons, centers say that assurance of stability of funding is as important, if not more important, than assurance of growth. Instability is difficult to manage and demoralizing.

Instability has several sources. One is an unexpected decision by a donor to discontinue or to reduce substantially its level of contribution. Iran, for example, stopped contributing after the revolution. Fortunately, however, such sudden changes have not happened often. So far no major donor has dropped out or reduced its contribution drastically. Another source of instability is the failure of donors to meet their pledges. This, too, is unusual and has happened only when a donor country suffered an unforeseen, severe foreign exchange crisis, as was the case with Brazil. The large number of donors (thirty-four in 1985) affords some buffering; it has often been the case that when one or two large donors have had to reduce, or not to increase, their contributions because of budgetary cutbacks at home, other important donors have been in an expansionary phase and were able to offset the impact. More important, though, is the fact that the United States and the World Bank both contribute in fixed proportions to the total amount contributed. Since between them they put up close to 40 percent of the total, they provide a strong element of stability (except in the unlikely event that contributions in the aggregate are fluctuating widely). Indeed, the 25 percent contributed by the United States is crucial, not only as an element of stability in itself, but as encouragement to other countries to give.

Another short-term source of instability is the tendency of donors, for various reasons including the timing of their respective fiscal years, to make their payments late rather than early in the year, whereas the centers must meet their expenses regularly throughout the year. At times, centers have had to engage in extensive short-term borrowing to compensate for delayed contributions.

Only the donors themselves can remedy the instability that results from the size, form, or timing of contributions. To a significant extent, however, instability can be due to extraneous circumstances over which neither the centers nor the donors

have any control. It becomes particularly acute in times of rapidly rising prices or decreases in the U.S. dollar value of the currencies contributed.

To afford the centers some protection during the course of the budget year, there is now a stabilization fund administered by the Secretariat and financed largely by the World Bank. It is a mechanism to protect each center during the course of the year from unfavorable variations in exchange rates and from cost increases higher than estimated. If the currency of a pledge falls in relation to the dollar between the time the pledge is allocated to a center and the time of disbursement, the center may claim the difference from the fund. It may also claim for price increases exceeding the inflation allowance in its budget. Conversely, if price increases are lower than expected or exchange rate changes favorable rather than unfavorable, the fund has a claim on the center. Near the end of the year the net claim for each center is calculated and, if more than 1 percent of its approved budget, the amount is paid out of or into the fund accordingly. The centers whose approved budgets are the more seriously underfunded are excused from paying in, and the fund does not pay out to centers comparatively well funded. The World Bank provides the necessary working capital for the fund from its annual pledge.

A total of about $3.2 million was required for 1984 and 1985, the first two years of operation of the fund, which was less than a third of the resources available to the fund. The mechanism worked well in those two years; most currencies fell against the rapidly rising dollar, but inflation was lower than in earlier years. How well it would work during a period of greater financial perturbation has not yet been tested.

Mobilizing Funds

A third and most important issue is how to raise more funds for the CGIAR in view of the high priority of the research it supports, the need to add some new programs, and the need to offset reductions in contributions from some donor members who may, in the future, find themselves in financial straits. A theoretical possibility is that through increased efficiency the centers themselves could make more resources available for high-priority programs. Such gains, however, are unlikely on any significant scale. While the original building standards of a few of the older centers may have been overly generous, there is no sign that the centers are today extravagant or wasteful. Agri-

cultural research conducted by international centers of excellence is inherently costly. To fulfill their leadership role and to ensure continuity in their research, they need to attract and retain highly qualified people, many of them recruited internationally. They also must have first-class equipment and observe high standards of maintenance, sometimes under difficult operating conditions. To be effective, the centers concerned directly with crop research must be located in the environment they are serving, so they must bear the additional cost of being far from sources of supply. Close collaboration with researchers in many developing countries implies substantial expenditure on travel and communications. Moreover, the international centers, unlike national research programs which are often conducted within universities or government departments, are self-sufficient institutions and must cover all their overheads themselves. Through external program and management reviews the efficiency of the centers is closely scrutinized, and extravagance is promptly brought to the attention of their managements. The evidence suggests that further pressure on the centers to economize would not yield much in the way of savings or real benefits.

Another possibility, raised from time to time by individual donors, is to require the centers to charge for some of their services and products. This, too, is a poor prospect. Each of the international centers has some earnings, partly from investing idle funds and partly from selling the products of its experimental farms, but these do not add up to much. A center could increase these earnings by charging more than at present for services such as training, but this might result in the service being provided to those who could afford to pay rather than to those who need it most. Centers could charge for the use of their conference facilities, but the amounts gained would be small.

Finally, the centers could sell the results of their research—the technology developed—rather than make it freely available, but this is at odds with the whole purpose of the CGIAR. All the money granted—almost all from public sources—to support the work of the international centers is for the purpose of developing and disseminating the technology needed by the developing countries. The centers go to great effort to spread knowledge of the improved technology more widely and, in collaboration with the recipient countries, to encourage its adoption. A major thrust of their economic research is to alleviate the constraints to adoption. Charging for this technology would run counter to the efforts of the centers and the intent of the donors. Moreover, much of the germ plasm used for experimental purposes comes

from the developing countries themselves, and the new varieties and supporting technology are developed in close collaboration with scientists in the national programs of the countries served. As a practical matter, it is virtually impossible to sort out the respective values of the contributions of the partners in this collaboration, and any effort to do so would certainly be counterproductive.

It follows ineluctably that the funds needed by the CGIAR must come from the Group's donors. When contributions to the Group were increasing rapidly each year, donor members newly joining the Group were an important source of additional funds. The largest new donors were the multilateral institutions, such as the European Economic Community, the International Fund for Agricultural Development, and the OPEC Fund. Today, however, most of the major countries and multilateral institutions outside the Eastern Bloc are donor members of the Group. Austria, one of the last holdouts, joined in 1985. Although six developing countries have become donors, and more may join in the future, their financial contributions will be a small part of the total; their undoubted value as members of the Group lies more in the contributions they can make in helping to formulate the Group's policies than in additional funding (see the discussion below).

Foundations such as the Rockefeller and Ford Foundations, the International Development Research Centre, the Leverhulme Trust, and the Kellogg Foundation have made valuable contributions to the Group's funding. There are, however, few foundations of this kind outside the United States and none with enough resources to commit much money to the CGIAR. Even the Ford and Rockefeller Foundations, having fulfilled their pathfinding role, now give less than one-third as much as their contributions in the early years. Better prospects might be found in the large church organizations that have evinced a strong interest in helping economic development in tangible ways, particularly in Africa. It is possible also that some industrial companies, especially those profiting from business in the developing countries, might be persuaded to support the CGIAR. These are all worthwhile possibilities to pursue, and the Secretariat is actively doing so, but it is unlikely that collectively the church organizations, foundations, and industrial companies could add enough to the CGIAR's resources to take it to a significantly higher level of operation.

The conclusion, by no means new, is that the CGIAR must continue to look to the existing donors. All but a few (such as the OPEC Fund and the International Fund for Agricultural Develop-

ment, which have severe problems in maintaining their own resources) could, if they wished, increase their level of contribution. The evidence is that the donor community in general is reluctant to increase its contribution to the developing world, except on an emergency basis as in the Sahel. But even within fixed aid budgets, there is a question of the priority to be given to international agricultural research.

The resources given to the CGIAR are a small part of what is provided in the aggregate for technical assistance. In 1982, out of total amounts provided for technical assistance by the countries of the OECD and the multilateral aid institutions, just over 2 percent was channeled through the CGIAR. Given the great need for new technology and the likely high return to investment in international agricultural research, there is, in principle, a strong case for the donors to give the CGIAR higher priority and increase their contributions to enable it to do more.

Assuming willingness on the part of donors, by how much should the system grow? It has been demonstrated many times that well-designed and well-managed agricultural research has a high payoff, markedly more than can be obtained in most other kinds of investment. Since these returns are substantially higher than the opportunity cost of capital, there is a case on that basis alone to invest more in agricultural research, including international research. The case is strengthened by the increasing demands on the international centers as their collaboration with the developing countries expands and the services they provide become more widely known. Moreover, many research needs are not being met. As already noted, the Group so far has concentrated on research to increase production of the principal foods, but this objective does not go far enough toward helping to ensure that the poor are adequately fed. The system's research needs some reorientation if it is to contribute to this broader objective. The range of research supported needs to be expanded to include research on additional food crops and livestock and on nonfood crops and other agricultural activities that generate income for the poor farmer. There is also a need for more strategic research (and possibly some selected basic research), even if there may be some contraction in applied research.

Yet once the Group departs from its present narrow focus, it is difficult to set the logical limits of its activity. Even if money were no constraint, there would be risks of spreading its efforts too thin. International agricultural research in all its dimensions is too vast a field for the Group. A greatly enlarged system, for all the benefits that might result, would imply more structure, for-

mality, and central management. Taken too far, this expansion could change the simple and informal character of the Group, traits which underlie its success. But given that a massive increase in contributions is unlikely, this risk is small. It would, in any event, have to be weighed against the benefits that would result if the Group were to revise its priorities and expand its scope to do more to raise the incomes of the poorest of the poor.

My conclusion is that the CGIAR system should grow prudently and pragmatically, selectively adding research on cash crops, both food and nonfood, and other research that will help to raise the productivity and incomes of the poorest farmers, stem deterioration in Africa, exploit opportunity in China, and explore some of the new frontiers—such as biotechnology—that may hold out great promise. These are modest objectives, but if they are to be realized the rate of real growth of contributions will have to be raised substantially above the level at which it has been running in recent years. Donors must therefore raise their sights for the CGIAR and give it higher priority among the demands on the resources they devote to technical assistance. Research supported by the CGIAR has been successful. It can be expected to continue to be. Success should be reinforced by the provision of significantly greater resources to the CGIAR system.

Participation of Developing Countries

The CGIAR exists to serve the needs of developing countries. The architects of the CGIAR therefore sought to find a means of ensuring that representatives of the developing countries would figure not only as beneficiaries, but also as active participants in shaping the policies and programs of a consultative group that—by tradition and form of organization—consisted of donor members. Their solution, in addition to stipulating that half of TAC's members should come from developing countries, was to include as members of the Group ten countries elected through the biennial regional conferences of the FAO. Two countries were elected, originally for a two-year term, from each of the five regions. The countries in turn nominated individuals, either research administrators or senior scientists, to attend meetings as their representatives, with the understanding that only one person from each region would act as spokesman on any particular issue.

This precaution has hardly been necessary, for the arrangement has not worked as intended. With rare exceptions in which particular individuals had prior association with the CGIAR

system in some other capacity, attendance by the designated representatives has been sporadic at best and their participation in the Group's deliberations negligible. The Group, wishing to avoid the image of being a "rich man's club," has been concerned to remedy the situation. The problem was addressed at length by the second review committee, which attributed it to the lack of briefing and commitment of those attending Centers Week. Recommendations to improve participation developing country representatives included the following:

- Appropriate mechanisms should be developed to provide information in advance about the system and the agenda of meetings.
- The mechanism for selecting representatives should be improved, so that those selected would be interested in and knowledgeable about the system.
- A mechanism should be developed whereby scientists and administrators in each region could deliberate and provide an informal briefing to their representatives.
- The CGIAR should support the cost of the participation of developing country representatives.

The Group endorsed these recommendations. A fund has been established to meet the expenses of developing country members attending the Group's meetings, and there has been some increased attendance as a result. Countries are now designated to serve a four-year term so representatives will have the opportunity to gain more experience with the CGIAR. But to make significant progress would call for a more concerted and sustained effort on the part of all those concerned, both within and outside the system. That such effort has not been forthcoming is perhaps due in part to a recognition that in the end it is not likely to be fruitful. The fact is that individuals serving for a limited term and without any personal or institutional link to the system are not likely to feel the sense of commitment necessary to make the effort to inform themselves, to attend the meetings, and to participate actively in them.

Support for this somewhat heretical view can be found in the much more effective participation of the representatives of those developing countries that are also donor members. By and large their participation has been as extensive as that of other donors, and the Group has benefited greatly from the perspective that they have provided. An appealing solution might therefore seem to be to expand the number of donors from developing countries.

There have been numerous efforts to do so in the past—some of which have borne fruit—and these are continuing, with good prospects that a few more countries may join. Lowering the minimum subscription from the present figure of $500,000 might attract substantially more members. But one of the basic purposes of the Group is to mobilize resources, and if its membership were to become too diluted without adding significantly to its resources, the Group's effectiveness would be reduced.

There are ways in which the Group can secure greater involvement of developing countries in its deliberations without changing its membership structure. One is by the sponsorship of symposiums or workshops through which the views of developing countries can be made known. Another is through the participation of developing country nationals in advisory groups or study teams, such as those that have been concerned with the impact study or with the two reviews of the CGIAR system. The Group has had recourse to both of these methods, but more can be done along these lines.

In the various components and services of the Group and system, there is a closer balance in participation between nationals of industrial and developing countries. The first two chairmen of the Group were Americans; the incumbent is Pakistani. All three chairmen of TAC have come from industrial countries, but the membership of TAC is divided equally between industrial and developing countries, and members from the latter have been equal partners in its deliberations. The CGIAR Secretariat now has two professional staff members from developing countries, and the executive secretary of TAC is Tanzanian.

It is, of course, at the centers that the research work of benefit to the developing countries takes place, and where the input of knowledge and advice from these countries is particularly important. Contacts with developing countries in symposiums and other forums confirm that their primary interest lies in more effective participation at this level. None of the directors of the early centers came from developing countries, but here again the trend is positive and three of the center directors—including that of IRRI—now do so, and a larger number of developing country scientists are serving in senior management positions. Three of the chairmen of the boards of centers are nationals of developing countries. On the boards of trustees themselves, slightly more than half (about 55 percent) of the seats were filled by individuals from developing countries in 1983; these individuals came from thirty-nine different countries. Perhaps some of these have

been "token" appointments, but many individuals from developing countries have served with distinction on center boards and played key roles in shaping their policies. More careful selection of trustees from developing countries who have the time to undertake this responsibility, and more thorough briefing of them, would further enhance their effectiveness.

For the senior staff, the numbers vary considerably among the institutions. The second review committee estimated that about one-third of the senior staff came from developing countries; in 1983 this proportion was about 45 percent, from forty-seven countries, and it is now closer to 50 percent. Most of the lower-level staff come from the host country.

It is at the level of program formulation and interaction with national programs that participation of scientists and administrators from developing countries is most important and potentially most useful. Individuals from developing countries contribute in a number of ways to the determination of policies, priorities, and modes of operation through participation in networks and other collaborative research programs, seminars and workshops, and numerous informal discussions. Some centers formalize these relationships through regular developing country participation in program committees of the board or in internal reviews. In its survey of the situation, the second review committee observed that "a great deal of effort is devoted by the Institutions to initiating and improving this involvement of scientists from developing countries in the determination of research priorities, the formulation of plans, and the implementation of collaborative programs."

All things considered, participation of developing countries in the CGIAR system is neither as good as it should be nor as bad as critics, including those inside the system, sometimes contend. More can and should be done—and I have made some suggestions to this effect—but progress is being made and participation is most extensive and effective in those activities where it best serves the interests of the developing countries. The second review committee summed it up rather well:

> We foresee that effective participation by the developing countries in the affairs of the System will continue to evolve along the lines that have already been developed. Owing to the large number of organizations and individuals involved in the work, however, there can be no escape from the continuing need to foster good communications at all levels of organization in the System and among all of the individuals concerned.

International Status

No two centers followed identical paths in arriving at their status as IARCs, nor do their charters or legal instruments contain identical provisions. Differences reflect the time and method of their establishment, the political situation in the host country, and the characteristics of local legislation. Thus, CIP was established as a nonprofit entity under Peruvian law by means of a covenant with the government of Peru, which refers to an agreement for scientific cooperation between the government and North Carolina State University. CIAT, CIMMYT, IITA, and IRRI were set up by presidential decree at the conclusion of arrangements made between the Ford or Rockefeller Foundation and the host government. IRRI was specifically accorded the status of an international organization, while IITA is a Nigerian organization "with an international character." (CIMMYT and CIAT are discussed further below.) IFPRI was incorporated as a not-for-profit corporation under the laws of the District of Columbia and was granted various privileges and immunities under the U.S. Public International Organizations Immunities Act.

Other centers were established through more direct participation of the cosponsors and the chairman of the CGIAR. ICRISAT was established by a Memorandum of Understanding between the government of India and the Ford Foundation, followed by a constitution agreed upon by the World Bank and the FAO which was formally accepted by the government of India under the UN Privileges and Immunities Act of 1947. The host-country agreements for ICARDA, ILCA, ILRAD, and ISNAR also involved one or more of the cosponsors and the chairman in varying degrees, typically as signatories to a Memorandum of Understanding through which the center was established.

In one way or another, the agreements with the host countries are intended to recognize that the centers are de facto international organizations, with global or regional mandates, governed by international boards of trustees, composed of international staffs, and serving the interests of an international community of nations. Further evidence of their international status is the fact that the centers enter into formal agreements with governments other than that of their host country. Some centers have as many as forty such agreements, involving a variety of institutions in industrial and developing countries, by which joint research programs are undertaken and networking systems are established.

A basic purpose of the host-country agreements is to confer upon the centers the privileges, and immunities from the laws

applicable to strictly national institutions, necessary for them to carry out their international mandates. These privileges and immunities have generally consisted of

- tax exempt status for the center, inviolability of its premises, and immunity of the center from legal process
- limited exemption from restrictions on imports needed to equip and operate the center and from restrictions on exports to permit the free flow of scientific materials (subject to appropriate quarantine regulations to prevent the import or export of harmful diseases or pests)
- freedom from foreign exchange restrictions on the transfer of capital into or out of the country
- expeditious issuance of visas and clearances for entry into the country of board members, staff, trainees, and official visitors to the center.

In some instances the right of the center to establish employment policies and conditions for staff on an international basis without discrimination as to nationality or any consideration other than qualification, merit, and experience is specifically guaranteed, but in others it is not. The right of the center to publish internationally the results of its research may be explicitly provided.

These immunities and privileges have been identified and defined in varying degrees in the legal instruments that have established the individual centers and governed their relationships with the host countries. Since the centers have generally operated with the active support and goodwill of their host countries, many of the problems that might have arisen because of omissions or imprecisions in the legal documents have in practice been amicably resolved. Despite occasional and usually minor frictions, the centers have generally been able to carry out their international mandates without difficulty.

In recent years, however, serious problems that affect their efficient operation have surfaced in connection with two of the oldest centers, CIMMYT and CIAT, both established before the CGIAR came into existence. CIMMYT is incorporated as a civil association under the laws of Mexico and, as such, its only formal immunity is exemption from taxes on its own income. However, a 1966 Presidential Accord encouraged government ministries to facilitate CIMMYT's operations, and as a result informal arrangements with Mexican agencies sheltered CIMMYT from the full effect of tax legislation, import restrictions and duties, and restrictions on the entry of staff, trainees, and visiting scientists.

Beginning in 1982, the combination of a severe economic crisis and a strict anticorruption campaign has forced administrators to stick to the letter of the law, denying CIMMYT the privileges it had enjoyed informally.

Three problems have arisen for CIMMYT as a consequence. CIMMYT's payments of taxes on its purchases and on the salaries of its international staff exceed by a substantial margin the amounts contributed to CIMMYT by the Mexican government. This means that the CGIAR donors are in effect providing a subsidy to the government by virtue of CIMMYT's presence in the country. Second, the enforcement of quantitative restrictions and duties on CIMMYT's import of equipment and supplies is prejudicing program activities and adding further to its budgetary requirements. Third, mounting restrictions on travel are affecting the freedom of movement of CIMMYT staff and others visiting on center business.

CIAT was established as a nonprofit corporation under Colombian law in 1967. Like CIMMYT, CIAT has enjoyed those de facto privileges of an international organization necessary to facilitate its operations. However, CIAT was pressed into negotiations for a change in its status by a lawsuit, still pending, that raises the issue of whether Colombian staff members with the benefits given to international staff are also subject to Colombian labor legislation. CIAT was also stimulated to seek international status when questions were raised regarding its right to manage international bank accounts under Colombia's monetary regulations.

Negotiations between the two centers and their respective host governments reached an impasse, and essentially for the same reasons. Neither the Mexican nor the Colombian government questioned the need for the centers to have the privileges and immunities associated with their international mandates. But neither government felt in a position, for internal political reasons, to confer those privileges and immunities unilaterally on a nominally national entity. The centers therefore turned, with the acquiescence or support of their host governments, to the CGIAR for help.

The logical approach would, of course, have been for the CGIAR itself to confirm the international status of the two centers or to confer it explicitly upon them should this prove the preferable course. But here the CGIAR's lack of juridical personality turned to its disadvantage. Not existing legally, how could it confer legal existence on the centers that it supported? To have the CGIAR membership do so collectively would have been too burdensome

and time-consuming, so the responsibility fell to the cosponsors. The members of the Group, apprised of the problem, passed resolutions at their meetings in May and November 1983, for both CIAT and CIMMYT specifically and for all centers and their host governments in general. The resolutions requested the cosponsors to find ways of assisting the centers and the host governments to take whatever measures might be necessary to ensure the continued full effectiveness of the international agricultural research centers.

The legal complexities facing the cosponsors in carrying out this request have proved greater than appeared at first sight. Discussions, primarily among the legal staff of the three agencies and with legal advisers to the two centers, have extended over several years. The FAO has decided that, for internal constitutional reasons, it could not be party to an agreement establishing an international organization. The World Bank and the UNDP are nevertheless forging ahead under their authority with a plan to reconstitute CIMMYT and CIAT as international centers, and progress is being made. Each center would operate as an integral part of the CGIAR system. It would have full juridical personality and function as a nonprofit autonomous agency, nonpolitical in management, staffing, and operations. Armed with this international status, the newly constituted centers would negotiate headquarters agreements with their host countries. One stumbling block has now been resolved by a provision of the draft charters which clarifies that, as signatories, the UNDP and the World Bank do not accept any responsibility for debts, liabilities, or obligations incurred by the new centers.

There is a great deal at stake in these negotiations. Not only must CIMMYT and CIAT be assured of the capacity to continue to operate effectively, but a precedent is likely to be set for other centers as well. None of the others has the exact legal status of CIMMYT or CIAT, but they may face new circumstances in the future where the ability of the cosponsors to ensure their international status may be important.

Management by Committees

The danger of overmanagement by a centralized bureaucracy was very much in the minds of those who shaped the original design of the CGIAR. On the one hand, there was concern about establishing yet another international organization to join the

proliferating ranks of such organizations. On the other hand, the Ford and Rockefeller Foundations stressed that the autonomy of the centers and the independence of their boards of trustees were essential conditions for their scientific excellence. There were already centers in being, and they were performing admirably; the main tasks for the future were seen to be the raising of more funds and the orderly expansion of the system on the basis of priority judgments.

While the characterization of the prospective CGIAR as a "forum" rather than an "organization" (see chapter 2) may have been intended, in part at least, to disarm critics, the fact remains that the Group was envisaged more as a deliberative than a decisionmaking body. The model of the consultative groups already in use under the World Bank's chairmanship appealed to the founders because such groups were indeed informal: they had no legal personality, did not raise funds through any burden-sharing mechanism, and took no votes. Hence, the CGIAR was launched as an informal entity, without any attention given—at least on the record—to how it should reach decisions. An advisory committee (TAC) was included, and a secretariat to provide staff services; but neither of these had executive functions, nor did the chairman, whose only specific duty was that of presiding officer. Similarly, the role of the cosponsors was undefined, other than to nominate TAC members for the Group's approval.

But the analogy to the conventional consultative group was always an imperfect one. The CGIAR's responsibilities extend well beyond those for fund raising. Moreover, the CGIAR does not only deliberate. It must decide, and ensure that action is taken on its decisions. Some decisions are routine or procedural, such as approval of the recommendations of the cosponsors for TAC members or of the CGIAR Secretariat for the CGIAR-designated members of center boards of trustees. Others, such as decisions on the annual programs and budgets of the centers, are far from routine, but the Group has recognized that it cannot collectively come to grips with them and has therefore relied on the advice and recommendations of TAC and the Secretariats. But there remain a large number of issues on which the Group as a whole makes decisions, among them

- determining the overall research priorities of the CGIAR
- fixing the financial dimensions of the system for a period ahead
- deciding whether to take on new activities

- defining the appropriate relationships between the CGIAR system and associated activities, including national research programs
- reviewing the principal thrusts of the scientific programs of individual centers and ensuring that the centers are properly managed
- devising and applying systems of review and reporting to provide accountability
- deciding on its own methods of organization and governance.

The external scientific and management reviews of the centers and the five-year reviews of the CGIAR system have provided much food for thought and action. Thus, the first and second system reviews made twenty-two and twenty-four recommendations, respectively, each of which called for decision and many for follow-up action. Difficult issues also come before the Group from time to time for decision on an ad hoc basis, such as those prominent on its agenda in 1985: the future of WARDA and the role of the IBPGR in relation to the FAO and the evolving international network of genetic conservation.

There are essentially two ways in which the Group can exercise its decisionmaking responsibilities: by delegation to permanent or ad hoc committees, or by acting in effect as a committee of the whole in managing its affairs. So far, the Group has consistently opted in favor of the latter approach. As mentioned in chapter 2, the idea that the cosponsors might act as a (self-appointed) executive committee was shot down before the Group formally got started. A proposed standby committee, to be activated in the event of a budgetary crisis, received only lukewarm support (it subsequently proved not to be needed). The establishment of a budget committee or management committee was widely debated as perhaps the principal (or at least the most controversial) recommendation of the second review; in the end, as described in chapter 5, the Group decided against it. No interest has been expressed in devolving more responsibilities on the cosponsors. Special committees have been designated to deal with particular matters—such as the steps preliminary to the launching of a new center—but they have all by design been short-lived.

The grounds for objection to the delegation of management authority to a committee or committees of the Group reflect the egalitarian spirit in which it has operated from the start. A few numbers can illustrate the point. By the end of the second year there were over twenty donor members, and there are now about thirty-five. To work effectively, a management or budget

committee should have in the range of five to nine members. Assuming that each committee member served a three-year term, it would be some twelve to twenty-one years before all the present donor members had an opportunity to serve. Moreover, this calculation implies that seats on the committee would rotate; when the issue came up, several of the larger donors made it clear that they would expect to have a permanent seat on a committee that would be deciding on the overall use of their contributions. With membership in the Group—and the size of individual contributions—purely voluntary, and with some of the smaller countries among the relatively most generous and supportive members, this approach was not acceptable.

The question still remains, however, whether consensus management by a committee of the whole can be expected to continue to work effectively in the future. Several considerations are germane. The volume of work coming before the Group has more or less stabilized, since no or few new initiatives are likely during the period of constrained resources. Nor is the donor membership of the Group itself likely to expand rapidly. In the past, decisions on whether or not to adopt new initiatives proved to be the most time-consuming and contentious—and the greatest burden on the consensus-making process of the Group. Program and budget matters have now come to the fore in their stead, but decisions on the programs and budgets of individual centers have been delegated to TAC and the Secretariats, except when major issues of principle or policy arise. (The separate issue of the workload of TAC, which no doubt is onerous, is amenable to other solutions.)

The CGIAR now meets twice a year for business meetings of up to three days' duration. By and large, it has been able to complete its business in that time without undue pressure. New and problematic issues will no doubt continue to come before it, but neither the volume nor the nature of the work suggests that the present procedures will become unworkable in the foreseeable future.

Is decisionmaking by consensus also durable? The need to proceed by consensus adds a dimension of complexity, and more time, to the Group's deliberations but ensures broader support for the decisions that emerge. Other organizations also act largely or wholly by consensus. The World Bank's Board of Executive Directors prefers to reach decisions in this manner and does so in the great majority of cases; but always in the background lies an agreed system of weighted voting that allocates the executive directors' votes down to three decimal places. It is

probably now too late, and it would be too divisive, to introduce a voting system into the CGIAR, whether weighted or unitary. Nor does experience suggest that it is necessary to do so, so long as the ingredients necessary for effective management by consensus continue to be in place. These are

- broad support for the objectives of the Group and confidence that they are being effectively pursued
- the demonstrated scientific competence of the centers and sound management by their directors and board of trustees
- well-prepared papers by TAC and the Secretariats, focusing clearly on the issues and recommending one or several appropriate courses of action
- adequate opportunity for all members to participate in the discussion, but self-restraint on their part not to prolong it unduly
- a few opinion-leaders whose well-considered views are likely to gain acceptance by their colleagues
- a chairman whose impartiality is undisputed and who can identify and help to shape a consensus
- self-restraint on the part of those members who must accept a consensus view that they do not share.

This list is long, but much of it can be summed up in one word: goodwill. So long as that remains, the present system of governance, however unstructured, is likely to be workable, and indeed a source of added strength to the Group as a whole. Times and circumstances change, however, as does the cast of characters. No past decision is inviolate, and issues of governance and management will no doubt continue to be raised in the Group's deliberations. The terms of the tradeoff are likely to remain the same: greater efficiency in the decisionmaking process by delegation of authority versus fuller participation by all members of the Group in its affairs.

8

Impact and Replicability

IT IS NOW twenty-five years since IRRI was established as the first of the international agricultural research centers. In that time, much has been written, both pro and con, about the consequences of the Green Revolution that was brought about in large part by the semidwarf varieties associated with IRRI and its sister organization, CIMMYT

The IARCs have now grown from two to thirteen, and the international system that supports them—the CGIAR—is itself approaching fifteen years of age. Granted that agricultural research is a long-term enterprise from which early and dramatic results cannot normally be expected, it is not too soon to ask what the impact of the international agricultural research system has been on food production, and more broadly on agricultural and economic development, in the developing world. What more can be expected of it in the near-term future? To what extent can the successes—and failures—be attributed to the unique features of the CGIAR system? And to what extent can the CGIAR model be replicated in other research fields, if so desired?

Impact

These are reasonable questions, but the answers to them must perforce be incomplete and not wholly satisfactory. Two points made frequently in earlier chapters need to be reiterated. The first is that the IARCs and the CGIAR do not exist in isolation but as part of a larger system of basic, strategic, applied, and adaptive research at the international and national levels. This research

system is complemented by national programs of extension, credit, and input supply. All of these elements play a part in the development of new technology and its transfer from research stations to farmers' fields. National and international policies toward food, agriculture, and economic development influence the rate at which new technology is adopted and the results that it achieves. It is difficult, and in some respects impossible, to separate out the particular impact of the IARCs and the CGIAR within this broader process.

Thus, the early achievements at IRRI and CIMMYT would not have been possible without the research undertaken in the United States, Japan, and elsewhere over the previous several decades or more. IR-8, the first of the so-called miracle rices, was the progeny of a cross made at Los Banos between strains coming out of the national programs of Taiwan and Indonesia. When a farmer plants a new variety—usually released by a national program and named by it—he is benefiting from a lengthy and diffuse process of technological innovation and transfer in which many organizations and individuals in different parts of the world have played roles of varying importance. Any effort to single out the role of the IARCs—and some will be made here—is bound to be subjective, qualitative, and to some extent arbitrary.

The second point has to do with the time frame for applied and adaptive research in plant breeding. The impact study carried out under the Group's sponsorship in 1984–85, which will be discussed at length later in this chapter, described it as follows:

> The process of plant improvement is laborious and, inevitably, time-consuming. The initial steps in the development of new crop varieties are to collect and characterize germ plasm—farmers' varieties, wild strains, and related species—and to assess farmers' needs in order to set breeding priorities. From data on the genetic materials and from examination of growing plants, the breeders choose, as parents for crosses, plants that have characteristics that they hope to combine in offspring. After the first cross, the progeny exhibit widely divergent characteristics as a result of genetic segregation. Breeders choose progeny with desirable characteristics and plant their seeds to form the next generation, or they may use selected plants to make additional crosses. By deliberately exposing the plants to high populations of insect pests, to high incidence of disease pathogens, or to other stresses, the breeder can cull inferior plants—the so-called screening process.

> After five to seven generations (many breeders grow two generations a year), lines that have survived intense environmental stresses and the breeder's unforgiving eye undergo preliminary yield testing. The lines are usually grown at several locations to get data on their reactions to different soils, climatic patterns, and complexes of diseases and insects. The international centers with crop improvement programs may carry out all the above steps, as do some developing countries that have large research capacity. Centers normally enter their most promising materials into international tests, or nurseries, that are distributed to national breeders who request them.

These steps are illustrated in figure 8-1.

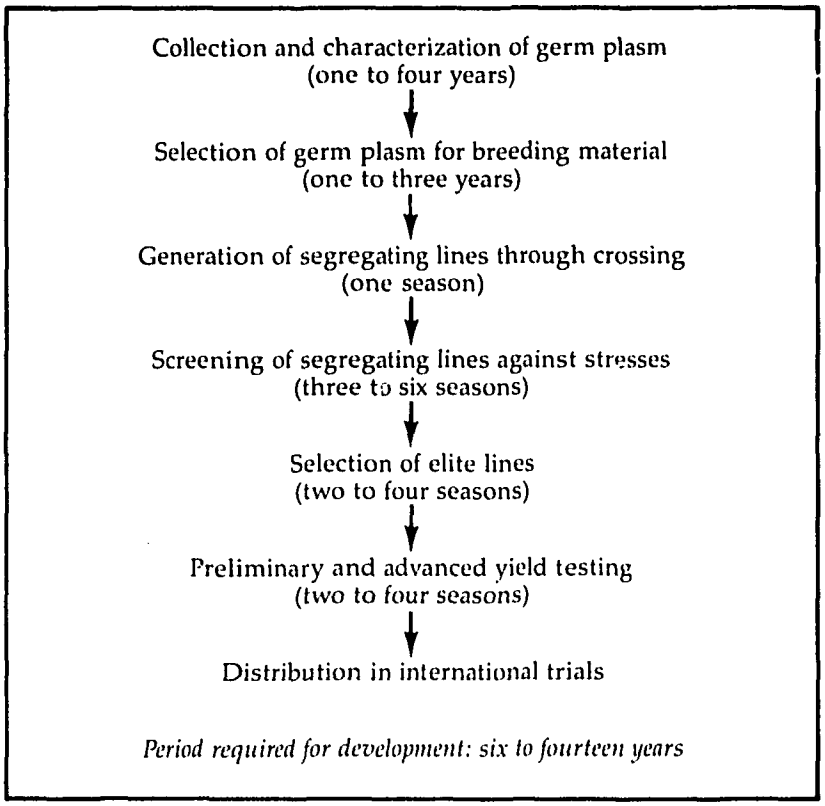
The next stage in the process—adaptation by national programs—is described by the impact study as follows:

> Additional time is required for national authorities to test and evaluate the suitability of materials for their individual conditions. Normally they evaluate materials in a preliminary way (often as part of an international nursery). Promising materials go on to advanced trials and then to farmers' fields. The process may be cut short somewhat by evaluating earlier in farmers' fields, but only a relatively few lines can be evaluated in farmers' fields because farmers are naturally more interested in growing crops than acting as directors of experiment stations. Testing under farmers' conditions is more expensive than on the experiment station because it involves travel and extra supervision. Three to six years usually elapse between first evaluation and release of a new variety.

It is illustrated in figure 8-2.

The total elapsed time between the collection of promising breeding materials and release of internationally and nationally tested varieties to farmers can be from nine to twenty years, although it can be somewhat shorter in the case of a strong national program that carries out by itself most of the steps shown in the first diagram. Experience will vary widely with the crop in question, but it is clear that IRRI's record in producing IR8 within four years was exceptional. (The impact study characterized it as "good luck.") This sobering time frame should be kept in mind when the actual and potential contributions of individual centers and their programs are discussed below.

Figure 8-1. *Stages in the Development of Crop Varieties*

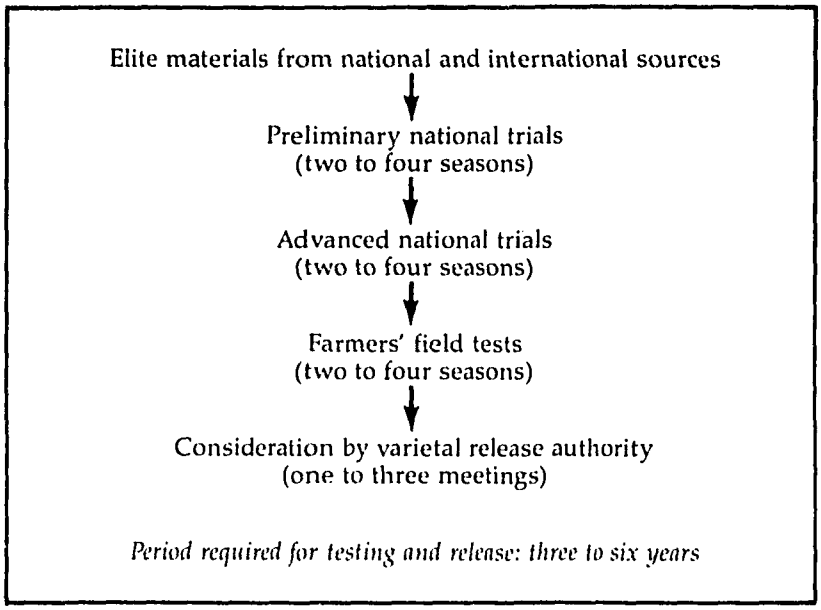


The Impact Study

The centers are mission-oriented, which means that they seek to solve concrete problems and produce practical results. The aid administrators who represent donors to the CGIAR are concerned with justifying to their heads of agency and national legislators that the CGIAR system is having an impact on the objectives it seeks to achieve. The question of impact has therefore appeared periodically on the CGIAR's agenda.

At its meeting in November 1982, the Group decided to conduct a study on the impact that the IARCs have had on agricultural development in the developing world. The outlines of the study were formulated in 1983 through a series of consultations with scientists and other interested parties; the staff work was done in 1984 and the first half of 1985.

Figure 8-2. *Steps in the National Testing of Varieties before Release*



The Group was concerned that the study not only be objective but also be clearly perceived to be so. It therefore decided that, unlike the earlier system reviews, the impact study would be entirely the responsibility of outsiders. An advisory committee of seven distinguished individuals, mostly scientists, was designated to oversee the study. The committee was headed by Frank Press, president of the National Academy of Sciences of the United States. At its final meeting, the committee had the benefit of a commentary prepared by a panel of independent authorities from developing countries. A five-man study team (including one member of the Secretariat) was under the direction of Jock Anderson of Australia Thirty-three authors were commissioned to prepare case studies on twenty-eight countries. In addition, eleven studies on special issues were commissioned. Based on these studies and other materials, the study team drafted its report; it was reviewed by the advisory committee, which then transmitted it to the Group for discussion at International Centers Week in October 1985. The report presented to the Group was entitled, "International Agricultural Research Centers: A Study of Achievements and Potential." I shall continue to refer to it, for the sake of brevity, as the impact study.

A novel and important feature of the study was the systematic effort to secure the views of concerned individuals in the national organizations of developing countries with which the centers have collaborated or are expected to collaborate in the future. The twenty-eight countries selected for study were intended to constitute as representative a sample as possible for this purpose. For each country, the person in charge of the study (usually a national citizen) was advised as to the approximate number and type of people from whom to seek opinions about the nature of the relationships with the centers. Typically forty to fifty people were interviewed in each country. Although presented separately in the three-volume impact study, the findings of these case studies are merged with the other study findings in the discussion that follows, which organizes impact under the headings of area, yields, and production; income distribution, nutrition, and social welfare; strengthening national programs; building human capital; and policy support. The potential impact of new varieties and technologies still under investigation at the centers is also assessed, after which some general observations are made.

The highlights of the impact study were presented to the Group and discussed by it in a seminar which occupied the first two days of International Centers Week. The seminar was not oriented toward reaching conclusions on the study. In general, however, the study was well received. The Secretariat's summary of "Main Conclusions Reached and Decisions Taken" during International Centers Week identified some of the most frequent suggestions and comments as follows:

- The implications of the study's findings for the future work of the CGIAR should be drawn out more directly.
- TAC should study the documents produced by the study and take them into account in its deliberations on the future of the CGIAR system.
- The system must consider whether it is currently meeting the research needs of Africa in the optimal way; that consideration holds equally well for other regions, but it is more pressing in Africa where there has been less impact.
- The CGIAR centers should tailor their programs to the needs of individual countries.
- The CGIAR should consider whether to expand its area of concern beyond strictly food crops and thus shift its emphasis from production to income.

- The study did not explain with complete satisfaction why the convergence of political, scientific, and bureaucratic will that led to the Green Revolution in the 1960s occurred in some places but not in others.

The study is likely to be published after it has been revised and edited, in a form that has yet to be determined. All references in this chapter are therefore to the version presented to the Group.[1] Since its findings are so germane to the purposes of this book, they will be reviewed at some length.

Area, Yields, Production

The principal measurable impact of center-related genetic materials on food production in the developing world continues to come from the semidwarf varieties of wheat and rice. After their introduction in 1965, the semidwarf varieties of wheat developed by the Mexico-Rockefeller program and subsequently by CIMMYT spread rapidly in a number of Asian countries, reaching nearly 40 percent in India by 1970 (table 8-1). Since then, the semidwarf varieties have spread gradually but steadily throughout the developing world.

Table 8-1. *Estimated Share of Semidwarf Varieties in Total Area Planted to Wheat in Developing Countries, Selected Years, 1965–83*

Country or region	*1965*	*1970*	*1975*	*1980*	*1983*
China	0.0	0.1	1.0	10.6	17.8
India	0.0	39.0	74.7	73.3	80.1
Other developing Asia	0.1	39.7	56.7	70.0	69.7
Middle East and North Africa	0.0	5.0	17.7	29.4	33.9
Sub-Saharan Africa	0.0	5.0	27.6	50.8	57.0
Latin America	0.3	10.8	16.2	41.9	82.2
All developing countries	0.1	14.0	27.0	39.9	49.8

About half of the total wheat area in developing regions was planted to semidwarf varieties in 1983, and in India and Latin America the share was four-fifths. Over 270 varieties of semidwarf wheat had been named by national authorities in twenty-nine developing countries by 1984. Contrary to popular percep-

1. I shall, however, continue the practice of not giving specific page citations to documents that are not available to the public.

tions, the new varieties are grown under rainfed conditions as well as under irrigation.

The spread of semidwarf varieties of rice has been equally dramatic. By 1983, about 58 percent of the rice land in the developing world was planted to semidwarf varieties, as shown in table 8-2. The first varieties were released by IRRI in 1965, and by 1972 nineteen IRRI-derived varieties had been named by national authorities. The rice research programs of CIAT, IITA, and WARDA have also produced varieties named by national authorities, mostly in the regions in which they concentrate. By 1984, over 300 rice varieties derived from or produced by the centers in cooperation with national researchers had been introduced into national programs in thirty-nine countries.

China discovered the semidwarf varieties of wheat and rice independently. IRRI established close working relations with China in the 1970s, and by 1983 IRRI varieties were being used extensively by Chinese researchers as parents for their newest and highest-yielding hybrid rices. China accounts for 32 million of the 72 million hectares planted with new rice varieties, but only 5 million of the 39 million hectares planted with new wheat varieties. Thus, if China were excluded from the statistics in tables 8-1 and 8-2, the proportion of area in the developing world planted to the new varieties would be slightly higher for wheat and substantially lower for rice.

The initial semidwarf wheats raised the yield potential under experiment station conditions to almost twice that of traditional varieties: seven to eight tons, compared with four tons, a hectare. The potential has since increased gradually to eight to nine tons a hectare. Few recent comparisons are available of yields under conditions in farmers' fields, but the impact study has conservatively estimated the difference between new and old varieties under field conditions as 500 kilograms a hectare.

Table 8-2. *Estimated Share of Semidwarf Varieties in Total Area Planted to Rice in Developing Countries, Selected Years, 1965–83*

Country or region	*1965*	*1970*	*1975*	*1980*	*1983*
China	27.6	77.3	93.0	94.8	95.0
India	0.0	14.8	31.4	45.0	54.1
Other developing Asia	0.1	10.0	24.4	38.2	39.8
Middle East and North Africa	0.0	0.3	1.3	10.4	11.0
Sub-Saharan Africa	0.0	4.1	10.4	12.9	14.9
Latin America	1.4	4.2	13.7	21.4	29.3
All developing countries	8.4	30.1	44.5	53.0	57.6

The yield advantage of the modern varieties of rice varies widely with growing conditions. Studies have shown that the new varieties can outyield the traditional ones by 10 to 100 percent or more. From its review of available studies, the impact study concluded that 600 kilograms a hectare would be a conservative estimate of the average yield advantage of modern rices. Farm yields of rice include the inedible hulls, which account for about one-third of the weight, so the yield advantage converts to 400 kilograms a hectare of additional food.

The new varieties do not require higher levels of inputs, but they respond to them more favorably than do traditional varieties. For this reason, most of the irrigated rice and wheat land—but a much smaller proportion of nonirrigated land—is planted to the new varieties, and they typically receive more fertilizer and greater attention to weed control through additional farm labor (when available) or herbicides. Since these additional inputs also contribute to production, the entire increase in output cannot be attributed to the varieties alone. Nonetheless, without the new varieties there would be little reason to use higher levels of inputs.

It is therefore possible to draw some conclusions about the increased production made possible by the new varieties. Including China, the new varieties of wheat and rice provide annually about 50 million tons of additional food. This is enough to meet the typical cereal needs of about half a billion people. These are impressive numbers by any standard.

Farmers are interested not only in more production but also in more stable—and therefore less risky—production. Some evidence suggests that the new varieties, with their greater response to purchased inputs and greater sensitivity to weather and diseases, may be associated with instability of yields. The evidence is not conclusive, and socioeconomic and other factors are involved, but it underlines the importance of breeding for more stable yields.

Most varieties of other crops worked on by the centers are at a much earlier stage of the research and development cycle, but are now beginning to reach farmers in developing countries in significant numbers. Centers launched breeding programs in the late 1960s or early 1970s on field beans, cassava, cowpeas, chickpeas, pigeon peas, tropical sorghum, pearl millet, and tropical forage crops. The research base on which to build was small in most cases, and centers had to start by collecting germ plasm and determining how the existing varieties could be improved.

Table 8-3. *Number of* CGIAR *Center-Related Varieties Released by National Authorities in Developing Countries through 1983*

Crop	*Africa*	*Asia*	*Latin America*	*Middle East and North Africa*	*Total*
Barley	0	2	0	8	10
Beans, field	4	2	90	0	96
Cassava	26	5	32	0	63
Chickpeas	0	1	0	2	3
Cowpeas	14	2	12	1	29
Maize	61	49	126	2	238
Pasture species	0	0	12	0	12
Pearl millet	5	3	0	0	8
Pigeon peas	5	2	0	0	7
Potatoes	31	16	12	2	61
Rice	31	140	129	2	302
Sorghum	8	18	5	0	31
Sweet potatoes	6	0	0	0	6
Triticale	2	2	7	0	11
Wheat, bread	40	44	114	66	264
Wheat, durum	5	3	13	20	41

Note: Excludes semidwarfs developed by national programs from sources similar to those used by the centers.

Twelve years after CIAT began its bean program, twenty varieties had been distributed through international varietal testing programs for evaluation by national authorities and had been named by national seed boards. Fifteen years after IITA began its cowpea research, twenty-one varieties had been named by country programs. Table 8-3 lists the number of IARC-related varieties released by national authorities in developing countries through 1983.

The lack of progress on maize remains something of a mystery. The Mexico-Rockefeller collaborative program began research work simultaneously on maize and wheat in the 1940s, and maize has shared equal billing with wheat in CIMMYT's global mandate. Some 238 center-related maize varieties have been released by national authorities in forty-one developing countries through 1983, a number comparable to that of bread wheat (264) and rice (302). These new maize varieties are estimated to have spread over 6 million hectares by 1984, a significant amount but still a small fraction of the land sown to modern varieties of the other two crops.

The impact study identified four factors contributing to the lesser impact of maize research:

- In contrast with irrigated wheat and lowland rice, which are grown in fairly homogenous environments, maize is grown under a great diversity of conditions in the developing world, and any individual variety is adapted to only a narrow range. Many individually adapted varieties must be developed, which can only be done effectively by local researchers.
- Maize is grown in many developing countries, while rice and wheat cultivation is more concentrated geograpically. Thus, international maize researchers must make more institutional linkages than wheat or rice researchers in order to reach the same proportion of national maize workers.
- Research on plant improvement prior to the work of the centers was addressed largely to yellow dent types, which are not as widely consumed in developing countries as white flint types.
- Because the improved maize populations from CIMMYT and IITA have no universal physical characteristics such as semidwarf stature, their crosses with local varieties and their adoption by farmers are much less noticeable than in the case of semidwarf wheat and rice.

In addition to the centers' work in providing improved germ plasm through plant breeding, other collaborative programs involving the centers have also helped to increase productivity and output by providing improved farming methods and materials. The impact of such programs has been limited, however, and few such technologies have yet achieved widespread use among farmers. The impact study commented that it is more difficult to assess the impact of management technology than of germ plasm technology and the problems of attribution are more complex. It summarized some of the principal achievements:

- Programs to improve potato seed are being carried out in a number of CIP-national research system collaborative programs. The technique of diffused light storage reduces sprout elongation, increases sprout numbers, reduces total storage losses, and allows a longer period of storage. This system is now being used extensively by farmers in Peru, Colombia, the Philippines, Sri Lanka, and elsewhere.
- ICRISAT has developed a package of improved technological options for increasing output on the soils (deep vertisols) in the wetter areas of semiarid India. This system is being used on about 4,000 hectares in on-farm tests by national program researchers and extension workers in the states of Karnataka, Andhra Pradesh, Mahrashtra, and Madhya Pradesh.

- IRRI has helped to introduce the biological nitrogen-fixing system using azolla into the Philippines and has helped in the exchange of azolla germ plasm among countries. One study in the Philippines found that farmers who incorporated azolla into their plots reduced their use of nitrogen fertilizer from 42 to 24 kilograms a hectare, without reducing yields.
- The use of short-duration varieties and improved management practices has enabled certain regions to increase the intensity of cropping patterns. The classic case is Bangladesh wheat affecting 0.5 million hectares; the deep vertisol technology is also a crop intensification strategy.
- CIAT has assisted Colombians in the development of techniques for drying cassava so that it can be sold as cassava chips for animal feed. By 1983, there were seven plants in operation in Colombia, and twenty more were being established in northeast Brazil, Mexico, and Panama.
- Cuban farmers have extensively adopted the system of cassava production used in Colombia, which was adapted from CIAT recommendations.
- The benefits of using IRRI threshers range from about $30–80 a year for portable machines in the Philippines and Thailand to $400 a year for large machines in the Philippines.
- The major plant protection technology advanced by the centers has been to produce pest- and disease-resistant varieties or to make pest- and disease-resistant germ plasm available to national systems.

Income Distribution, Nutrition, and Social Welfare

Even critics of the Green Revolution have conceded the dramatic impact on food production of the new varieties of rice and wheat. Their criticisms have been directed, in varying degrees, to the social impact of these varieties on income distribution, employment, nutrition, and the welfare of the poor. These are valid issues to consider in assessing the impact of the CGIAR system. The original terms of reference of the CGIAR note that "in all of [its] deliberations, account will be taken not only of technical, but also of ecological, economic and social factors," and members of the Group have displayed increasing interest in the effect of the centers' work in alleviating poverty. The impact study reviewed the vast scientific literature on this range of topics, which it discussed in terms of the modern varieties' physical

features, their distribution among different kinds of farmers, their impact on the demand for labor and land, and their effect on the food consumption and nutrition of the poor.

PHYSICAL FEATURES AND THE POOR. Several biological features of the modern varieties make them particularly suitable for poor farmers.[2]

- The time it takes modern varieties to reach maturity does not vary greatly, whereas traditional varieties, being sensitive to daylength, do not flower until some critical number of hours of daylight occurs. Daylength-insensitive varieties permit double cropping, which smooths the flow of food supplies available to the farm family during the year. This can be of particular benefit to poor farmers who have difficulty saving from one harvest to the next or borrowing when a lean harvest occurs.
- Some modern varieties resist moisture stress better than traditional varieties. Millets and sorghum are bred for intensive root systems. Wheat producers in Pakistan and Tunisia and rice producers in the Philippines and Bangladesh have often adopted modern varieties mainly because of their resistance to drought. This feature benefits poor farmers, who may have to depend on unreliable irrigation or rainfall.
- The poor farmer, who lacks the information and money to combat insect hordes and diseases, has gained from the wide range of genetic resistance to insects and diseases that has been bred into more recent strains of the new varieties. The more robust plants that have been developed have lifted average yields without sacrificing maximum yield potential. Also, the centers have helped national breeders to respond quickly to new or mutant pests, such as the successive brown plant hopper biotypes that emerged in Indonesia. On the other hand, center researchers have perhaps not given sufficient attention to weeds, one of the poor farmer's more serious problems.
- Modern varieties can sometimes yield better than traditional varieties even without fertilizer. As newer modern varieties are bred to resist pests and diseases, their advantage over traditional varieties at zero fertilizer use has increased, even under

2. One of the authors of the impact study (Michael Lipton, an economist who has specialized on poverty issues) commented during the International Centers Week discussion that "the biology of the modern varieties is almost optimally designed for the poor."

moisture stress. But for the poor farmers, who predominate in areas of unreliable rainfall, the gain may be too small to interest them in adopting the modern varieties, the more so since the favorable results may depend on better agronomic practices than are the rule among poor farmers.

These features are undoubtedly of benefit to poor farmers who live in relatively favored ecological regions. But many of the poorest farmers live in semiarid areas, or in rice-growing regions with unreliable rainfall, and modern varieties so far have offered insufficient advantage to them. Significant change in these areas is likely to occur only when modern varieties of millet or sorghum become available or when techniques that raise the efficiency of water use, such as microirrigation, can be used in combination with modern varieties of less drought-tolerant crops such as wheat.

One of the more serious criticisms leveled against the modern varieties is that, by reducing the genetic base, they are increasing future vulnerability to widespread crop failure, a particular threat to the poor farmer. Paradoxically, although genetic variation is the basis for plant breeding, the effect of successful breeding programs is to restrict gene pools to highly productive, more uniform varieties. Genetic resources are primarily seen by plant breeders as a source of identifiable characteristics and only seldom as a source of increased overall genetic diversity. The success of modern varieties can mean that other genetic variation is not utilized and may in time be lost. This is a danger of which the centers are aware and which they are addressing in their conservation and breeding programs. The centers are in the process of building up, or have already built up, large, freely accessible germ plasm collections, including wild races, that are used in their breeding programs. IBPGR, working in over 100 countries, is encouraging the worldwide conservation, evaluation, documentation, and utilization of genetic resources. IBPGR has directly or indirectly organized 500 missions in eighty-eight countries, particularly in the tropics and subtropics, resulting in the accession of over 100,000 samples in gene banks. For the major crops, a large amount of the world's genetic diversity has been collected and is being conserved for future use.

DISTRIBUTION AMONG FARMERS. Initial research on the relationship between farm size and adoption of the new technology showed that large-scale farmers adopted new varieties sooner than small-scale farmers. This led some observers to con-

clude, incorrectly, that the new technology favored large-scale farmers and could not be adopted by smaller ones. Smaller farmers sometimes lag in adoption because they wait until their wealthier neighbors have proved the new varieties, or because they cannot get scarce inputs at first. But there is substantial evidence to show that where modern varieties are suited to the soil and climatic conditions they ultimately are adopted by roughly the same proportion of farmers in all size groups. Small farmers tend to sow a higher portion of their land to the new varieties and, because they operate with more labor intensity, may in fact get higher yields per hectare than large farmers. Early adopters may benefit, however, by marketing their output before the large expansion pushes prices down, but to some extent this is a reward for their willingness to take risks.

There is similarly no correlation between ownership of land and adoption of modern varieties. Tenant farmers are as likely as owner farmers to respond to the perceived advantages of the new technology. There is no evidence that modern varieties, as such, lead to the eviction of tenants. For both tenants and small farmers, however, the necessary inputs, credit, and extension services must be available on a nondiscriminatory basis for adoption rates to be comparable with those of large farmers. This is a matter of government policy, not of research-based technology.

The principal differences in rates of adoption are not related to farm size or land ownership, but to regional differences in natural resource endowment. As already mentioned, vast areas that have poor soils and little irrigation have been largely untouched by the agricultural revolution. These areas tend to have large numbers of the poor. Poor farmers may actually be worse off absolutely—as well as relative to those who adopt the new varieties—to the extent that increased production elsewhere lowers the prices that they can realize for their traditional varieties. Significant progress toward alleviating poverty in these regions through research will require that efforts be directed more specifically to the problems of resource-poor farmers. The centers are moving in this direction, in Africa and elsewhere, and coming to recognize that the environments in which new varieties are tested and selected will have to be more representative of resource-poor areas and input conditions than has been the case in some of their experiment station programs.

DEMAND FOR LABOR AND LAND. How have the modern varieties affected the already serious problem of unemployment

and underemployment in the developing world? This question has become increasingly important because a large and growing proportion of the poor are landless or nearly landless (cultivating a fraction of a hectare and deriving most of their income from labor). As Lipton has pointed out, small farmers cannot automatically be equated with the poor.

The impact of modern varieties on employment has generally been positive. They raise labor demand per hectare, especially around harvest time and when double cropping becomes possible. In most countries and at most times of the year, the supply of labor is ample, mobile, and growing. The result of higher labor demand is therefore increased and more stable employment (or lessened underemployment) rather than any significant increase in real wage rates. The increased employment and income, however, is in itself a major improvement in the welfare of individuals and families who would otherwise often be at or below the subsistence level.

To some extent the modern varieties have resulted in labor shortages at peak seasons. These shortages have induced the development and adoption of labor-saving inputs such as threshers, tractors, and weedicides, which may then be used to displace labor during other seasons as well. While the employment effect of the modern varieties is nonetheless positive on balance, the impact study recommends that the centers steer research on modern varieties toward patterns that discourage such results (for example, screening varieties for characteristics that will call for more labor-intensive methods of cultivation and processing). The issue of farm mechanization in the surplus labor conditions of developing countries is a complicated one, however, and a variety of divergent views were expressed during the seminar at International Centers Week.

The demand for land is also increased by the new varieties, although less than the demand for labor. But usually the supply of land cannot be increased in response, so that the modern varieties have led to higher rents and land values.

FOOD CONSUMPTION AND NUTRITION. One of the most important effects of the centers' output on the welfare of the poor has been through their food consumption. By increasing the supply of basic foodstuffs, their prices have been kept lower than they would otherwise have been, counteracting the ten-

dency for food prices to rise as demand grows with increased population and higher incomes. In low-income countries, the poorest 20 percent of the people typically spend 60–75 percent of their income on food, and even then are not able to purchase a sufficient amount. The poor thus benefit most from the ability to purchase cheaper food; in developing countries for which data are available, the same reduction in the price of food leads to twice the relative increase in real incomes for poor households as for rich ones.

How much the poor benefit as consumers from the new varieties depends in part on which staple foods figure most prominently in their diets. Modern varieties of rice and wheat have prevented mass starvation in much of Asia. But in Africa and in semiarid Asia, increased production of these varieties has done much less for poor consumers who eat mainly sorghum, millet, maize, and cassava.

The urban poor benefit as food consumers from lower prices. The impact on poor farmers producing new wheat and rice varieties is more complex. They may lose to the extent that the combination of increased output and lower prices results in lower total income. These losses, if and when they occur, can be mitigated by shifting to other crops from which returns are higher or by increasing on-farm consumption, of particular importance to farmers at or below the subsistence level. Government policies with respect to the import of food and the pricing of agricultural products can, of course, affect these results.

It is now widely recognized that malnutrition is essentially the result of insufficient energy intake (that is, a lack of calories) and not, as previously believed, of protein deficiency. By moderating food prices and thereby increasing food purchasing power, modern varieties have been the main factor improving the nutrition of the poor of the developing world. The impact study comments that such improvement should be the central objective of the research programs of the IARCs and questions the priority of some center research directed at raising the protein content of foods. "Poor at-risk consumers need preferably cheaper, more food energy, stabler and more easily absorbable—rather than, say, high-lysine maize." Similarly, since legumes produce costlier protein, and much costlier calories, per hectare than cereals, legume research has fewer nutritional benefits than is often supposed. Increased legume production can, however, reduce dietary monotony and vulnerability to drought.

Strengthening National Programs

National research programs in developing countries are both clients for the product of the centers and, increasingly, partners with the centers in creating that product. The relationship is symbiotic: the national and international research efforts are mutually reinforcing, and each benefits from the strength of the other. Without effective national research and extension programs to exchange, test, and validate germ plasm, to adapt varieties developed at the centers to national conditions, and to provide extension and other services to farmers, the activities of the centers would be to little avail. The relationship between the centers and national programs has long been a matter of interest to CGIAR members, as indicated in earlier chapters. A particular concern has been that the growth and prosperity of the centers supported by the Group should not be at the expense of national programs in the developing countries nor be detrimental to them. In this as in most other regards, the findings of the impact study are reassuring.

The study divided the centers' impact on national research systems into three categories: impact on aggregate national budgets for research; impact on priorities in the allocation of research resources by commodity, project, and discipline; and impact on the structure, planning and management, and research methods of the national institutions concerned with research and technology transfer and on the linkages among research, education, and extension institutions. The same organization will be followed here.

FINANCING NATIONAL RESEARCH. National agricultural research systems have grown rapidly since the early 1960s, a period that coincides with the growth of the international agricultural research system. The national systems have progressed most steadily in Asia, where real expenditure has grown in almost all countries. Increases in expenditure and personnel were accompanied by changes in institutional structure and research priorities. There was an initial period of institutional instability, but most countries in Asia now seem to be developing effective national research systems. Latin American research systems also grew very rapidly, but research expenditures in some countries declined in real terms during the 1970s. There was also a period of reorganization in several countries. Research expenditures in Africa also experienced a high rate of

growth although, as in Asia, there was considerable variability by country. Many African research systems were caught up in the larger problems of adjustment following independence. Some countries had fairly radical and disruptive changes in their research systems, while others remained highly dependent on—and in some cases in the control of—foreign researchers. From 1959 to 1980, government expenditures on agricultural research increased sixfold in Asia and Latin America and over fourfold in Africa. Government expenditures on research increased not only in absolute terms but relative to the size of the agricultural sector in the national economy.

Many factors help to account for this rapid growth. Food crises generated pressures from consumers for a more reliable supply of food. The urban sector needed more abundant food supplies, more food exports, and fewer food imports as a means of promoting industrialization. The publicity surrounding the Green Revolution helped to create the perception that agricultural research was a principal means of increasing food and other agricultural production.

Despite the impressive growth, there are still weaknesses in many national agricultural research systems. Even in the larger systems, there is evidence of underinvestment in research. Smaller countries face difficult problems of educating and retaining a sufficient number of scientists and technicians. Some commodities are still neglected, and some national programs are not organized to make effective use of available resources.

The international agricultural research centers appear to have had a positive impact on the level of funding of national research. The early successes of the high-yielding varieties of wheat and rice raised the expectations of national leaders about the potential benefits from their own agricultural research. Senior research scientists from CIMMYT and IRRI played key roles in delivering this message to national authorities. Collaboration with the centers raised the productivity of national research and helped to convince governments that there would be high returns in the future. Foreign donors became convinced that agricultural research was a productive investment at both the international and national levels, and the period witnessed substantially increased international assistance to national programs. Instead of displacing international or national funding for national research programs—as sometimes feared—the IARCs in general have both encouraged it and made it more productive.

One of the issues papers prepared for the impact study made an effort to quantify, through the use of an econometric model, the influence of the centers on national spending on research and extension. It found that neither the data nor the theoretical concepts were completely adequate for the task; the results were therefore described as "preliminary," and cannot be regarded as definitive. The analysis found that an increase in total spending by the centers on field crop research led to increased spending on both research and extension by national programs. Investing in research by the centers appeared to have a greater enhancing effect on national spending than other forms of aid.

The amount by which national spending rose in response to increased effort by the centers was strongly influenced by the size of the country. Countries with large areas of farmland can capture more benefits from the products of the centers simply because there is a greater scale of production to which to apply new technologies. They increased their funding both absolutely and relatively more than small countries. The latter are likely to rely more heavily on support from the centers, and there is some risk that international spending may displace national spending. In the case of host countries, no clear or causal relationship could be established between center and national spending.

RESEARCH PRIORITIES. The impact of the centers on research priorities, and in particular on the allocation of resources among commodities, has been dramatic. Before the advent of the IARCs, national research was primarily oriented toward commercial crops for export, and domestic food crops received little attention. The emphasis of the centers on food production undoubtedly influenced priorities at the national level, although both international and national programs found common inspiration in the world food crises.

The inducement effect is clearest where no comparable national research program existed before a center started its own. Cassava research is an example. India was the only country with a national cassava program before CIAT was established. In a survey of twenty countries, the impact study found fourteen with national cassava programs, all linked in one way or another to CIAT programs, materials, or trainees. Wheat research programs in the Philippines, Thailand, and Burma have similarly been stimulated by CIMMYT's tropical wheat research. Collaboration has led to increases in the size of existing programs in many

countries. Bangladesh affords a striking example: in the early 1960s, about twice as much research expenditure was devoted to jute as to rice, although jute accounted for only about 10 percent of the value of agricultural production, whereas rice accounted for 50 to 60 percent; by the late 1970s rice research was three to four times that of jute. Several donors supported the emphasis on rice production and provided financing to build up rice research capacity.

An analysis of commodity research expenditures for twenty-five developing countries showed that, during the 1970s, there was a strong positive association of national commodity research expenditures with research expenditures on the same commodities by the centers. That is, national research investments increased more rapidly for commodities being researched by the centers than for commodities in which the centers were not involved. Newer national programs responded most strongly to the activities of the centers. As national programs matured, national priorities tended to reassert themselves; Bangladesh, for example, began to develop research capacity in food crops other than rice.

Some cases were encountered, particularly in host countries, where centers "crowded out" local research efforts. The Philippines, for example, has relied on IRRI to provide virtually all the rice research that it needs. It is not clear that this is disadvantageous, at least so long as IRRI is present. The redirection of research resources toward food crops, which the centers have stimulated, seems generally to have resulted in a more efficient allocation of these resources, especially because food crops were neglected by colonial governments.

Perhaps the most important impact of the centers on research priorities has been their orientation of researchers toward solving farmers' problems. This shift of research efforts cannot be quantified, but national research and administrative personnel who have worked with the international system over a long period persistently point to this as one of the principal contributions of the centers. By serving as role models, by their collaborative programs and networks, by the conferences and seminars that they sponsor, and by their training programs, centers and their scientific staffs have helped to reorient national programs toward practical, applied research on farmers' problems. ICARDA's Nile Valley project, which tests technology to increase yields of fava beans on farmers' plots, is cited as a good

example of encouraging national scientists from Egypt and Sudan to work with international scientists on farmers' problems in the field.

INSTITUTIONAL STRUCTURE. The centers have also contributed to the strengthening of national research through formal and informal activities directed toward improving the organization, management, and research techniques of national institutions; encouraging the provision of germ plasm; and promoting international scientific communication through data base services, international meetings, and publications.

The CGIAR centers, for example, have been organizational models for some national institutions. EMBRAPA, the Brazilian national agricultural research organization, established a series of commodity institutes organized in multidisciplinary teams as the basic structure for Brazil's national agricultural research system. Bangladesh, China, and Indonesia have built rice research institutes modeled after IRRI, with technical assistance from IRRI personnel. Other countries have copied parts of the centers' commodity research programs; the Indonesian Genetic Evaluation and Utilization Program, for example, took both the name and the organizational structure of a similar IRRI program.

Also by their example the centers have promoted on-farm research programs, which are being used by national researchers as an input into the research planning process. The centers' emphasis on farming systems research has encouraged national institutes to establish similar research programs of their own. Many countries have initiated farming systems research programs, partly at the behest of donors and with the "special project" assistance of the centers, and partly at their own initiative.

A more direct effect has been exerted by ISNAR, which was established for the sole purpose of strengthening national programs. ISNAR has recommended institutional and organizational changes in twelve of the eighteen countries to which it has sent major review and planning missions. Proposals have varied widely in content, depending on the specific needs of each country. A number of the proposals are being implemented with ISNAR assistance.

ISNAR's management training activities are designed to strengthen the managerial capabilities of agricultural researchers. More than 130 individuals, mostly from Africa, have participated in management training programs. ISNAR has also devoted considerable attention to developing manpower and

training plans for many of the national research programs that it has assisted.

Many of the centers have had a hand in enhancing research methods in developing countries. One of the most important new research approaches that centers have developed and popularized is the "high-volume crossing approach"—the procedure of making a large number of crosses and exposing them to heavy pressure from relevant pests and diseases. This approach has become the convention for most small grains programs around the world, replacing the standard plant breeding approach featuring a few, carefully chosen crosses that were grown under protected conditions at experiment stations. Most of the IARCs have developed research techniques to screen lines for disease and pest resistance, which have been particularly appreciated by national programs and emulated insofar as practicable.

As part of its efforts to preserve germ plasm, IBPGR has been responsible for some important new institutions—the development of new national genetic conservation programs in about fifty countries and of national genetic resource committees in twenty-five countries. It also provides other assistance to national institutions to strengthen their capacity to carry out genetic resource conservation work.

One of ILCA's more important "products" has been the analytical services that it provides to national agencies that have large data bases on livestock production but lack the human skills or computers to appraise and use such data. African researchers analyze the data at ILCA headquarters with the assistance of ILCA staff.

The centers provide professional interactions and regular services that increase the productivity of national research systems. Conferences sponsored by the centers build communications links among researchers from different countries, help researchers to keep current with developments in their field, and provide occasions for national researchers to gain recognition and prestige.

Publications from the centers provide both a source of new information, methods, and ideas and a place for problem-oriented scientists to publish their findings. Several of the centers have computer-based information services that provide references, copies of journal articles, and bulletins to national researchers on request.

The centers also play an important role in linking national research systems through research networks. As indicated in

chapter 7, these networks can take many forms, the most common of which are the genetic materials testing networks.

The foregoing observations have been partly based on, and are corroborated by, the findings of case studies completed by the study team in twenty-five of the twenty-eight developing countries selected. In the case studies, the provision of germ plasm of important food crops was most frequently cited, along with training, as the most valuable contribution of the centers. The availability of germ plasm collections and networks has significantly raised the goals of national researchers and facilitated their efforts to get more public funding for their operations. In general, national researchers considered the workshops, conferences, training opportunities, newsletters, and publications from the centers to be more useful than comparable services provided by other (regional or bilateral) sources. Centers' services were rated higher in continuity, consistency, and essentiality. In the early days of the CGIAR system, national researchers sometimes objected to "high-handed" attitudes on the part of center staff. These complaints were isolated and largely confined to a few individuals; now that relationships have matured and become more collaborative, national researchers are reported to be very positive about their professional association with colleagues at the centers.

Building Human Capital

One of the most important ways to strengthen national institutions is by building up their staff capacity. TAC commissioned a study of training within the CGIAR system just before the impact study was organized. The impact study used the TAC study as the basis for its own report, which is summarized here.

The centers see the staffing of national research programs with trained scientists and technicians as vital to the accomplishment of their own mission. They have therefore taken a direct hand in training personnel from these programs. More than 17,000 people have participated in the various types of training provided by the centers over the past two decades, and approximately 3,000 a year receive training currently. Many of those who have received training are now international and national leaders who have made significant professional contributions to agricultural development in their countries. Each center has training links with many countries (up to eighty in some cases), and each of the countries studied has links with an average of seven centers.

More than 13,000 persons from developing countries have participated in formal group training courses. These courses last from one week to several months—often for a crop season to permit participants to take part in the full spectrum of productive tasks. The largest number—almost half—have come from countries in tropical Africa, with Asia accounting for the next largest number. As the demand for such training grows and strains existing capacity, centers are collaborating with national agencies in conducting formal training programs locally. Former trainees often serve as instructors.

About 500 candidates for doctoral degrees, and 900 candidates for master's degrees, have done their thesis research under the supervision of center staff members. Usually this work takes two to three years. Most of these degree candidates come from developing countries and find that thesis research at a center is more pertinent to the needs of their home country than research conducted at a university, whether at home or abroad. Postdoctoral training is undertaken at only a few centers.

In addition, special training programs have been provided for about 2,300 individuals, again very largely from developing countries. These are scientists or others who come to a center by prearrangement to learn a technique or to study a specially organized series of topics.

Developing countries value the training provided by the centers and would welcome more of it, especially at the university level. Their willingness to release scarce personnel for substantial periods of time and to assure them of positions on their return demonstrates the high regard they have for training. Former participants speak not only of gaining knowledge and technical skills but of personal growth in dedication to both physical and intellectual work, in motivation, determination, purpose, and self-confidence. For many individuals who come from educational systems that stress theoretical knowledge and literature study, the opportunity to work with a crop in the field from sowing to post harvest, or to learn a specialized technique in the laboratory, instills practical competence and understanding. Continuing contact with the center afterward offsets isolation and helps participants to feel that they are valued citizens of a professional world.

The subsequent careers of participants suggest that their training enables most of them to serve the research and development needs of their countries more effectively, even though many are eventually promoted out of practical research and some move to

commodities and disciplines different from those in which they were trained. For all these reasons, training at the centers clearly has strengthened agricultural research and the agricultural education systems in many countries and has played its part in the increases in output that many of them have realized.

For the centers, former trainees provide the most important channel of communication between the centers and the national programs with which they cooperate. Former trainees do much to promote the work of the centers through cooperative programs, networks, and research dissemination. They are sought out by visiting scientists from the centers and may be invited back to participate in workshops and help in the training of others. The training programs also help to identify suitable candidates for staff positions at the centers. One center has a formal association of training alumni, and all send their published material to as many former participants as can be reached.

Policy Support

Recognition of the need for and importance of research in support of sound agricultural and food policies has grown in step with the work of the centers. By now it is abundantly evident that improved technology and higher production alone cannot solve the problems of low food consumption and malnutrition.

In the past two decades, food production worldwide has risen substantially, due in no small part to the combined research efforts of the national and international centers. Even during the years of poor harvests in the early 1970s, the global supply of energy from basic grains alone—without counting the energy derived from oils, sugar, meats, fruits and vegetables, or pulses—exceeded estimated average per capita requirements by more than 20 percent. By 1977, global supplies of grains exceeded global energy requirements by almost 50 percent. Yet, despite this apparent abundance of total supplies, many millions of people remain inadequately fed.

Gains in production through the new technology have been unevenly distributed across countries, within different regions of a given country, and over time. Similarly, the rate of growth of food consumption has been much lower and more variable in some countries, and regions, than in others. "To understand and influence the level of food consumption," the impact study points out, "requires attention to the economic, political and

institutional setting as well as the technological circumstances. Research that leads to a better understanding of the nature and role of both domestic and international policies, and helps alleviate the constraints that they impose, is an important element of global agricultural research."

IFPRI was brought into the CGIAR system in 1980 with the specific purpose of doing research on the complex set of food policy issues. The need for socioeconomic research, however, was foreseen at Bellagio and figured on the agenda of TAC as early as 1973. Today, most of the centers engage in some form of social science research; in fact, over three-quarters of the total social science research in the CGIAR is conducted by centers other than IFPRI. Social scientists are on the staff of eleven of the thirteen centers, ILRAD and IBPGR being the exceptions. At several centers policy research is conducted within the farming systems research group. At others it is carried out within a separate department of economics or social science, but closely linked with farming systems research. At one center it is incorporated into the work of multidisciplinary commodity teams. In all centers this work focuses on the policy environment as it affects the generation and diffusion of new technology (on "constraints" to technological adaptation, in IRRI's terminology), rather than on the broader issues of food and agricultural policy, which are the exclusive province of IFPRI.

The impact study observed that for the centers to claim credit for constructive policy changes made by national governments would be not only empirically difficult to demonstrate but also impolitic. However, it commended IFPRI's research on input policies, food security, crop insurance, and food subsidies, and CIMMYT's policy seminars, as having contributed to a more informed debate and been in demand from national policymakers. It also credited IFPRI—through its seminars, research publications and abstracts, programs for visiting scientists, and projects in developing countries—with having enhanced national capacity for policy research.

The work of the centers has also had less direct and tangible impact on national policies. From the early visits of Borlaug to Asia in the 1960s, senior scientists from the centers have had access to national leaders in developing countries and have undoubtedly exercised a positive influence in orienting food production and distribution policies to reap the benefits of the new technology. By their own emphasis on social science research and policy analysis, the centers have created greater awareness

of the importance of this policy work and helped to enhance its status within national programs.

Social science policy research has been internally beneficial to the centers as well. Studies of the allocation of research resources within the centers have enhanced the productivity of their research efforts and permitted wider and more effective collaboration with national programs. Support for assigning only secondary priority to breeding for higher protein content came from studies at ICRISAT and elsewhere that showed that better protein nutrition could be achieved more economically by focusing on high-yielding and widely adapted varieties. More generally, policy analysis has relieved the continual pressure on the biological scientists to justify their work and to modify their approaches to achieve a broad array of social goals.

Potential

We have seen that most of the concrete results that the centers have realized—as measured by increased production—have come from the improved varieties of wheat and rice that originated at CIMMYT and IRRI. Although this is understandable in view of the long lead time for applied research and the absence of a comparable stock of knowledge from basic and strategic research on other crops, it highlights the importance of assessing the potential impact of the research work now under way. What can be expected of the research that should be coming to fruition over the next five, ten, or fifteen years?

The impact study cautioned against expectations that the centers will be able to maintain the very exceptional economic rates of return of the past, not only because the centers are focusing more on crops other than rice and wheat, about which less is known, but also because a greater proportion of the output of these crops comes from less favorable environments. The same could be said about future research on rice and wheat as it addresses more difficult problems and concentrates more on nonirrigated areas. Still, the advisory committee was bullish: "Agricultural science in the 1980s is in a state of rapid transition. Genetic engineering and other tools of biotechnology promise to greatly increase the potential gains from investment in research."

Each of the centers prepared a statement on the expected future impact of its work. IRRI, for example, assuming that it con-

tinues to invest $25 million annually in rice research and that collaboration with national programs is sustained, expects to contribute additional rice in South and Southeast Asia worth $16 billion to $17 billion annually by the year 2000—a staggering figure which the impact study characterized as "clearly conservative" since China, East Asia, Africa, and Latin America were not included. ICRISAT estimated the gross value of additional output of sorghum, millet, pigeon peas, chickpeas, and groundnuts in the year 2000—based on current levels of research funding—at $7.6 billion. (These amounts are the gross value of additional output, without allowing for the additional cost of inputs or attempting to isolate the effect of the new varieties as such.)

As the impact study emphasized, "the estimation of future impacts is fraught with pitfalls. Understanding of the processes of generation and international diffusion of technological change is most imperfect." Its overall assessment was nonetheless very positive:

> A review of the broad sweep of expected results from the centers indicates that some impressive gains may be made, particularly in technologies that are applicable to large areas. At almost every center, if just one major project meets expectations, it will generate returns far exceeding the cost of the center. In fact, there are a few undertakings that, if any one is successful, will generate benefits greater than the present costs of the entire CGIAR System.

This conclusion was based in part on a detailed analysis of six selected cases: improvement of rice for favored upland areas of Latin America; biological control of cassava pests; tolerance to aluminum in wheat; tolerance to heat in wheat; resistance to downy mildew in maize; and use of true potato seed. The method of analysis was designed to capture the principal characteristics of investment in research, which the impact study defined as follows:

- There is a lag between when a project is initiated and when any results are first applied;
- Adoption of a new technology takes time, as farmers learn and experiment;
- Most biological technologies require continued investment to maintain their productivity;

- Expenditures by the centers are only one part of the total investment needed to produce and extend a new technology; and
- Future uncertainties make the payoff to investment in research uncertain.

The assumptions made were intended to be conservative. Thus, allowances were made for both research lags and adoption lags (the latter generally assumed to be ten years) and for "maintenance research" needed after the critical investment period. It was assumed that research expenditures by the centers need be matched by only an equivalent amount of additional expenditure by the national programs of each country. To offset this questionable assumption, only 20 percent of the benefits were attributed to the work of the centers; the remainder was assumed to be due to the effort of national research and extension programs and to national investment in rural infrastructure and in human capital.

Table 8-4 summarizes the results for the six cases. The returns in all cases are very satisfactory, and in some very favorable indeed. It should be stressed, however, that these findings can at best be regarded as illustrative. The analytical framework depends on a series of arbitrary assumptions which, although intended to be conservative, are subject to a very wide margin of

Table 8-4. *Estimated Future Payoffs to Selected Technologies*

Example	*Present value of future net benefits discounted at 10% a year (millions of dollars)*	*Internal rate of return (percent)*	*Benefit cost ratio*
Rice for favored upland areas of Latin America	84	25	3.3
Biological control of cassava pests	220	41	4.5
Tolerance to aluminum in wheat	140	45	6.2
Tolerance to heat in wheat	86	28	4.0
Resistance to downy mildew in maize	32	17	2.3
Use of true potato seed	274	28	7.6

error. To avoid spurious precision, it would probably be safer to say that the expected returns are likely to be in the range of 10 percent to 60 percent (the impact study says 20 percent to 40 percent), but a sensitivity analysis indicates that alternative assumptions about such variables as the research lag and the net yield per acre result in even wider variations in the estimated returns.

Despite the inevitable shortcomings of the analysis, the overall conclusion probably remains valid. Potentially, there are still some very large gains to be made from research work now in the centers' pipelines. Most of the centers' research deals with technologies that can be widely adopted and are relevant to large areas, so that even small increases in productivity can give rise to large increases in output, even after allowance is made for all the additional costs that have to be incurred. In most of the centers, at least one specific research project holds out this promise.

Conclusions

Some of the founding fathers of what was to become the CGIAR, meeting for the first time at Bellagio in 1969, were animated by a vision of a world free of the age-old specter of hunger and famine. Realization of this vision still lies well in the future, and it is now apparent that new technology cannot do the job alone. Yet the new varieties in large part developed at the CGIAR-supported international centers and transmitted to developing countries are transforming agriculture in many parts of the world. Mass starvation, particularly in Asia, has been averted by the greater production and consumption resulting from the modern varieties. Famine, when it has occurred, has been due to a particularly unfavorable combination of circumstances and has been localized to parts of Africa.

Perhaps the key statistic is that, very roughly, half of the area devoted to wheat and rice in developing countries is now planted to the semidwarf varieties. Including those grown in China, the new varieties provide annually some 50 million tons of additional food, enough to feed half a billion people.

Contrary to some beliefs, the new technology is not biased against the small farmer or the poor. Some features of it are in fact favorable to the poor, and in areas suitable for the new technology small farmers have, in time, adopted it at least in the same proportion as larger and more wealthy farmers. The impact

on demand for labor, and hence on employment, has also been positive on balance. But perhaps the principal benefit to the poor has come from the increased food consumption made possible by the lower prices resulting from increased production. As a result, nutrition has improved through the greater per capita availability of food energy. While the reduction in genetic variability arising from the new plant breeding techniques might expose the poor, in particular, to the threat of widespread crop losses through unexpected pest or disease problems, genetic potential is in fact being enhanced by the germ plasm conservation and utilization programs stimulated by IBPGR and participated in by all of the crop-oriented centers.

Also contrary to some beliefs, the emphasis on international agricultural research has not been at the expense of national research and extension efforts. Spending on international research has in fact stimulated spending on national research programs, which has grown rapidly over the period coinciding with the expansion of the IARCs. The relationship between international and national programs is symbiotic, and the international centers have served to strengthen national research institutions in several important ways: participation in collaborative networks, reorientation of priorities for national research, teaching of better research methods, large-scale training of national personnel, and programs of seminars, symposia and publications. Support for better national policies on food and agriculture has been provided by IFPRI and the socioeconomic research programs of other centers.

It is also important to recognize what the CGIAR system has *not* accomplished. Most of the significant increases in yields, area, and production have come from the semidwarf varieties of rice and wheat pioneered by IRRI and CIMMYT in the 1960s. Research on other crops, generally grown in more hostile environments and not benefiting from the stock of past basic and strategic research available on rice and wheat, has not yet produced new technology adopted by national programs and reaching farmers' fields in substantial amounts (although it is beginning to do so). Even on rice and wheat, most of the increased production has come from irrigated fields or regions of high rainfall where the gains from increased production warrant the use of complementary inputs of fertilizers, pesticides, and herbicides. Although the new varieties can, under some circumstances, outproduce traditional ones even without such inputs, in harsh climatic and

ecological conditions poor farmers have inadequate incentive to adopt them.

Large areas of the developing world, where many of the poorest people live, have therefore been untouched by the spreading agricultural revolution. The position of some of the poor farmers has in fact been worsened because they have received the lower prices for their output that result from increased productivity of modern varieties in other, more favored areas. The centers are increasingly directing their research programs to the less favored crops and regions, but much remains to be done and spectacular results are not likely to be forthcoming.

Even with these qualifications and reservations, and however credit for what has been accomplished is shared between the centers and the national programs which are their partners, there can be no doubt that the investment of the international community in the CGIAR system has paid handsome dividends. Few international assistance programs have achieved so much in such a short time. And a review of the potential impact of research work now in progress at the centers gives good reason to believe that this investment will continue to be amply justified in the future.

Replicability

Impressive as these results may be, some critical questions remain to be answered. To what extent can the results be attributed to the unique characteristics of the CGIAR system? Would they not have occurred otherwise? In short, what contribution did the centers and the CGIAR make that would not have come about in their absence? Could the CGIAR system be reproduced today, and if so what things—with the advantage of hindsight—should be done differently? Finally, to what extent is the CGIAR a model for collective ventures in other fields? These questions inevitably entail speculation and conjecture, but they should be asked because they address the ultimate value of the CGIAR as an experiment in international cooperation.

What Was the Unique Contribution of the Centers?

Although the original international centers played a pioneering role in developing the new high-yielding varieties, some re-

search on these varieties had taken place, or was taking place concurrently, at institutions in the United States, Japan, and a few other industrial and developing countries. The great potential of these varieties was beginning to become apparent. Had the centers not existed, therefore, it is virtually certain that some other mechanism, or combination of mechanisms, would eventually have been developed to promote the necessary further research and to spread its results in the developing world. As Jock Anderson, director of the impact study team, put it during the seminar at International Centers Week, "if the system of centers did not exist, then something very much like it would have had to be invented, and supported actively."

One could speculate at great length (but with little profit) as to what institutions and mechanisms might have been created and how much they might in fact resemble the existing CGIAR system. Presumably donor agencies, both multilateral and bilateral, would have helped to effect the transfer of the new technology by direct assistance to national research programs in developing countries. The interest of the international scientific community would have been engaged, and collaborative arrangements would have sprung up between research organizations in the industrial countries and their counterparts in the developing world. Some types of regional networks would in time have been established to exchange germ plasm among developing countries, and as the importance of genetic conservation became better understood some international system to promote it would have developed. As the high returns to agricultural research in the tropics became more evident, greater impetus would have been given to these various efforts and new organizations created, if necessary, to carry them out.

A plausible case can be made, however, that the CGIAR system had a unique and significant impact. It led to the development of a wider range of techniques, accelerated the process of technology development and transfer, and spread its results more widely than might otherwise have occurred. Indeed, it is perhaps not too presumptuous to suggest that, as a result of the CGIAR, the world is a different and better place.

Here again it is useful to distinguish between the activities of the IARCS and those of the CGIAR itself. The principal features of the international centers should be familiar by now and need only be recapitulated briefly here. There are a number of ways in which the IARCS made a unique contribution:

- The centers were located in developing countries and focused on tropical agriculture, which had often been ignored by research in industrial countries. They also brought a new focus on food crops, particularly those most prominent in agricultural production and consumption in the developing world.
- The work of the centers was mission-oriented. It sought to address and solve the practical problems facing farmers in developing countries. This orientation was also often missing from the work of research organizations, including those in developing countries.
- With a critical mass of scientists, the centers were able to achieve economies of scale. Plant breeding is, as the impact study emphasized, a game of "numbers roulette." The centers could make a large number of crosses and selections efficiently and thus enhance the prospects of success. Few national programs, at least at the time the centers came into being, had this capacity.
- With their international mandate, the centers were able to make crosses of wider applicability to different ecological conditions and to exchange, test, and validate germ plasm through collaborative networks with a larger number of developing countries than would have been possible with national programs. Their international status with independent boards of trustees gave the centers a freedom from political influence by their host countries and from a diversion of their activities to meet short-term political considerations.
- The centers' use of interdisciplinary teams, by bringing together a variety of specialties, made it possible to deal more effectively with the complex problems of raising and stabilizing the yield of individual crop varieties. This approach was a relatively novel way to organize and manage research when the centers were founded.
- The CGIAR's commitment to the "international center of excellence" brought other advantages as well. In particular, it enabled the centers to provide the salaries, living arrangements, and working conditions—including the most modern equipment—necessary to attract and retain international scientists of high caliber.

Although most of these activities were beyond the reach of national programs, certainly at the outset, they were not undertaken at the expense of national research efforts. On the con-

trary, the work of the IARCs reinforced and strengthened the national programs in several ways that were discussed earlier: by demonstrating the productivity of agricultural research and thereby attracting more government funds to it; by helping to shift priorities in favor of a greater focus on food crops; by introducing an orientation toward commodities in research programs, which hitherto tended to be organized by disciplines, and emphasizing a problem-solving approach; and by strengthening the organization and staffing of individual programs through collaborative networks, staff training, and other forms of technical assistance.

What Was the Unique Contribution of the CGIAR?

The concept of a consultative group predated the formation of the CGIAR, but the latter introduced enough novel features that it can be considered an innovation in its own right. In its methods of mobilizing funds, setting priorities, administering aid, and ensuring accountability, the CGIAR, it can plausibly be argued, has made a unique contribution to international agricultural research. Indeed, the "magic" of the CGIAR has lain in its ability to convert what under other circumstances might have proved to be serious liabilities into sources of cohesion and strength. It has done so in several ways:

- As a "nonorganization" without legal status or juridical personality, the CGIAR has been able to avoid the bureaucratic pitfalls into which many international organizations have fallen. It has not had to seek universal membership, nor has it been subject to the pressures of nationality quotas, or even pressures to hire particular individuals. With a minimum of organizational structure and no formal procedures, it has been able to conduct its business expeditiously and in a professional environment. There is not even a formal record for which individuals or delegations might be inspired to make speeches.
- The absence of a system of burden sharing has probably enabled the Group to raise more, rather than less funds. The CGIAR has fared relatively well in fund raising, compared with other international bodies. It has avoided sterile debates about "fair sharing" of the aid burden, while its open pledging sessions have exerted real, if subtle, pressure on donors. The United States has maintained the 25 percent share that has been customary for it in international organizations with for-

mal subscriptions. Other large bilateral donors have, for the most part, been strong supporters, and many of the smaller donors—Canada and Australia are notable examples—have contributed more than would have been derived from a burden-sharing formula.

- The large number of donors, and their diversity—private foundations, multilateral organizations, regional banks, and national governments—have ensured greater stability of funding and shielded the Group from the vagaries of support of individual donors.
- The absence of a system for taking votes has prevented any one donor, or small group of donors, from dominating the Group and imposing its point of view. Management by consensus has called for a discipline on the part of members of the Group that they have readily accepted. The egalitarian spirit of the Group has thus become a strong, cohesive bond that has enabled it to weather several difficult episodes.
- The three cosponsors have given legitimacy and continuity to the Group, with the World Bank providing a home, an adequate budget, and logistical and staff support. Scientists considering whether to join the system have been able to perceive it as a stable, ongoing venture.
- By enlisting eminent scientists from both industrial and developing countries, TAC has provided a professional, objective forum for setting priorities and reviewing programs and budgets. It has helped to maintain the Group's sharp focus on the principal food crops of the developing world.
- The two Secretariats have provided staff services to the Group and to TAC and have helped to implement a system of reviews that has provided accountability and assured donors that their money was being carefully administered.

Under a different set of circumstances this loose, informal, flexible, collegial system of governance might not have worked as well. The amalgam of the system is goodwill, a goodwill that springs from a common purpose, a shared view that an objective of high priority is being effectively pursued. Had the centers not been seen to be performing well, the CGIAR would have been subject to greater, perhaps intolerable strains. Conversely, the smooth functioning of the CGIAR has given the centers an assurance of stable funding and a freedom to pursue their scientific investigations with a reasonable minimum of oversight to pro-

vide accountability. The union of the IARCs and the CGIAR has thus been a happy one, each drawing strength from the presence of the other.

Finally, there is the human element. Individuals have undoubtedly made a difference. Throughout its relatively short history, or even the longer history that began in Mexico in 1941, the CGIAR system has been fortunate to have the right people at the right place and time. George Harrar, Norman Borlaug, Sterling Wortman, Frosty Hill, Robert Chandler as the founders of the international centers; Robert McNamara as the godfather of the CGIAR; Sir John Crawford as the first chairman of TAC—it would be invidious to extend the list, since even a long ledger would exclude many dedicated and able persons who were first attracted to, and then excited by, the challenge and the opportunity.

Could the CGIAR Be Re-created Today?

One way of testing the usefulness of the CGIAR system as a model for other ventures is to ask whether it would be possible to recreate the CGIAR under the conditions prevailing in 1985. This is not a simple question and perhaps not a very enlightening one, since it depends on the assumptions one is prepared to make. To what extent has the new technology already been discovered, developed, and tested? Are IRRI and CIMMYT in existence as international centers or are they yet to be invented? The fact is, however, that the CGIAR benefited from a favorable combination of circumstances, some of which could not easily be reproduced today.

Perhaps the key issue is the role of the Ford and Rockefeller Foundations. The development aid community and the role of the private foundations within it have changed over the past fifteen to twenty years. It is difficult to imagine that the foundations could play the same leadership role today that they did when the original centers and the CGIAR were established. Neither foundation is in fact very active on the international agricultural scene at this time, although their partial withdrawal may largely be a response to the successful accomplishment of their mission. Be that as it may, the foundations are not now in a position to play the prominent role, exercise the entrepreneurial spirit, and provide the professional leadership that they did at critical stages in the evolution of the CGIAR.

This change of role would affect how the centers could now be organized and run. One somewhat paradoxical example is international status. The private foundations were readily able to negotiate international status for the original centers—albeit a somewhat cloudy one, as subsequent events have shown—whereas the international organizations that are now shouldering the task—the World Bank and the UNDP—are finding it more difficult to do so (as seen in chapter 7). No doubt a solution will be found, but the formula of an international center as an independent legal entity is not one that the official aid community is likely to have arrived at by itself. The model of an independent, self-perpetuating board of trustees with each member serving in an individual capacity is also not one that would likely be originated by, or appeal to, public aid agencies, and some form of mandatory representation would probably be insisted upon. Scientific management of the centers by the director general and senior staff could more readily be accepted.

As to the Consultative Group itself, the particular sharing of responsibilities agreed upon by the heads of the cosponsoring agencies could probably not be replicated. The FAO would plausibly argue that it should be the lead agency, with results that would inevitably be different. Since the consultative group mechanism existed before the establishment of the original CGIAR, any attempt to establish one today would still have a precedent for the informal pledging of contributions without any formula for burden sharing. However, some mechanism for ensuring the participation of developing countries in the management of the Group would probably be insisted upon and could become a bone of contention. Pluralistic membership would make management by consensus more difficult. The idea of TAC, however, as an independent scientific advisory body would probably still be acceptable.

All this is admittedly speculative. I would not conclude that something analogous to the CGIAR could not be recreated today; on the contrary, it probably could if circumstances warranted it, but the CGIAR of today would differ in salient respects from the CGIAR that we have known. Whether it would be as effective is open to question. The founders of the CGIAR took over an ongoing enterprise that had already shown its efficacy and achieved impressive results. They found a way to mobilize international support to fund and administer that enterprise on a much larger scale without sacrificing the features that had con-

tributed to its success. This was a very significant achievement, the importance of which I would not underestimate. The CGIAR stands today as a strong and viable system that, in close association with the national research programs, is continuing to bring a better life to many in the developing world.

But to create such an enterprise de novo would be more difficult. This conclusion should not be startling; it would probably apply equally to many successful activities that benefited from and were able to exploit a favorable set of circumstances not readily duplicated. But it may have implications for the extent to which the CGIAR can serve as a model in other fields.

What Should Be Done Differently?

Another way of shedding light on the essential features of the CGIAR and their replicability is to ask: if the CGIAR system could be recreated today, what things should be done differently? This brings us back somewhat from the realm of pure speculation, but nonetheless remains subjective, and people equally familiar with the CGIAR might well come up with different answers.

THE BOARDS OF TRUSTEES. The boards of the centers play a vital role in ensuring their independent, scientific management, and this independence must be preserved. Still, the organization of the boards might be modified somewhat. The boards of trustees now are self-perpetuating, self-renewing, and formally accountable only to themselves. These anomalous features made the most sense when key board members were appointed by one or both of the foundations, which also kept a close and benevolent eye on the proceedings of the boards and the center management and a firm hand on the purse strings.

In practice the boards of trustees have been increasingly mindful of the injunction of the second review committee that they should act as though they were accountable to the Group. This is reflected both in the growing interaction of the board chairmen through their committee and in the appointments of new trustees by the boards. Virtually all centers have adopted the review committee's recommendation on the term of service of board members. But the fact that individual donors have different policies with respect to participation by their officials on center boards can be a disequilibrating factor.

With hindsight, I believe it would be preferable to have more of the board members nominated or designated by the CGIAR itself, as is now done for three of the board members of almost all of the

centers. The existing boards would still play a very active part in the selection process, as they do for the CGIAR-designated members, and the trustees would still serve in their individual capacities and not receive instructions from the Group. But involving the Secretariat, and through it the members of the Group, more actively in the selection process might help to ensure that the membership of all boards had an appropriate blend of geographic backgrounds, professional disciplines, and relevant experience. This is the procedure followed on a smaller scale for appointment of the members of TAC, and it has worked very well. It could be combined with improved measures to indoctrinate new board members and to brief all board members regularly on CGIAR activities. Having the full board meet more frequently than once a year would also be desirable.

DEVELOPING COUNTRY REPRESENTATION. We have seen that the process of designating developing country representation on the CGIAR through the FAO regional conferences has not been very effective. Again with the benefit of hindsight, it is evident that the process lacks the necessary ingredients for success.

It is not easy, however, to devise an alternative approach that would ensure more effective participation of developing countries in the deliberations of the Group. (As indicated in the preceding chapter, developing countries are well represented at other points in the system.) TAC membership is evenly balanced between industrial and developing countries, but TAC's role is advisory and its members (other than the chairman) do not regularly attend or participate in the Group's meetings. Encouraging developing countries to become CGIAR donors has in practice proved the best way of providing developing country representatives who are well informed, interested, and active. Considerable efforts have been devoted to enlisting more developing countries as donor members, but no doubt more could be done. As a last resort, consideration might be given to designating a minimum number of developing country donor members (for example, ten) with a suitable geographical distribution and, if necessary, reducing the minimum subscription of $500,000 so that the membership quota could be filled.

PRIORITIES. Priority setting in the CGIAR is a dynamic process, and it is necessary to avoid the temptation to apply the emerging priorities of the mid-1980s, such as the emphasis on biotechnology or on sub-Saharan Africa, to the conditions of the

early 1970s. Even in hindsight, the initial focus on basic foods produced and consumed by the large masses of people in the developing countries seems to have been eminently right. There may have been undue emphasis on improving the quality of food, as distinct from increasing its quantity, as a means of improving nutrition. And there was inadequate recognition that increasing the production of food crops consumed by the poor was not a sufficient condition for increasing the consumption of the poor in the absence of measures to increase their purchasing power (including research on commercial crops grown by smallholders). But these matters were less well understood in the early 1970s than they are today. The same might be said about the whole package of policies and institutional measures—price incentives, better extension services, more reliable credit, secure water supplies—necessary to ensure the optimal deployment and use of the new varieties.

Is the CGIAR *Model Replicable?*

The last question, asked frequently by those seeking to emulate the CGIAR's success, is whether its model can be applied in other fields. If it is correct, as I have suggested, that the CGIAR itself could not readily be recreated de novo on today's scene, it might seem to follow automatically that it cannot readily serve as a model in other fields. But that would be far too negative a conclusion.

It is fair to say that efforts to emulate the CGIAR model have so far had only partial success. A Consultative Group on Food Production and Investment, launched in the wake of the World Food Conference, bore the title of a consultative group, was cosponsored by the same agencies as the CGIAR, and had a small secretariat located in the World Bank. It had laudable objectives: to encourage the flow of investment resources into food and agriculture and to help in the preparation of national food plans. But it lacked a clear focus or mandate, and as talk did not give way to concrete action the high-level attendance at its meetings waned. After several years the cosponsors agreed to terminate it. Efforts by the UNDP, the World Bank, and the Rockefeller Foundation over a protracted period to cosponsor an organization to conduct research and development on cotton and cotton textiles were well advanced but eventually came to naught when the proposal was caught up in North-South issues of politics and trade. Other attempts to launch consultative groups—in such fields as energy

and forestry—never got past the talking stage. A group of donors are supporting a successful program to deal with onchocerciasis (river blindness) in West Africa, but the program is too specialized to provide a useful example.

TROPICAL DISEASE RESEARCH. There is, however, another major international research program, patterned in part on the CGIAR, that is a viable enterprise. It is the Special Programme for Research and Training in Tropical Diseases (TDR). Both its similarities and its differences with the CGIAR are instructive.[3]

The TDR was started by the World Health Organization (WHO) in 1974 to deal with six major diseases endemic to many tropical developing countries: malaria, schistosomiasis, filariasis, trypanosomiasis, leishmaniasis, and leprosy. It did not get under way until 1977–78, however, after three years of negotiations to establish its modus operandi. The UNDP, the World Bank, and the WHO are cosponsors, with the WHO the executing agency. The World Bank agreed to become a cosponsor in 1978, but did not become a donor until 1981 when changes were made that satisfied it that the organization and management were sound. The World Bank also administers a trust fund through which many donors contribute. Voluntary pledges come from a large number of donors, including private pharmaceutical firms and more private foundations than contribute to the CGIAR. There is a Scientific and Technical Advisory Committee (STAC) of eighteen scientists and other experts drawn from various parts of the world; it is the apex of a complex system of working groups and scientific committees described more fully below. A comprehensive system for review and evaluation culminates in a quinquennial (external) review of the performance of the TDR as a whole.

The most striking difference between the CGIAR and the TDR lies in the system of research and development. The TDR is the quintessential network. Drawing on the WHO's extensive experience and contacts with institutions and scientists throughout the world, individual networks have been established using existing facilities and staff. No funds are provided for capital invest-

3. The discussion of TDR is based on these World Health Organization publications: *Venture for Health*, (Geneva, 1984); *Tropical Disease Research, Seventh Programme Report, January 1983–December 1984*, (Geneva, 1985); and *Evaluation of the Special Programme for Research and Training in Tropical Diseases: Report of the External Review Committee to Review the First Five Years of the Special Programme's Operations*, (Geneva, 1982).

ments; the TDR makes available only the additional funds needed to carry out specific research projects. The spectrum of research activity extends from basic laboratory work in such fields as molecular biology and biochemistry, in which the pharmaceutical industry plays a part, to field research on such topics as tools for disease control in villages in tropical countries (although the field activity is still not adequately developed because of a lack of trained staff). The proportion of research project funds going to institutions and staff in developing countries has increased and now exceeds 50 percent. In addition to the research projects, roughly 25 percent of TDR funds are used for long-term programs to strengthen the capability of research institutions and to train staff in the tropical countries in which the diseases are endemic. As of the end of 1984, the TDR had supported over 2,000 projects in 100 WHO member countries. More than 4,000 scientists and health administrators from 125 countries have taken part in the planning, research activities, and program evaluation.

Administering a networking system on this scale calls for substantial overheads. Scientific Working Groups (SWGs) were initially established for each of the six diseases and for four areas covering more than one disease. The SWGs have since increased to thirteen. They are charged with identifying priorities and developing strategic plans. Steering committees for each SWG are then responsible for implementing the plans. There are now thirteen steering committees for the six diseases and various program thrusts (such as vector biology and control, epidemiology, and social and economic research). The TDR Secretariat in Geneva, provided by WHO, has a staff of about eighty, two-fifths of whom are professionals and the remainder administrative and secretarial staff.

There has been one external program review of the TDR, conducted in 1981. The review committee was headed, interestingly enough, by David E. Bell, now chairman of the Department of Population Sciences in the School of Public Health at Harvard University and who, as executive vice president of the Ford Foundation, played a key role in the establishment and early years of the CGIAR, as we have seen. The committee specifically compared the effectiveness of the networking approach with a center-based approach:

> The Committee has carefully weighed the advantages and disadvantages of the various approaches, and endorses the network approach as an appropriate scientific mechanism for the TDR Programme. The Committee recognizes that the

concentrated effort possible in centre-based research may be more efficient than a far-flung network for the resolution of specific problems. On the other hand, the Committee considers that the principal strengths of the network approach are its ability to mobilize worldwide scientific expertise towards a common objective, and its widespread impact on strengthening research capacity in endemic countries. In comparison with a more centre-focussed approach, the network approach has substantially lesser requirements for large capital expenditures, and the nature of its institutional support is such as to facilitate the assumption of responsibility by local authorities.

The Committee is aware that a network mechanism is subject to certain weaknesses; special efforts must be made to overcome these weaknesses in order to insure the most effective use of the resources available to the Special Programme. Because of its nature, the network approach is inherently complex to administer, and requires strong central management to avoid the risk of a dispersal of efforts over a broad front with inadequate direction and control. The network approach also runs the risk of a multiplicity of committees and meetings of various sorts, with a large amount of staff time devoted to servicing meetings. . . . Such a large number of meetings necessarily adds considerably to the overall cost of administration of the Programme. . . .

As with any network, the high quality of leadership is a crucial ingredient for success, and in this case, the leadership has come not only from the Programme's management staff, but also from the many scientists involved in the network, especially those on the Steering Committees and the Scientific and Technical Advisory Committee. To ensure the continued high quality of the TDR Programme, it is important that attention be given to selection procedures for the key groups in the network.

The TDR differs somewhat from the CGIAR in fund raising. The TDR has no lower limit to the size of individual contributions. Through the end of 1984, there were forty-four donors, some contributing as little as $500, $1,500 or $5,000. Notwithstanding this greater latitude in funding, the TDR has experienced serious problems in mobilizing resources, probably more so than the CGIAR. Contributions peaked in 1980, declined considerably in 1982, and have stayed relatively constant in nominal terms since

then at the level of about $25 million. They have therefore dropped substantially in real terms. In addition to donor fatigue and the strength of the dollar—factors also affecting the CGIAR—the location of the TDR within the WHO—a UN agency with a regular budget based on multilateral contributions—has made fund raising more difficult.

The TDR's organizational counterpart to the CGIAR itself is the Joint Coordinating Board (JCB), which coordinates the interests and responsibilities of the cooperating parties. It consists of thirty members, the majority of whom are government representatives. Twelve members are selected by the contributors to the TDR and another twelve by WHO regional committees, from among the countries that either are affected by the diseases studied or provide technical or scientific support to the TDR. The three cosponsors also serve on the JCB, as do three additional members selected by it. The JCB meets annually to review and decide on the planning and execution of the TDR's program. This includes reviewing and approving the work program, the budget and arrangements for its financing, the annual financial statements and progress reports, longer-term plans, and proposals for STAC membership.

Since the dimensions of the program are already set (the six prescribed diseases) and individual projects are relatively small (averaging about $50,000), the functions of the Joint Coordinating Board are less comprehensive than those of the CGIAR. Its one meeting a year takes two to three days. The first external review committee recommended that it spend less time on administrative matters and more on substantive aspects, including progress and obstacles in selected program areas.

Because the JCB has somewhat shifting composition and meets only once a year, the cosponsors have a substantially greater role in the TDR than in the CGIAR. They are formally gathered into a standing committee, which serves as an executive group to the JCB. The standing committee is charged with reviewing the TDR work program and budget before its presentation to the JCB, proposing financial arrangements, approving budget reallocations during the financial year, and reviewing other aspects of the TDR program and informing the JCB about them. The first review committee commented that "because of its continuity, flexibility and easily accessible nature, the Standing Committee has proved to be a valuable, indeed essential, part of the management structure of the TDR Programme."

The TDR is still a young enterprise, and it would be unreasonable to expect substantial results from it so soon. But its achievements were already noted by the first review committee in 1981, when it concluded that,

> while scientific results thus far are limited, they are significant and entirely appropriate considering the long-term nature of biomedical research. The Programme has added substantially to the resources devoted to research on the six diseases and now accounts for 25–30 percent of the worldwide effort; it has mobilized important new scientific resources devoted to the six diseases; and it has created through its networks a mechanism that encourages collaboration among scientists around the world. Moreover, the Programme's system for incorporating peer review of research efforts by high-quality scientists from many countries and by an independent scientific review committee has enhanced WHO's capacity and standing in the international scientific community. The Committee, therefore, judged the Programme to be well launched and of major significance.

There has been further progress since 1981, and several products have been brought to, or close to, the stage of field use. World Bank staff were able in 1985 to advise the Bank's Board of Executive Directors that the TDR's scientific output was highly satisfactory. The prospects are now reported to be good for having an effective vaccine against malaria within five to ten years. Such a development would undoubtedly give a major impetus to funding for the TDR. It should be noted, however, that, as measured by financial resources employed, the TDR is only about one-seventh the size of the CGIAR. Whether the present system of organization and management would be viable if the TDR were to be increased several fold is still untested.

CRITICAL FACTORS IN REPLICABILITY. The differences between the CGIAR and TDR experiences suggest that each activity tends to some extent to shape its own course. Personalities, institutions, and the particular circumstances of the time influence the outcome, and what might be unthinkable in one situation—such as an executive role for the cosponsors—may be quite workable in another. It is therefore desirable to generalize from the particular characteristics of the CGIAR, drawing on the TDR

experience as well, to try to identify the factors that have contributed to success. Anyone contemplating other ventures of this kind can then assess whether the factors apply in other settings. The list is a formidable one:

- *A high-priority objective.* Both the CGIAR and the TDR were created to address serious problems that affect many millions of people. Helping in the conquest of world hunger—or, in the more prosaic language adopted by the CGIAR, increasing the quantity and improving the quality of food production in the developing world—was seen as the highest priority on the global agenda in the late 1960s and early 1970s. It still ranks close to the top and continues to have great appeal. The manifest importance of its objective enabled the CGIAR from the beginning to command the attention and support of heads of aid agencies, even to the unprecedented extent of their forming a working party to help bring it into being. It continues to be an objective that fires the enthusiasm of those at all levels who participate in this enterprise.
- *A clearly defined mandate.* The Group has resisted the temptation to broaden its mandate to include nonfood agriculture, and even within the food crops it has concentrated on those most important to production and consumption in developing countries. Even if some expansion of its mandate is warranted, the Group's continual attention to priorities helps to ensure that the research effort is not dissipated among too many activities. The TDR, too, has a clear mandate to focus its research on six tropical diseases deemed to be of high priority.
- *A mission-oriented strategy.* The IARCs are positioned at the middle of the research spectrum. Drawing on the results of basic and strategic research largely done elsewhere, their own applied research is closely linked with the research programs of national institutions in developing countries. The centers are organized and directed toward solving practical problems and achieving tangible results. The TDR, which is also oriented toward a specific mission, covers a broader spectrum of research than the CGIAR and has not yet had time to produce tangible results.
- *A proven (or promising) technology.* By the time that the CGIAR was established, plant breeding technology had been successfully applied to rice and wheat crops in many developing countries, and the Green Revolution was well under way. The same technology appeared to hold the promise of producing superior and higher-yielding varieties of other crops. The CGIAR

thus did not have to cope with donors' usual reluctance to provide large-scale funding for basic or strategic research, or for the development of new technology, that may hold little prospect of achieving results in the short or medium term.

- *A viable system of research and development.* The "center of excellence" model was well suited to generating new varieties, testing them on a broad scale and in different ecological zones, and disseminating the results widely. The centers could be linked with national research programs in a variety of networks, depending on their respective strengths. Other ways of organizing the research and development process, such as networking, may be equally appropriate to deal with other research problems. The choice is likely to depend on the state of existing knowledge, the strength of the institutions charged with developing it, and the functional relationships among them. Close relationships with the client countries through training programs, symposiums, library services, and programs for disseminating research results enhance the effectiveness of the research and development system.
- *Professional, scientific management.* Other features of the center model—international status and independent boards of trustees appointed for their scientific or administrative competence—help to insulate the management from political interference or bureaucratic control. The appointment of highly qualified directors general, the recruitment of skilled scientific staff on an international basis, and the provision of adequate compensation and favorable working and living conditions have reinforced the professional strength of the institutions. Again, the center model is not necessarily the only or best approach; a different system of management and governance might be more appropriate in a different setting, provided that it ensures high professional standards.

The foregoing considerations apply at the level at which the research programs are conducted. The CGIAR itself has contributed to the success of the venture in ways that can be generalized:

- *Mobilizing funds.* The consultative group mechanism has been an effective means of raising funds from a variety of public, quasi-public, and private sources for which a burden-sharing formula would not be appropriate. More formal arrangements might prove necessary if all the funds are provided from national governments or official aid sources.

- *Setting priorities.* The Technical Advisory Committee, comprising independent experts from different scientific disciplines and different industrial and developing countries, has performed an important role in setting priorities on the basis of scientific judgments. TDR has followed a similar, although somewhat more complicated, pattern. The approach can easily be varied as particular circumstances may warrant.
- *Making policy.* The CGIAR has provided a forum in which issues could be discussed, policies debated, and decisions reached. Decisionmaking by consensus has been the rule, and in the long run it is likely to be the preferred approach even in more formal arrangements, if it can be successfully managed. Staff services by a secretariat (or two secretariats in the case of the CGIAR) of competent professionals play a key role in policy formation.
- *Ensuring accountability.* A comprehensive system has been put in place to review the programs and budgets of the centers (and thereby to allocate funds among them), the scientific programs and management of the centers, and the performance and impact of the CGIAR system itself. Experts from both inside and outside the system have been consulted, in varying combinations, for these purposes. Many variations on this review and reporting system are possible, and the TDR has adapted it to its own purposes; but some such system is essential to satisfy donors that their funds are being used efficiently and effectively.
- *Providing stability and legitimacy.* In the informal setting of a consultative group, there must be some way of securing the legitimacy of the activity and its long-run stability. Cosponsorship by three agencies of the United Nations system, with one agency taking the lead in administering the program to the extent necessary and in providing an institutional base for secretariat services, has met this need with a minimum of bureaucratic infrastructure.

This list appears formidable indeed. But one should not lose sight of the overall picture in the welter of detail. The essential ingredients of success can be extracted from the CGIAR experience. They lie in the pursuit of a high-priority objective through a well-focused effort that is based on a promising technology and research approach and carried out in a professional environment relatively free of political or bureaucratic constraint. These are rigorous criteria, but by no means impossible

to satisfy. The ultimate lesson of the CGIAR experience is therefore positive. When people of goodwill—be they scientists, administrators, or government officials—work together toward a worthwhile objective through a research effort that is well conceived and professionally managed, much can be accomplished.

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