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AD HOC RESOURCE PEOPLE

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PART I -- NETWORKING IN THE CGIAR

INTRODUCTION

1. Spurred by scarce funding and recognized economies arising from collaboration, international cooperation in agricultural research is rapidly gaining momentum. Cooperation among agricultural scientists is not new, but the current extent of collaboration and especially use of research networks is unprecedented (13). Agricultural research has entered a new era in international cooperation. More and more researchers are forging formal and informal working partnerships, either on a regional or global basis, to accelerate the flow of information, trim costs, and speed up technology transfer to farmers. Many of these partnerships involve the use of research networks to stimulate research on major problems, and to provide mutual assistance and joint planning of programs (14, 48).

2. In its broadest sense, networking implies the linking of individuals or institutions with a shared purpose. The simplest networks are something like television networks in the United States; each company acts as a hub channelling programs along spokes to its affiliated stations. Some agricultural networks operate this way, particularly those involved with information outreach (Figure 1a). In such networks, communication is two-way, but mostly between the hub and the institutions represented by the spokes. International nursery networks often begin this way.

3. The function of the hub or nerve center of a network is information collection, assimilation, synthesis and dissemination, as well as stimulation of research, coordination, and training.

4. Most researchers have colleagues with whom they correspond and exchange ideas and information, and some may call this a network. In this case, though, there is no clearly defined hub or nerve center, rather a loose web of intermittent contacts. These informal networks often set the stage for larger, formal collaborative programs.

5. Most networks are evolutionary in nature, beginning simply and gathering momentum or complexity as time goes on and as more is learned or achieved by its activities. And, of course, that is one of the strengths of the networking approach. Scientists can participate where they are, as they are, with benefit to all. With time a network may take on more and more attributes resembling collaboration among peers, but most do not start out that way. In embryonic networks, communication may be more one-way than two-way, commitment of resources may be limited, planning may be centralized at the hub and so on. But with time, participants gain confidence and experience, the network will become more and more collaborative and begin to achieve an effective partnership.

6. Most networks discussed in this paper are formal, international arrangements in which participants receive mutual benefit. The concept of networking used here implies more than a passive relationship with a one-way flow of material information or initiative. Constituent nodes in many networks discussed here employ feedback loops to interact with each other.

Participants are not just recipients but partners in planning and implementing the program. Information flows from the hub along radiating spokes and back, as well as along the rim connecting the participants (Figure 1b). Longer-established international nurseries generally function in this manner. In some networks, nodes may establish a sub-network to tackle that portion of the task that has been assumed by them (Figure 1c). Successful agricultural networks involve active participation by members and a commitment of resources, either in the form of staff time, facilities, or finances. The real test of a network is whether collaborators are willing to provide resources for the joint effort.

7. This paper discusses the development of agricultural research networks and the extent of CGIAR involvement in them. The concepts behind networking and the principles guiding their organization and operation are analyzed. Networks, ranging from nurseries for testing crop germplasm to those devoted to farming systems research, are described in order to highlight the great diversity of activities embraced by networking as well as the approaches used. Tangible benefits derived from networks are identified. Finally, the future role of international networks in the CGIAR is explored.

HISTORY OF AGRICULTURAL NETWORKS

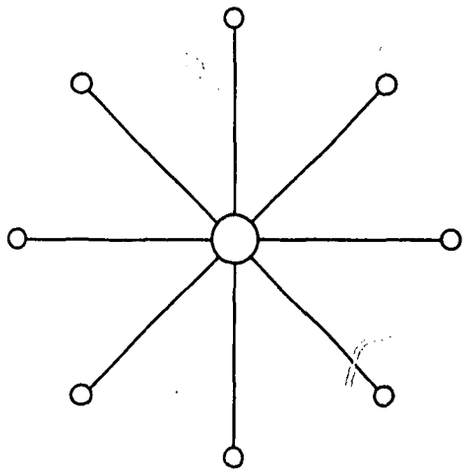
8. During the colonial period the British, Dutch, and French each established a series of research stations concerned with improving productivity of tropical export crops such as cotton, groundnuts, or sugarcane. These stations effectively improved output of some cash crops in the countries involved, but collaboration with territories outside the particular colonial system was limited. Also, because most stations were primarily operated by expatriate staff, many ceased to function after independence.

9. In the United States, networking in agricultural research has its roots in informal groups of scientists working together on a regional basis. The continental size of the U.S. and its diverse ecological environments created a need to link research at state, regional and national levels. A two-tier system arose to increase agricultural productivity across the country; a federal organization, represented by the Department of Agriculture (USDA) and the state-run agricultural experiment stations. The two systems synchronized research programs on widely-shared problems. For example, in the 1920s the hard red spring wheat program linked individuals working at state agricultural experiment stations in the northern great plains and the north central region (35). Similar regional networks were established to promote research on hard red winter wheat in the Plains, soft red winter wheat in the East, and white wheat in the Pacific Northwest.

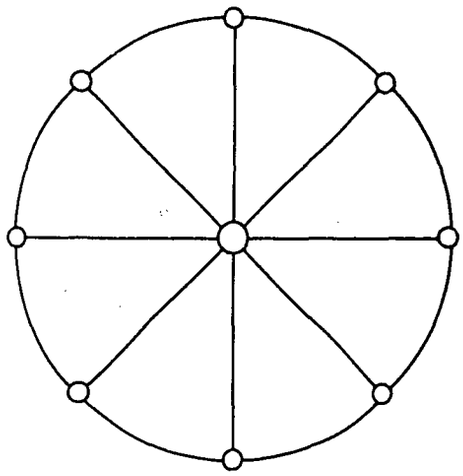
10. Networking also provided a springboard for the development of hybrid maize in the U.S. In 1925, researchers working at state agricultural experiment stations in the Cornbelt coordinated their programs to avoid duplicating efforts and to share results. This network, coordinated by the USDA, led to the release of commercial hybrids in the 1930s (19, 35).

Figure 1
A Schematic View of Networking, Using the Wheel as a Means to Illustrate Linkages between Participants; Relationships Become More Complex as the Network Evolves Until More Than One Hub Emerges

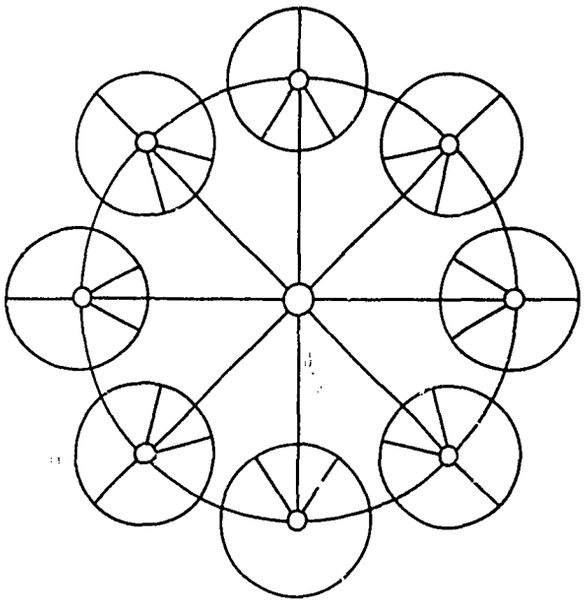
(a)



(b)



(c)



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11. Before World War II, scientists exchanged a limited amount of germplasm with other countries, but for the most part agricultural networks were informal and national in scope. A serious outbreak of a new race (15B) of wheat stem rust in the United States during the early 1950s triggered the establishment of the first formal, multinational network to screen crop germplasm. The International Stem Rust Nursery, born in 1950 and coordinated by the USDA, was the first systematic nursery to transcend national borders (8, 34). Cooperators were easy to find, since scientists realized that a neighbor's problem today could be theirs tomorrow. Initially, researchers in the United States, Canada, Mexico, Colombia, Ecuador, Peru, Chile, and Argentina benefited by sharing and evaluating wheat materials together. By 1970, 150 scientists in 40 countries in the Americas, Europe, and the Middle East had joined the network (35).

12. Another early agricultural research network is PCCMCA (Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios) which grew out of a meeting in Turrialba, Costa Rica, in 1954 (18). Originally, the Central American network of scientists and administrators focused on improving maize breeding and production, but by 1964 beans, sorghum, rice, root and horticultural crops, and livestock were included. During its embryonic stage, only 20 to 30 scientists participated in the network, whereas between 400 and 500 individuals now collaborate in PCCMCA. The network has expanded to include several Caribbean countries, and some tropical South American countries attend the network's annual meeting. PCCMCA has forged cooperative working relationships with CIMMYT, CIAT, CIP, and ICRISAT, particularly for the exchange of crop germplasm. In 1984 PCCMCA will reach 30 years of continuous activity.

13. During the late 1950s, India, with the assistance of the Rockefeller Foundation, began its All-India coordinated crop improvement programs. The first of these systematic national networks were devoted to maize, sorghum and millets; in the 1960s the concept was extended to include rice, wheat and other crops. Rockefeller Foundation provided the coordinator or joint coordinator for the program which involved researchers working in a specific crop in the Indian Council for Agricultural Research (ICAR) and the individual states of India. In general, workshops were held once a year during which workers reviewed results of the past year. Periodic visits by the coordinator(s), exchange and testing of germplasm within India, and annual reports were also involved. The first of the All-India Coordinated Crop programs preceded the IARCs, although with the establishment of IRRI and CIMMYT, these Centers quickly became important participants in the All-India effort and made them more international (1).

14. The Food and Agriculture Organization of the United Nations (FAO) and the U.N. Development Program (UNDP) have for many years employed a network approach to promote agricultural development. FAO has used networks to foster research and technical collaboration in various fields, to upgrade national research capabilities, and to arrange for training and information exchange. A large number of these activities have been supported by UNDP. Since 1963 the FAO/UNDP Regional Project on Field Food Crops in Near East and North African countries has collaborated with CIMMYT and others in testing

improved cereal lines and in training national scientists. A series of ten cooperative research networks (ESCORENA) has been developed since 1975 among European agricultural research institutions with the participation of developing countries. Among the subjects of these networks are maize, sunflower, olives, soybean, sheep, and pastures. A similar approach is followed in Latin America, while in Asia research and development networks relate to buffalo, coconut, root and tuber crops, organic fertilizers, and farm machinery. In Africa, there is a comprehensive program for control of trypanosomiasis and a network on agroindustries. Currently, there is a move underway to increase FAO's involvement in networks, in a catalytic and supportive way (3).

15. United Nations agencies have actively supported other agricultural networks. Following the 1972 Stockholm conference on man and the environment, for example, UNESCO and UNEP organized a series of Micro-Biological Resources Centers (MIRCENS). MIRCENS, which link research institutes into regional networks in East Africa, the Middle East, Southeast Asia, and Latin America, work on biological nitrogen fixation, waste recycling, biological control of pests, and industrial fermentation processes. In 1976, the MIRCENS network began systematically organizing genebanks for micro-organisms important in agriculture, fuel production, and in the food and brewing industries.

16. Since the early 1960s, International Agricultural Research Centers (IARCs) have acted as catalysts for many of the subsequent efforts to establish global agricultural networks. The oldest IARCs, IRRI and CIMMYT, have been especially active in setting up research networks, often beginning with international nursery activities. IRRI, for example, initiated the first international rice nursery in 1963. In 1964, CIMMYT organized the International Spring Wheat Yield Nursery (ISWYN) by merging two regional programs, the Near East-American Spring Wheat Yield Nursery, which began in 1962, and the Inter-American Nursery Trials, which started in 1960 (35).

17. All the IARCs use the networking concept to further their work. International nurseries are currently evaluating the genetic potential of root crops, cereals, pulses, and forage plants. Most of these transnational nurseries are relatively recent since many IARCs are less than twelve years old. Although most of the international nurseries are in tropical countries, industrial nations also benefit from participation and in turn developing countries and IARCs benefit from collaboration with strong scientific institutions of industrial countries.

18. Three IARCs either grew out of networks or were established specifically to promote networking in their areas of responsibility. ICARDA, for example, picked up the network strands laid out from 1968 to 1976 by the Arid Lands Agricultural Development (ALAD) program. ALAD was established with the help of a consortium of donors led by the Ford Foundation to increase agricultural production in the Middle East. ALAD was not so much an institution but rather a mechanism for testing germplasm of cereals and pulses, as well as improving sheep productivity. Research was conducted in widely scattered sites by national organizations. ALAD had laid much of the groundwork for regional nurseries by the time ICARDA was established in 1976.

19. The idea of network coordination was also influential in the formation of WARDA and IBPGR. WARDA assists in linking rice researchers in 15 countries of West Africa and helps supervise and run a series of coordinated research trials in member countries. IBPGR serves as a catalyst for promoting work on crop germplasm conservation and acts as a clearinghouse for information and conservation planning. With a mandate to promote the establishment of genebanks and to coordinate the collection and storage of germplasm, IBPGR is at the hub of a network that is crucial to the continued success of plant breeding (42).

20. Donor organizations have also had an active part in multinational cooperative programs in agriculture as well as other research areas. In the 1970s, for example, Canada's International Development Research Centre (IDRC) funded 72 international networks at a cost of approximately $64 million (39). Of the 72 networks, 17 were in agriculture, and these projects accounted for $34 million. Roughly 43% of IRDC's budget is absorbed by projects that are heavily involved in networking. A number of other bilateral donors have helped to support and foster research networks. Many of these donors are members of the CGIAR.

21. Although networking has now penetrated into various scientific endeavors, including human diseases, agriculture provided an early seed bed for the concept and most international networks are concerned with agriculture. Networks have multiplied and spread into virtually all areas of crop and livestock research. Participants have found networks to be a straightforward, logical approach to developing effective working relationships among countries. The growth of networks, essentially a creation of this century, is impressive and more such cooperative arrangements are likely to crystallize in the future.

PRINCIPLES AND CONCEPTS

22. Networks are set up for various purposes. Some focus mostly on research, others are established primarily to facilitate communication or technology transfer, while others have several aims, including research, extension, training, and information exchange.

23. Networks generally spring up in response to problems that need immediate attention. But in order for a network to remain viable, the problem must also be shared by several countries or regions. A major reason that some networks have proved successful is that cooperating institutions realize that joint efforts at several locations have greater impact than isolated, individual projects.

24. The cost effectiveness of networks is another important reason for their impressive growth. In networking, existing facilities and staff are used rather than making expenditures for erecting buildings and acquiring more personnel. Maximum reliance on utilization of existing infrastructure and capacity is thus a major principle of networking; a key point to remember is that current investments may indeed be reduced by making better use of facilities or staff developed through previous investments, but such

investments must be made by someone sometime. Networks also attempt to make better use of currently available information as well as to generate new knowledge. A research task is broken down into components which participants choose to work on as their contribution to the research program. By adopting a common or comparable methodology and by coordinating research, duplication of effort is avoided. The blending of resources of industrial countries, developing nations, and IARCs boosts efficiency and reduces research costs. Networks also help to provide a viable structure for international funding for research on crucial problems.

25. Networking is a useful approach in establishing research priorities. Cooperative arrangements concentrate on widely-perceived problems, and identify priority aspects of those problems. Participating scientists use a common or comparable methodology, but individuals make adjustments for local conditions and specialize in activities that are most urgent locally. Information on a widespread problem is thus generated from an assortment of environments; this is especially useful when devising remedial action. A particularly important contribution of networks is the exposure they provide for Third World scientists to new research methodologies and discoveries. Networks frequently provide training, further boosting the skills and competence of technicians and researchers, and build the confidence and expertise of scientists in developing countries, thereby strengthening national programs.

26. Networks, for all their benefits, are no panacea. To be successful, research problems must be correctly identified and activities must be carefully planned. Linking a group of poorly-organized and ill-prepared programs into a network in the absence of a solid scientific foundation will not yield desired benefits. In the Third World, agricultural networks are generally better developed in Asia and Latin America where national programs are stronger.

27. The Second Review of the CGIAR (6) concluded that networks function effectively when: (1) the scope of research is well defined, (2) the problem is shared by all the participating countries, (3) activities are restricted to a geographic region, thereby facilitating communications, (4) participating institutions are involved as equal partners, (5) each participant gains from the association and therefore enthusiastically supports it, (6) participating institutions have funds to collaborate fully, (7) the lead institution has sufficient capability to provide strong and enlightened scientific direction. An FAO conference (14) suggested that a successful network requires mechanisms for: (1) establishing and executing a cooperative program; (2) exchanging research information; (3) exchanging research materials; (4) group training and fellowships; (5) securing a multidisciplinary approach for applying research results are at national level, and (6) some kind of nerve center.

28. Although most networks are relatively young, a few additional lessons from experience can be stated: First, networks begin with a problem that needs solution. Second, participants tackle aspects of the network program for which they have a comparative advantage. Third, networks work because participants want them to; effective networking cannot be legislated

or mandated. A strong self-interest is therefore required for all participants. Fourth, for some networks, a regional focus rather than a global approach may be most useful. Neighboring countries often have common ecological characteristics, so research problems are more likely to be similar, communication and travel are generally cheaper and easier, and the chances are greater that collaborators speak a common language, and the closer the countries are geographically, the more likely they are to share a common culture, which facilitates the transfer of technology. Fifth, networks can provide a mechanism for mutual support between national research programs. Networks can foster genuine cooperation, pride and mutual respect among participants, but this requires successful collaboration over time.

ORGANIZATION

29. Networks range in organizational complexity from a simple, informal association between a handful of scientists at different locations to a formal agreement signed by dozens of organizations and governments. Whether casual or formal, networks often begin with correspondence between researchers working on a common problem. Scientists discuss difficulties encountered during research and share information on advances as well as failures. Professional meetings often provide the setting for scientists to compare their research efforts. A group of researchers will frequently use this opportunity to summarize results in a state-of-knowledge document for publication. As an outgrowth of fruitful interactions at conferences and symposia, scientists may agree to coordinate research.

30. Individual networks may grow to the point that formal arrangements are necessary. This sometimes occurs in the testing of crop lines, where formal agreements between institutions and governments facilitate the flow of germplasm. Where training is involved, memoranda of understanding can help the processing of visas for trainees. As a general rule, the more complex the network, the more likely it will be formalized. A network that spans several continents, offers training, involves the exchange of crop material, livestock, or machinery is a strong candidate for a documented arrangement. Some international networks, on the other hand, choose to remain informal, even when several countries are involved. The West African Farming System Research Network, for example, is avoiding any formal agreements involving governments, at least during its early years.

31. The strategic locations of IARCs, their formidable scientific expertise, and their continuity through core funding, all propel the centers into leading roles in networks. CGIAR centers often serve as catalysts by planning joint research projects, facilitating the exchange of information, and by organizing training courses (5). IARCs often follow up on a desire among scientists for more interaction and cooperation by providing a network coordinator, arranging seed money, offering training, and by speeding up data analysis and publication. The IARCs also help organize regular planning and evaluation meetings, as well as monitoring tours to specific study sites.

32. All networks must be guided by an effective leader. The network coordinator is usually elected by participants to serve for a specified time. Network leadership is a crucial and sensitive issue that requires careful consideration. Cooperation will wane if researchers feel that the

network leader is coercing them into a methodological straight-jacket, or if they feel they are not receiving recognition for their contributions. Many of the international agricultural networks are currently coordinated by IARCs, regional institutions, or strong national programs.

33. After a network is in place, leadership may shift among senior scientists. A rotating leadership post can help to identify and build leaders in national programs and assuages concerns about domination by stronger members. On the other hand, frequent leadership changes can break the continuity of programs and erode the network's cohesion. Where participants in a network are of roughly equal scientific calibre, a rotating leadership position may be helpful, provided that it does not occur too frequently. If leadership changes hands too often, research quality is likely to suffer. Ideally, research is coordinated by an individual who is trusted and valued by all participants. In the case of networks involving institutes of varying research capabilities, collaboration is probably best served by leaving leadership in the hands of the strongest institution. Th. also helps to ensure continuity of leadership.

34. The network coordinator visits each participating program, facilitates communication among network scientists, oversees data analyses, and organizes monitoring tours. The coordinator may be assisted by a policy, steering, or advisory committee, usually composed of scientists from IARCs and national programs. At least one senior scientist from each of the participating countries is normally invited to join the advisory committee. Sometimes an expert working outside the network is included on the policy-making board. Advisory groups are kept reasonably small, rarely exceeding 20 individuals, so that business can be conducted smoothly. In the case of extensive networks involving dozens of members, positions on the advisory committee are rotated by country so that all participating nations have an opportunity to take part in planning and policy formation.

35. Flexibility is one of the major advantages of network organizations (40). Activities can be shifted quickly in response to needs identified by participants. Because networks do not require an elaborate bureaucratic machinery and do not involve extensive hiring of staff or building of infrastructure, startup is relatively straightforward and quick. Mid-course corrections to research programs can be readily administered. Resources can be easily added or curtailed, thus making it possible to accelerate the pace of research, keep it stable, reduce, or terminate the work.

PROBLEMS

36. Networks can experience difficulties, and not all networks work or work well. Some have ceased to operate, and for some of these it is not clear just why. It could be, of course, that some networks have completed most of the work they set out to do and decided to disband (e.g. the International Rice Agro-Economics Network, IRAEN); and that is as it should be since flexibility and self-determination are important principles in networking. Also, some networks may blend into other activities and lose their identity, as in the case of the Inter-Asian Corn Program. But there are other cases where these evaluations do not apply; undoubtedly much could be learned from the experiences of less successful networks.

37. For many networks, multidisciplinary research is required. Finding ways to carry out such research effectively still troubles many experienced and well-developed institutions, and the problem is not less difficult in international networks.

38. For some problems, networking may be a slow way to get things done. This can certainly be so for networks requiring more formal structure, or where participating institutions have widely varying research capacity. Time is required to train key participants and for them to begin effective work at home. Alsc, institutional inertia or lack of interest may seriously hamper network effectiveness. At times, network success may require waiting for the slowest participants.

39. In networks of national programs where each participant chooses a key element of a series of commonly-identified problems to work on, a country may be reluctant to trust another to perform research necessary for its welfare. Only earned trust and confidence will overcome this problem.

40. Management and leadership problems present formidable challenges. Strong and effective leadership is needed, yet domination by one or another participant may be resented. It is not easy to balance democratic and representational concerns with effective leadership needs.

41. Another concern is that of governance, especially in networks where participants differ significantly in experience and capacity. As one senior agricultural scientist put it, "management of an enterprise by democratic processes making all equal partners irrespective of their knowledge and experience does not necessarily lead to cost effectiveness" (17). How to balance the interests and activities of partners of unequal knowledge or experience is a concern facing many network leaders.

42. Networks depend on rapid exchange and dissemination of information and materials. Yet returns from some linked research programs are slow. The network needs timely reporting from all sites to be most effective, yet tardy or missing sites hold up the whole operation, including data compilation, analysis and reporting. How long should the network coordinator wait for tardy reports? Should a "quick and dirty" interim reporting system be used? Should an interim data analysis system be used?

43. Some network reports arrive late, sometimes too late to be used effectively in planning for the next crop season. Also, persons who are not members of the network can experience difficulty in obtaining network reports. How to deal with non-members of a network remains a challenge.

44. Adequate funding support is also a concern. Funds are needed for network coordination, travel, and communication. Also, funds are needed to assist developing country scientists to carry out their work. Such funds fulfill a pump-priming function but should not replace funds that normally should come from participants' budgets.

45. Some travel is necessary in a network, to visit major research sites, assist in training and data analysis, and to hold joint planning meetings. Travel in some networks may be excessive. Certainly frequent travel and joint discussions mean little unless the pace and quality of research increases. Balancing communication and planning needs with quality research is essential.

46. Care should be taken that network meetings do not become "closed camps" or gatherings of a clique or group of friends. Networks should find ways to bring outside ideas and talent into their work, e.g. in training courses, monitoring tours and planning meetings.

47. There are numerous complaints about international nurseries, including: too much poorly evaluated germplasm (junk germplasm one senior plant breeder terms it); too many entries, raising costs and tying up scarce manpower; too self-serving (too many IARC entries, few or no commercial entries for comparison, few entries from publicly-supported programs outside the network); inflexible experimental designs which cause local scientists to lose interest in "running someone else's trial"; and slow return of information from combined analyses (sometimes taking years).

48. Not everyone wants to be a contributor in a network, some are satisfied to be recipients. Networking cannot be effective if receiving is the only motivation.

NETWORK VARIETY

49. A diverse range of networks has sprung up to meet the research and information needs of various aspects of agricultural development. Within the CGIAR, international nurseries set up to test advanced breeding materials are the most numerous and extensive networks, but networks are also devoted to such topics as the rational use of crop byproducts, livestock diseases, cropping and farming systems, and information outreach (Table 1). This assortment of networks reflects the multifaceted nature of agriculture and the need to tap the inputs of various disciplines in order to improve research. This section will discuss some of the diverse networks in which the CGIAR is involved, starting with nurseries, then proceeding to crop residues, agronomy, socio-economic aspects and library services. The subsequent section will explore in more depth two African networks, one dealing with farming systems and the other with a livestock disease.

Table 1

Some international research agricultural networks with CGIAR participation (see Annex 5 for Acronyms).

NETWORK	COORDINATOR(S)	REGION	COUNTRIES	STARTED
IBYAN (International Bean Yield Adapation Nursery)	CIAT	World	30	1976
CEAREP (CIMMYT Eastern African Regional Economics Program)	CIMMYT	E.Africa	14	1976
PRACIPA (Proyecto Andino Cooperativo de Investigacion en Papa)	CIP	Andean countries	4	1982
PRAPAC (Programme Regional pour Amelioration de la Pomme de Terre en Afrique Central)	CIP	Central Africa	4	1983
PRECODEPA (Programa Regional Cooperativo de Papa)	CIP	C.America and Caribbean	6	1978
SAPPRAD (South Asia Program for Potato Research and Development)	CIP	South Asia	6	1982
IPMAT (International Pearl Millet Adaptation Trial)	ICRISAT	Asia, Africa, L. America	22	1975
ISVAT (International Sorghum Variety Adaptation Trial)	ICRISAT	World	37	1977
ARNAB (African Research Network on Agricultural Byproducts)	ILCA	Africa	6	1980
Trypanotolerance	ILCA/ILRAD	Africa	9	1983
AFSN (Asian Farming Systems Network, formerly the Asian Cropping Systems Network)	IRRI	Asia	12	1974
AMN (Agricultural Machinery Network)	IRRI	Asia, L.America	9	1975
INSFFER (International Network on Soil Fertility and Fertilizer Evaluation on Rice)	IRRI/IFDC	Asia, Africa	19	1976
IRTP (International Rice Testing Program)	IRRI	world	75	1975
WAFSRN (West African Farming Systems Research Network)	Univ.Florida	W.Africa	10	1983
INTSOY (International Soybean Program)	Univ.Puerto Rico/ Illinois	World	70	1973

International Nurseries

50. The oldest IARCs, IRRI and CIMMYT, have led in setting up international nurseries and today every crop-related CGIAR center works with its collaborators to assemble and distribute advanced breeding lines to countries that request them. The logistics of operating an international nursery are enormous. The material, obtained from IARCs and national programs, must be packaged and air freighted to numerous locations, often on several continents. Scientists travel to some of the sites to monitor crop performance. Participants employ a standardized reporting procedure which can be transferred to computer disks or tapes. Feedback from the widely separated nursery sites is collated and analyzed. The IARCs usually coordinate such nurseries because they have the staff, facilities, experience, and funding continuity to undertake such a massive task. It is intended that participants in international nurseries will receive early reports of results obtained at the testing sites, but communications and data compilation and analyses sometimes make early reporting difficult.

51. Crop-mandated IARCs are usually involved in several nursery networks. CIMMYT, for example, contributes to at least 9 major international nurseries (8) for which it distributed 1,884 trials of wheat, triticale, and barley worldwide in 1980 (10). The number of countries participating in international nurseries often fluctuates, but the trend is upwards. In 1974, for example, CIMMYT sent trials to 83 countries; in 1979 and 1981, 134 and 101 countries, respectively, participated (45, 47, 10). IRRI's International Rice Testing Program (IRTP) involves 700 scientists in 75 countries in Asia, Africa, Latin America, Oceania, and Europe (26). During the 1970s, more than 130 developing countries joined networks designed to test crop breeding material (16).

52. Nurseries can be divided into two basic types. The larger ones usually screen for high yield and wide adaptability. Other nurseries are established primarily to measure resistance to pests and diseases or environmental stresses. The specialized nurseries are chiefly designed to test materials in certain "hot spots" where insect or disease pressure is particularly heavy, to identify sources of resistance. In some cases, materials are tested for tolerance to extremes of cold or heat, acid soil, high aluminum soil, or severe flooding or drought. As national programs improve their capacity to identify and analyze their own problems, they will increasingly request more specialized nurseries to find germplasm that will fit their local needs.

53. The Latin American Disease and Insect Screening Nursery (LADISN) for wheat is an example of a nursery that specializes in a particular environmental challenge. Assembled in 1972, the CIMMYT-coordinated network alerts cooperators to outbreaks of new, virulent races of wheat rust. Participants in LADISN are thus able to get a reading on disease resistance of promising material before it is released to farmers (45). And in the Andes, five countries have established nurseries to screen for stripe rust and barley yellow dwarf virus; these nurseries serve as an early warning system to regional breeders working with wheat and barley (10).

54. IRRI also operates specialized nurseries. Nurseries for rice blast, bacterial blight, tungro virus, brown planthoppers and stemborers are regularly assembled by IRTP. The Rice Blast Nursery, for example, teams up with the All-India Coordinated Rice Improvement Project to test materials at over 100 locations. Although most specialized nurseries focus on diseases and pests, some address soil and climatic problems. IRTP, for example, operates nurseries to screen for tolerance to saline and acid soils, as well to low temperatures.

55. It is expected that crop-mandated IARCs are heavily involved in international nurseries, but so is one of the CGIAR-supported livestock centers. ILCA (International Livestock Centre for Africa) is interested in exploiting the rich genepool of native clovers in Ethiopia. ILCA has already assembled a genebank containing 2,100 accessions of legumes and grasses and works closely with Ethiopia's Plant Genetic Resources Center. To evaluate the potential of new forage species, ILCA has gained the cooperation of several African nations to test the materials in various environments. ILCA has found that cooperators are relatively easy to find when germplasm is offered in exchange for testing. As with many networks, ILCA's forage program publishes a newsletter which helps bring promising material to the attention of national programs.

56. Because some countries must contend with special problems, national programs will continue to play major roles in nursery networks. National programs help identify sources of resistance to particular problems, and in some cases make the necessary crosses to incorporate this resistance into germplasm that can be used elsewhere. New crosses and advanced lines are tested in nurseries under stressful conditions before being shipped to countries that have not yet experienced the problem.

57. A major benefit of international nurseries is that germplasm is evaluated across a wide range of geographical conditions. Breeding for resistance to several pest and disease problems has been made possible by the widely separated testing sites. Also, new pests and diseases have been spotted, and sources of resistance identified. International nurseries thus help build stability and safety into crop varieties.

58. Although international nurseries have clearly helped to improve production and have fostered global collaboration, they have nevertheless stirred some dissatisfaction. National programs occasionally feel burdened by the number of entries to be planted; the uneven feedback of results reflects this irritation. Even IARCs may complain that some of the entries are of little or no use to them. Another criticism that has emerged is that sometimes nurseries distribute material that has not undergone adequate preliminary screening. Poorly evaluated germplasm raises the cost of networking by unnecessarily increasing the size of trials. Quarantine problems also sometimes impede the effectiveness of international nurseries. Valuable seed destined for trials occasionally deteriorates in government warehouses because clearance has not been arranged or because of misunderstandings. Finally, international nurseries only serve the major food crops; vegetables, specialty crops, trees, and food crops of local importance are poorly represented in nursery networks. This naturally reflects research priorities, but more modest networks are likely to begin in the future to serve these commodities.

59. Most national programs are willing to test lines of special interest to others as long as the quantity of trials does not overwhelm their limited resources. Governments realize that international nurseries save their programs considerable time and money since much of the preliminary crossing of the material has already been done. In the case of IRTP, for example, the network saves national rice programs an average of two to five years of breeding effort for a given result (26). Concern about who benefits most from international nurseries is likely to abate in the future as national institutions assume more responsibility for more advanced plant breeding and network coordination.

Multipurpose Commodity Networks

60. CIP networks tend to be regional and test germplasm along with other aspects of potato production. CIP provides a coordinator during the first two years; thereafter the job is rotated among collaborating countries on an annual basis. CIP is currently involved in five regional networks, most of which are less than two years old (Table 1). These networks, each involving about six countries, pool resources by dividing up responsibilities. Participants concentrate on aspects of boosting potato production for which they are best equipped. In the South Asia Program for Potato Research and Development (SAPPRAD) network, for example, the division of responsibility is as follows: Philippines (germplasm improvement), Sri Lanka (production of true potato seed), Papua New Guinea (simple methods of seed multiplication), Indonesia (tropical agronomy), and Thailand (potato storage).

61. PRECODEPA (Programa Regional Cooperativo de Papa) uses the same approach as SAPPRAD, but works in Central America and the Caribbean. With the help of the Swiss Development Corporation, CIP initiated the network in 1978 based on the idea that it would be difficult for Latin American countries to mount separate research programs into all the areas that limit potato production (12). To cover the remainder of Latin America, PRACIPA (Proyecto Andino Cooperativo de Investigacion en Papa) was organized. These regional networks operate with CIP as the hub and participating nodes operate subnetworks around their particular individual specialties (Figure 1c).

Factor Research

62. A number of networks have been organized to deal with problems related to factors of production. Four of these will be reviewed briefly in this section.

63. To increase the efficiency of fertilizer uptake by rice and thereby reduce costs to farmers, IRRI and the International Fertilizer Development Center (IFDC) coordinate the International Network on Soil Fertility and Fertilizer Evaluation on Rice (INSFFER) which connects 72 scientists in 18 African and Asian nations. The network tests various fertilizer formulations and application methods to reduce nutrient losses due to erosion, leaching, and volatilization. IFDC provides technical support and chemicals to be

tested, while IRRI coordinates data collection, analysis, and reporting (28). IRRI provides a core staff member as network coordinator. IRRI economists have assisted INSFFER by devising a questionnaire on fertilizer use by farmers that can be used in different areas, thereby facilitating economic calculation of alternative methods.

64. To facilitate the transfer of technology to small-scale farmers, IRRI has established networks that gather information on farming systems. The International Rice Agro-Economics Network (IRAEN) gathered information at the village and farm level on cultural adjustments and economic changes that follow the release of modern varieties. Although IRAEN has ceased its work, many researchers in the original network continue to collaborate. A central aim of the network was to pinpoint factors that account for the yield gaps between experimental plots and farmers' fields (2). Teams of agronomists, economists, and statisticians measured yield fluctuations over a wide range of environments in Thailand, Malaysia, Bangladesh, Taiwan, and the Philippines. IRAEN participants also analyzed the costs and benefits of acquiring modern varieties and new machines. Collaborators in the IRAEN network included a sister CGIAR center, ICRISAT, and national programs, such as India's Central Rice Research Institute (CRRI) and the Malaysian Agricultural Research and Development Institute (MARDI). Information from IRAEN was fed into other networks, such as INSFFER and the Asian Farming Systems Network.

65. IRRI provides a fulltime coordinator from its core budget for the Asian Farming Systems Network (AFSN). Although IRRI stimulated the formation of the network, participating countries do most of the planning and research. Multidisciplinary research teams involve 470 scientists working in 12 Asian countries. Indonesia alone has over 100 trained individuals cooperating in AFSN. The network has conducted training courses in cropping systems research in which national program scientists have been involved as instructors. The AFSN has been very effective in developing and testing on-farm research methodologies for cropping systems research.

66. The Agricultural Machinery Network (AMN), coordinated by IRRI, unites the efforts of 20 scientists working in nine Asian countries by concentrating on developing intermediate technology that can be readily adopted and maintained by small-scale farmers (27). Information from ACSN and INSFEER has helped AMN workers to design simple machinery needed at farm level to help improve rice production.

Special Purpose Networks

67. Some networks are set up for special problems rather than for commodities or factors of production. ARNAB (African Research Network on Agricultural Byproducts), for example, is attempting to improve the digestibility of crop residues for livestock. The ILCA-coordinated network crystallized with the support of the Australian Government at the 1981 Douala meeting of the African Association for the Advancement of Agricultural Sciences. ILCA was chosen as the network leader because of its printing facilities. English and French versions of the quarterly ARNAB newsletter are sent to 1,200 individuals and institutions. Some of the research

conducted in the network includes the mixing of groundnut residues into livestock feed in Senegal, and exploring ways of incorporating cacao pods into livestock meal in Nigeria. An ILCA scientist visits each of the six participating countries twice a year to help disseminate latest research findings. ILCA offers in-service training for midlevel technicians as part of the ARNAB network. In 1982, 18 Africans participated in the ARNAB course in Ethiopia. ILCA also serves as a clearinghouse for requests from national organizations for funding crop by-products research.

Information Exchange

68. Some networks do not involve research and development at all, but are designed primarily as mechanisms for collecting and dispersing information. ILCA's microfiche service of unpublished government documents illustrates the concept of pooling of resources in networking. ILCA staff visit agricultural agencies of African governments to photograph documents that may be useful to agricultural researchers. In return, the governments receive microfiche copies of these materials as well as documents of other countries. ILCA's Selective Dissemination of Information (SDI) service is another example of an information network although its activities are mostly limited to hub-spoke interactions. Its purpose is to keep scientists abreast of new publications in their research areas. Each scientist in the network receives a monthly computer printout containing citations and abstracts of relevant journals and books (23). ICRISAT also has a monthly SDI service which is being widened to include non-ICRISAT scientists (21).

69. Some other networks can also be classified primarily as information outreach efforts. The recently established West African Farming Systems Research Network (WAFSRN), for example, is contacting people working on farming systems in ten West African countries to assess the state of knowledge of the subject in that region. At the first WAFSRN workshop held in November 1982 at IITA, a steering committee was elected and various study groups formed to survey on-going farming systems research in West Africa, to do an inventory of terminology and definitions in farming systems work, to conduct a literature search relevant to the network, to publish a newsletter, and finally to map farming systems zones in the region.

NETWORK CLOSEUPS

70. A closer inspection of a couple of networks will provide an opportunity to explore in more detail the history, structure, goals, and functioning of two kinds of collaborative efforts. The networks selected for close-up examination not only differ in subject matter, one dealing with farming systems and the other with a livestock disease, but they are also separated by age. It will be seen that although the two networks tackle different problems, many organizational similarities remain. And by selecting networks at different development stages, it will be possible to point out concrete accomplishments as well as the strategy employed to reach the threshold for generating research results. Both of the networks discussed in this section are located in Africa.

East African Regional Economics Program

71. Farming systems work has been conducted under different names at many of the IARCs since they began operations. The main aim of farming systems research is to study farms and farmer circumstances in order to uncover major constraints to increased agricultural production, and to find new or improved technology that is suitable for adoption. The idea is to determine the kinds of changes in technology and policy that would be most helpful. This may or may not involve modern varieties or modern equipment. But if farmers are involved in the identification and development of improved practices and procedures, the products of research are more likely to fit farmer circumstance, and hence have better chances of adoption. Such research is carried out by IARCs in their farming systems programs which include both social scientists and production scientists.

72. In 1976, CIMMYT established the East African Regional Economics Program to promote farming systems research in 14 national programs. The network is headquartered at ILRAD in Nairobi and helps national institutes set up their own research agenda. CIMMYT provide leadership for the network through its regional economist stationed in Nairobi. Emphasis is placed on field work, particularly since much remains to be learned about the various agricultural systems in the region.

73. To assist in institution building, the network offers various workshops for participants. One workshop, offered twice a year by the University of Zimbabwe, is tailored to field researchers. Trainees, mostly economists and agronomists, receive five weeks instruction in methodology. The second type of workshop is targeted for research directors and administrators. Participants in this workshop, offered every 12 to 18 months, discuss budgetary matters and funding policies. The third workshop, conducted at nine-month intervals, is designed to upgrade the skills of bench scientists, particularly in data analysis.

74. In addition to the workshops, the network will help set up in-house training if a country has at least ten people interested in conducting farming systems research. Zambia has recently organized such training with periodic visits by CIMMYT staff. The network newsletter, published in Nairobi, keeps participants in touch with ongoing research in the various countries.

75. The network's most valuable contribution to date has been the training of Africans so that they can perform their own farming systems research using a commonly agreed upon methodology. This will greatly facilitate cross-country comparisons of agricultural bottlenecks to increased food production. Fourteen countries actively participate in the network.

Trypanotolerance Network

76. Trypanosomiasis, a debilitating and often fatal livestock disease, is triggered by blood parasites that are transmitted by tsetse flies in Africa and by other vectors in Asia and Latin America. Two forms of the

disease, Trypanosoma brucei gambiense and T. brucei rhodesiense, also provoke sleeping sickness in people. Recently, T. vivax has been responsible for serious outbreaks of hemorrhagic trypanosomiasis in Latin America, and T. evansi has become a serious problem in several south and southeastern Asian countries. Concern is thus mounting for a viable cure or control for the disease which plagues some 50 countries.

77. Traditional control measures, ranging from elimination of wild animals that serve as reservoirs for the disease to removal of vegetation used by the vectors, have all had limited success and in some cases have exacerbated environmental problems. It has long been known that certain breeds of African cattle, particularly the N'Dama and West African Shorthorn, tolerate trypanosomiasis, but their potential has until recently been largely ignored. It was thought that they were too small and unproductive to be of much use in cattle breeding and that resistance was a local phenomenon.

78. In 1977, UNEP and FAO commissioned a survey of the extent of trypanosomiasis in Africa and the location of trypanotolerant breeds of cattle, sheep, and goats. The results of that ILCA-conducted study, based on intensive field work in 18 countries, were published in 1979 (24). A major finding of the study was that trypanotolerant livestock, although generally small, were as productive as other breeds in areas with low rates of trypanosomiasis transmission and much more productive in high trypanosomiasis risk environments.

79. The survey document provided several leads toward greater understanding of the role and potential of trypanotolerant animals. Consequently, an informal network was initiated in 1981 to coordinate research on trypanotolerant livestock in Zaire, Gabon, Nigeria, and Ivory Coast. Two years later, the network was expanding into Togo, Senegal, and the Gambia, and was placed on a formal footing under the leadership of ILCA. Benin and Congo are expected to join by 1985. ILCA provides a network coordinator and provides leadership and research in animal management, and shares a division of labor with ILRAD and the International Center of Insect Physiology and Ecology (ICIPE) in an unusual but important synergistic relationship using the talents and strengths of each center.

80. Much of the laboratory work in the trypanotolerance network is done at ILRAD in Nairobi. ILRAD also supplies a veterinarian and an entomologist who visit study sites in the network. ILCA provides specialists in animal management, nutrition, genetics, and economics, based at the network headquarters in ILCA, Nairobi. The network team coordinates the collection of information on tsetse challenge, animal health, and livestock productivity in different environments. Data are assembled in Nairobi and taken on floppy disks to ILCA's headquarters in Addis Ababa for analysis. The multidisciplinary network is funded by the European Economic Community and the governments of Belgium, France, Gabon, Netherlands, Nigeria, the United Kingdom, and West Germany.

81. As the consortium-financed network expands, demand increases for technicians and scientists with the appropriate skills. To help fill this need, ILCA, ILRAD, and ICIPE jointly operate a seven-week training course. Students spend a month at ILRAD learning about livestock health and diseases,

two weeks at ICIPE where they concentrate on the life cycles of the 22 species of tsetse flies known to transmit trypanosomiasis, and one week at ILCA on livestock productivity. ILCA, ILRAD, and ICIPE have just prepared a training manual for the network which also contains a sample of recent scientific literature on trypanosomiasis (38). Fifteen people have thus far passed through the course that has been offered four times. Plans call for operating the course twice a year for a total of ten trainees per annum.

82. The N'Dama and West African Shorthorn breeds are the principal foci of research in the network. These humpless cattle number close to 8 million head in Africa but only account for approximately 5% of the continent's cattle herd. Their contribution is likely to increase in the future, however, following confirmation of the superior ability of N'Dama and West African Shorthorn to thrive in trypanosomiaisis infested areas and produce more meat and milk than other breeds (36, 37).

83. Much of the research will be conducted, at least initially, on larger commercial or government ranches. In Zaire, for example, N'Dama cattle are being evaluated on two ranches with the financial assistance of the Belgian Government. One of the selected livestock operations is in an area infested with trypanosomiasis, whereas the other is in a region where little transmission of the disease occurs. In Nigeria, N'Dama cattle shipped from the Gambia are being monitored in a range of trypanosomiasis risk situations. In this manner it will be possible to gauge the degree of trypanotolerance in the breed. Work is not confined to commercial ranches, however. The network also investigates the performance of trypanotolerant livestock in 90 villages in Zaire, as well as rural settlements in Nigeria. ILRAD is using embryo transfers to move N'Dama stock across Africa to upgrade livestock with reduced chances of spreading diseases.

84. The network of 20 scientists has uncovered some indications as to how certain cattle breeds survive attacks of trypanosomiasis. Perhaps the most important discovery is that the resistance is genetic and is not merely a localized condition as previously thcught. Trypanotolerant cattle mount a more effective antibody response against invading trypanosomes than do disease-prone cattle types. The N'Dama and West African Shorthorn withstand infection with trypanosomes by regulating the growth of the parasites. Red blood cells of N'Dama and West African Shorthorn also resist destruction better during infection. Network researchers are also investigating other possible mechanisms for tolerance, ranging from breath chemistry to skin twitching to repel the biting flies.

PAYOFFS

85. It is difficult even to speculate on the impact of networks, whether in terms of increased production or other benefits. In the past, this is due to the nature of networking, where national, regional or international institutions work together in mutually supporting roles, but where stronger national programs are a major long-term objective and, hopefully, are associated closely with the resulting gains to developing country agricultural production. In such relationships, credit for individual participants should not be particularly visible, especially for

participants not representing national programs. Parenthetically, donor organizations must recognize this principle in understanding the role of international research organizations. A whole network can take pride and share some satisfaction when a participating national program successfully releases a new crop variety or helps to improve local production. But most of the credit will accrue to the national program, as it should, and the network can be pleased that it played a role in the process.

86. Institution building is clearly one payoff of networking. Helping national institutions to gain confidence and competence in identifying, analyzing, and solving local problems is a major benefit of the network approach. Helping in the training of key individuals to conduct high priority research is also a principal means of institution building. For example, participation in the analysis of network data for a crop season and then planning for the next crop season should be highly beneficial for participating scientists. In the Asian Farming Systems Network, participating scientists also critique experimental designs used in the previous crop, and make necessary modifications for the next crop season.

87. Training in a network context is also potentially efficient. Tying training to a carefully planned research program gives direct relevance to specialized training designed to meet network research goals. Also, network activities provide a ready framework for effective use of trainees upon their return home. Modest resources from the network can be used to help the trainee get started in research at home. Included are improved seeds, purchase of essential plot or laboratory equipment, fertilizers or pesticides, acquisition of local transportation, and so on.

88. Time may be saved through networking. In most cases this will be through the sharing of research tasks and acquisition of certain scientific skills or germplasm through collaboration with IARCs, strong national programs or others. The development of superior germplasm with multiple resistance to pests or environmental stresses, improved cultural practices, or other improvements in production or handling should save research time and expense for individual participants.

89. Networking provides a way for national programs to be contributors and not just recipients in international research. This should help to provide incentives for young scientists desiring to make a contribution to the solution of important problems. Increased confidence and morale of national scientists are important but less tangible benefits of networking.

90. A problem faced in trying to assess the impact of networks is that it is not always easy to isolate the benefits, nor to convert these benefits into monetary units. It is difficult, for example, to gauge in money terms the beneficial effect of institution building as a result of networking. Even for tangible products, such as improved germplasm, concrete information is often lacking. For many varieties, we do not even know the area planted let alone the value of increased production. Before highlighting some of the payoffs from networking, though, it will be useful to examine the cost of some of the cooperative efforts.

91. Although networks are considered inexpensive ways of conducting research, there are costs involved for those who take the initiative. Travel, lodging, coordination, and publications account for the bulk of the budget in most networks. For example, it costs approximately $70,000 to transport and lodge 30 West African participants for a week-long workshop at IITA. It is customary to seek special funding to underwrite networking expenses. Generally, information networks are cheaper to operate than research-oriented collaborative programs. And costs soar the larger the network, particularly if transoceanic travel is necessary.

92. The West African Farming Systems Network, an information network, is requesting $140,000 per annum for five years for operating expenses. CIMMYT's Eastern African Regional Economics Program, also mainly an information and training network, costs the center $250,000 a year. The Trypanotolerance Network costs the centers involved close to $350,000 a year, even though it covers fewer countries, because it is a research network involving laboratory equipment and supplies. ILCA's proposed animal traction network is expected to require $1.5 million over three years. IRRI costs for the UNDP-supported IRTP network are budgeted at $7.7 million for the five-year 1980-4 period (47).

93. The total cost of a network, of course, includes both the budget contributions of all the participants, and the opportunity costs of the time spent on network business. So far as we know no one has undertaken to work out this figure for a particular network. The assumption is generally made that these items are not great in relation to the benefits, and that the gains from participation for the institutions and individuals involved are self-evident. It seems clear that this assumption should be challenged in any serious attempt to evaluate networks. It is very likely to be true in many cases, but perhaps there are some networks where the demands made on participants are out of proportion to the gains, and do constitute a diversion from more important work.

94. Although it is difficult to arrive at concrete payoff figures derived from networking, a major benefit is the time saved by networks. How much networking may help boost research efficiency depends on the focus of research and capabilities of network members, but the figures may be in the order of 10 to 30 percent. No methodology exists for determining what proportion of a particular improvement in production can be attributed to networking. In particular there seems no way to distinguish the contribution of the network itself from the contribution of the research done at the hub or any of the nodes. Of course that research, in turn, may be influenced by the existence of the network with regard to quality, timeliness and even choice of subject.

95. In spite of the risks involved, this and the following paragraphs attempt to identify some of the outputs which are associated closely with networks and seem unlikely to have occurred in the same fashion without the support of a network structure.

96. Through cooperative arrangements with national programs, CIMMYT's international maize nurseries have led to the development of 24 open-pollinated populations with varying resistance to diseases and with different agronomic and grain qualities. From these populations, 70 varieties have been released by national programs in 20 developing countries (4). By 1979, the International Rice and Testing Program had launched 30 HYVs of rice in 18 Asian, African, and Latin American countries, in just four years of operation (32). National programs have made important contributions to the IRTP network by providing material that has been released to farmers in other countries (Table 2). This illustrates the rim concept in networking in which members interact with each other as well as the hub (Figure 1b).

Table 2

Rice Varieties Provided by National Programs and Released to Farmers in Other Countries

IRTP Entry	Origin	Released
IET1444	India	Nepal
1ET2935	India	Nepal
1ET2855	India	Mali
Pelita I-1	Indonesia	Burma, Vietnam
KN117	Indonesia	Burma
Kn-1b-361-1-8-6-10	Indonesia	Philippines
BG90-2	Sri lanka	Burma, Nepal
BKN6986-108-3	Thailand	Burma
Biplab	Bangladesh	Vietnam
BR51-46-C1	Bangladesh	India
C22	Philippines	Burma

Source: IRRI, Los Banos.

97. The other IARCs started later than IRRI and CIMMYT, but their international nursery programs are already demonstrating their value. As of 1983 for example, the 19 countries participating in the CIAT-sponsored International Bean Yield and Adaptation Nursery (IBYAN) have released 48

varieties that are being multiplied for release or have been distributed to farmers. All bean selections leaving the second stage of the IBYAN network now resist bean common mosaic virus, and the nursery has helped locate lines that survive all known races of anthracnose (Colletotrichum lindemuthianum), a worldwide and highly destructive bean disease.

98. While networks testing crop germplasm have made important contributions, networking in agronomy and farming systems has also been notable. For example, technology generated at Asian Farming Systems Network sites is now the basis of major production and extension programs in Sri Lanka, Nepal, the Philippines, Indonesia, and Bangladesh (15). Several machines developed by the Agricultural Machinery Network are finding uses in the hands of relatively poor cultivators. Various models of portable and sturdily built threshers are now being successfully used in several countries, such as the Philippines, Thailand, and Pakistan; in many cases, farmers have discovered that the machines pay for themselves in a year or two. A power tiller developed at IRRI has already been adopted by 10,000 farmers in various Asian nations and more machines, such as five-row seedling transplanters and small water pumps, will soon be entering extension pipelines. Some 600 five-row seedling transplanters have been built in Burma and are likely to be adopted on a large scale in the near future.

THE FUTURE OF NETWORKING IN THE CGIAR

99. Networking has proven to be an effective means of increasing the efficiency of agricultural research and in improving international collaboration in research. A major lesson that can be drawn from networks is that they must be founded on the bedrock of self-interest. Pragmatism, rather than just goodwill, motivates successful research teams. People participate effectively in networks when they have a stake in the outcome and when they exercise some control. The ability of networks to speed up results, whether they lead to positive results or dead-ends, saves scientists time and institutions money. Practical results generated by carefully conceived collaborative research thus provide a powerful incentive for networking.

100. Most IARCs are heavily involved in networking. This is remarkable, considering that networking does not even appear in the founding documents of CGIAR centers. Originally, the IARCs were conceived as centers of excellence, and relationships with national programs were not such a major concern as they are now. At that time the IARCs were seen as hubs producing information and technology for client institutions in developing countries, with the research products flowing essentially outward. While the centers continue their functions as nodes of high quality research and as hubs of collaborative activity, their linkages with national programs are changing as the latter strengthen. The emergence of networks reflects in part this adjustment to new realities; relationships are being fine-tuned to avoid duplication and competition.

101. It seems apparent that the IARCS will continue to be heavily involved in networks. As a means of working effectively with many national research programs, networks present great flexibility and opportunities for collaboration. If that thesis is accepted, then the major question is what form will future networks take?

102. Most networks are evolutionary in nature, often arising from the shared interests of a few scientists, and are simple in organization. Many, in fact, are organized on the hub-and-spoke model, with an IARC forming the hub and involved in a two-way flow of information with individual participants. Probably most of international nurseries started in this way; some of them probably still operate this way. Most networks will move on to the hub-spoke-rim model where participants interact not only with the hub but also with each other. Finally, participants along the rim may begin to become hubs, either for the entire network or for specific activities. This is happening more and more as national programs become stronger.

103. IARCs often serve as the hub or nerve center for a network, especially when it is first set up. In some cases the hub role is assumed by an IARC without much discussion or comment; in others an IARC may be asked by a group to assume that role. A necessary question is, must an IARC always be the hub of a network? The answer is, of course, no. IARCs do operate in many cases as one of the nodes in a network wheel and do so effectively.

104. There are, of course, good reasons for IARCs to be deeply involved in networks dealing with their mandated commodity or research specialty. In some cases this may require a strong leading role in the network. Howoever, as national programs assume more and more responsibilities, IARC involvement and leadership requirements will change. Being able to determine when and how to change will require careful planning and sensitivity to national goals and needs.

105. In the past, some IARCs have been perceived as paternalistic, but this perception is changing. The stance adopted most frequently by the IARCs today is that of cooperating on a partnership basis with national programs in joint activities whenever possible. This evolving partnership is necessary since national institutions are increasingly able to help themselves. In the case of well-developed national programs, IARCs collaborate on joint projects as peers. National programs and IARCSs are seeking new and better ways to work together. CGIAR centers will continue to enjoy a comparative advantage in organizing and coordinating networks for some time to come. Their role will be especially useful in the case of smaller countries with a limited capacity to mount broad-based research programs (43).

106. Although the pace of improvement among Third World national programs is uneven, the CGIAR system is clearly playing more and more of a supporting collaborative role for national research programs. In germplasm work, for example, the IARCs will likely do less breeding of finished varieties but will instead concentrate on providing evaluated germplasm and superior parental lines to national programs. Given the enormous logistical tasks IARCs will continue to be heavily involved in the coordination and handling of international nurseries for testing.

107. Another way in which IARCs can continue to service networks is by providing training. The various courses, workshops, and fellowships offered by the networks are important in the effort to build national institutions in developing countries and to increase their effectiveness in collaborative efforts. The CGIAR systems has made important contributions to these goals.

The International Network on Soil Fertility and Fertilizer Evaluation on Rice, for example, has sponsored five 4-month long training courses that have graduated 106 individuals from 14 countries. By 1983, the 5 to 6 month course offered by the Asian Farming Systems Network (AFSN) had trained 317 persons from 29 countries. The Agricultural Machinery Network trains village-level craftsmen so that they can manufacture and repair farm machinery. Because of growing interest, many networks are planning to add courses. Demand is so keen for the AFSN course, for example, that IRRI is considering offering the course twice a year so that 90 students can be served.

108. IARCs can also contribute by acting as even more efficient information clearing houses. IARC libraries are usually extensive, well-managed, and up to date. Furthermore, most IARCs operate printing facilities and presses which rapidly publish newsletters, pamphlets, conference proceedings, and books. Such facilities are being used and expanded to serve networks. CIP, for example, wants to establish a global communications network for the exchange of potato information (11).

109. The CGIAR system can continue to assist networks by employing state-of-the-art technology to facilitate the storage of burgeoning data and to speed up the sharing of results. Just as the IARCs are employing computers to facilitate administration and work in germplasm conservation, so scientists will take advantage of breakthroughs in microelectronics to improve the efficiency of collaborative research. Technology for speeding up communication exists, but the infrastructure is still inadequate in many parts of the Third World. Computers often exchange information over telephone lines, but main lines are sporadic and function erratically in many developing countries. Satellites can be used to bounce messages across the globe, thereby sidestepping telephones.

110. Many networks will thus incorporate computer terminals at participating institutions that will be linked to each other. Collaborators in the network will be able to call up data obtained elsewhere in a fraction of the time it takes to use the mail. Computers will allow scientists to update and exchange information quickly. Teleconferencing, using computers and satellite communications, will permit cooperators in a network to conduct some workshops without the expense and inconvenience of travel. The cost of computers is plummeting, so Third World institutions will be increasingly able to afford terminals, multi-colored plotters, and rapid printers. IARCs are adding this dimension t[illegible] training programs so that more technicians and scientists become compu[illegible]ate.

111. Because networks [illegible]ecoming increasingly common, there is the danger that they may become so profuse as to burden researchers and compete with national programs. A good idea can be carried too far, and the IARCs will have to avoid this pitfall. They should be able to because they are generally careful to take on projects only if they contribute to their overall goals. Also, networks do not proceed very far unless funding is secured and because IARCs have core research programs. Further, networks can be disbanded when a problem has been solved or when another mechanism is found to handle it.

116. The need for increased support for networking in agricultural research is now widely recognized (45, 46, 6, 30, 31, 33, 41), and the IARCs are gearing up to meet the growing interest in cooperative research. For example, CIAT, CIMMYT, ICARDA, ICRISAT, and IRRI, highlight the importance of networking in their long-range plans (7, 9, 20, 22, 25, 29). CIAT and CIMMYT foresee that most of their staff additions for the rest of this decade will be in the area of regional cooperation (7, 9). ILCA envisages a larger role for itself in networks and hopes to double the number of countries in which it is engaged in research projects (ILCA, 23).

117. It would appear that networks will continue to be an important factor in the CGIAR system and will be used to advance agricultural research. Not all networks will be successful, because the relationships involved are without precedent. For it should be understood that, most of all, networks are based on relationships. Dr. M.S. Swaminathan stated the case clearly in a recent letter (44): "Networks represent a delicate web of relationships .... this web can be preserved and strengthened only through mutual respect, recognition, and credit sharing".

PART II -- THE FINANCIAL ENVIRONMENT

INTRODUCTION

118. This portion of the report summarizes the recent developments in the financing of the CGIAR, as a background to the consideration of financial requirements in 1984 and subsequent years. It deals with individual centers only to illustrate general points. The financial situation in each center is covered in detail in the program and budget document submitted by the center to the Group, and in the commentary prepared by the CGIAR secretariat on each budget submission.

CONTRIBUTIONS

119. As reported to the Group in May 1983, the total of CGIAR contributions for core programs of centers in 1982 was about $144 million, an increase of about $13 million or 10% over contributions in 1981. This figure was, however, much below the Group's planning figures for 1982. It was $19 million below the lower of the two levels recommended by the TAC and approved by the Group in November 1981. It was also $10 million lower than the estimate of probable contributions made by the CGIAR secretariat at that same time, and $5 million below the $149 million figure to which approved budgets were reduced, in emergency action by the TAC at the request of the Group, in March 1982.

120. The components of the change between the secretariat's November estimates, and the actual outcome are instructive:

(a) Exchange losses amounted to about $4 million. The November estimate for total contributions was based on then current exchange rates. The exchange loss has been calculated by comparing the actual rate received by centers in changing non-dollar contributions into dollars with the rate used in making the November estimate.

(b) Some $5.8 million of contributions included in the secretariat's estimate did not materialize during the year. The secretariat's estimate was based as usual on amounts pledged by the donors with or without caveats, or, when no pledge was made, on the basis of informal communications with donors.

(c) On the other hand, $2.1 million not foreseen in November 1981 was provided by several donors, two providing virtually the whole sum.

(d) Some $0.6 million originally pledged as core ended up being contributed for special projects, but this was more than offset by a single donor's pledge of $0.9 million moving in the other direction, for a net gain of $0.3 million for core programs.

(e) In the case of four donors, funds provided for restricted core activities could not be spent during the year, resulting in a reduction of contributions attributable to 1982 of $2.9 million.

121. The difficulty of making accurate estimates is a continuing problem, and a critical one for the system. The estimates made at different times by the CGIAR secretariat not only form the basis for the decision on budgets for the year, and for the matching contributions of donors that use a matching formula, but also form the basis for program planning by centers during the year. The importance of this estimate will be further increased if it becomes the basis for triggering use of the stabilization mechanism in the event of unforeseen shortfalls.

122. The present estimate for core contributions in 1983 is $160.5 million. (The transfer into core of special projects involving contributions of $12.5 million increases this total accordingly, but, for purposes of comparison, the transfer is not included in the contribution figures used in this discussion.) If realized, $160.5 million would be 11% higher than contributions in 1982. It compares with requirements of $166 million for the lower level of the bracket approved for 1983 by the Group in November 1982, and with a secretariat estimate at the same date of contributions totalling $163 million. The principal sources of change are the same as in 1982, although some of them cannot be calculated exactly at this time.

(a) Exchange losses realized and projected, based on rates as of November 1982, are $1.8 million.

(b) Contributions pledged or estimated by the secretariat in November which are not likely to be realized amount of $3.8 million.

(c) Contributions made or pledged which were not projected in November 1982 amount to $7.1 million, including $1.5 million from a donor that had not contributed for several years.

(d) Shifts from core contributions to special projects other than those transferred into core account for about $4 million.

123. For two years, therefore, the level of contributions provided by the Group has turned out to be less than was expected at the beginning of the year in question, and less than the lower level of approved budgets.

IMPACT ON CENTERS

124. The difficulties of 1981, a year which saw a number of centers operating at a deficit, and the uncertainties of 1982, led most centers to start 1982 with programs planned at levels below those conditionally approved by the Group. They were thus prepared for the shortfall that did occur and were able to adjust to it with somewhat less damage to their programs than might have been expected. In fact the amount of adjustment made by centers turned out to be more than was ultimately required. Substantial funds were allocated to centers relatively late in the year which had not been planned for, and which were used in the remaining time for delayed capital expenditures and equipment replacement and for restoring working capital. Also, $3.7 million were carried over into 1983 by nine centers that ended 1982 with positive balances.

125. Uncertainty carried over as well into 1983, and the centers in general have been managed conservatively to protect against the possibility of income from contributions being lower than expected.

126. A major positive factor over the two year period has been the combination of slower inflation and faster devaluation of the currencies of the host countries of many centers and of other countries in which centers operate. The price factor built into the system's budget for 1982 was 13.6% (reduced in March from 15.5%), with substantial variation among centers. Retrospectively, it appears that the combined impact of inflation and devaluation would justify a price factor of only 3 to 5% for 1982, calculated in just the same way. Several centers do not believe that the calculation is a fair representation of cost changes actually faced by the center in the conduct of its business, but overall it is clear that the impact of price changes has been less than anticipated. In 1983, the average price factor in the budget was 14% and the secretariat's current estimate is just half of that figure, or 7%.

127. In one case, the change was spectacular. Successive Mexican devaluations have reduced the dollar requirements to finance CIMMYT's approved budgets by a total of $9.7 million, one third in 1982 and the balance in 1983. This made funds available for distribution among other centers. In other cases, the impact was smaller and more gradual, and the benefit has gone mainly to the center directly affected.

128. A second, much smaller, factor has been the tendency of a few centers, mainly newer ones, to find that their expenditures were growing less quickly than anticipated, so the funding requirements could be reduced during the year. It appears that this source of flexibility is virtually exhausted.

129. As a result of these changes, the amount now estimated to be needed to finance the program presently projected for all centers in 1983 is $158 million, somewhat below the present estimate of contributions. However, the funding situation of individual centers varies, and there are still uncertainties with respect to some contributions. The majority of centers are funded at or close to the bottom of the bracket, two are funded well into the bracket or above it and one will have to operate well below the bottom of the bracket this year even with the World Bank exercising its full role of residual donor. It should also be borne in mind that the bottom of the bracket represents a minimum program, not the desired program as recommended by TAC.

DISBURSEMENT PATTERNS

130. Late payments and late decisions on the allocation of pledges among centers continue to create problems in program management. As of mid-September, some $18 million remained to be disbursed, compared with $13 million at the same date last year.

131. The seriousness of the problem varies with the type of contribution involved. Unrestricted core contributions received later than expected cause cash flow problems, which can be handled to some extent through the cash facility established by the World Bank. Such problems do not generally cause long term difficulties provided that the funds expected are ultimately received. On the one hand late disbursements may sometimes result in increased exchange rate loss, as was the case in 1983; on the other hand, late disbursements may leave a center toward the end of the year with a larger cash balance than it can use in accordance with budget plans.

132. The greater difficulty, however, comes with restricted funds. For some donors the restriction merely implies earmarking a contribution for a certain part of the core program, which requires very little of a center beyond careful bookkeeping. A number of donors, however, are required by their own procedures to regard core grants to centers as multiyear project activities for planning and accounting purposes with strict budgets and time-limits. In such cases, late decisions or late disbursement can make it difficult for the center to use the money during the year originally planned. Under the present CGIAR budgeting system carry-overs of restricted funds are treated, like other carry-overs, as reductions in the next year's requirements and provide only a limited benefit to the center involved. Delays in implementation of restricted core projects can occur, of course, for reasons not connected with donor disbursement patterns. Such delays may cause unexpected increases in requirements for unrestricted funds, for example by requiring salaries of permanent staff to be met from unrestricted rather than restricted funds. This is a topic which requires study, and will be included in the overall study of the budget and accounting system (see Part III). In the meantime, it is hoped that donors will be able to exercise the maximum of flexibility to assist centers in making efficient use of available funds.

RESTRICTED CONTRIBUTIONS

133. It appears that the tendency to increase restricted contributions at the expense of unrestricted core has continued. As suggested above, the importance of the overall total may be of less consequence than the character of the restrictions involved. One type of restriction which appears to be growing considerably is linking a contribution to the participation in center activities of a host country institution or scientist. While linkages of this kind are often very fruitful, and in fact occur in center programs independently of any donor restrictions, too much of this kind of requirement by donors can raise serious issues of priority and efficiency, particularly for centers that are hard pressed for funding. This aspect of restriction should receive further attention from the centers, the donors and if necessary, TAC.

Table 3

Restricted and Unrestricted Contributions to Centers' Core Programs 1979/83
($ million)

	1979	1980	1981	1982	Estimate 1983
Restricted Contribution	15	22	33	38	45
Restricted Contribution related to transferred projects	NA	NA	NA	NA	13
Total Restricted Core	15	22	33	38	58
Unrestricted Contribution	85	98	98	106	115
Total Contribution	100	120	131	144	173
(percent)					
Restricted, excluding transferred projects	15	18	25	26	28
Restricted, including transferred projects	NA	NA	NA	NA	33

SPECIAL PROJECTS

134. The extreme form of restriction is, of course, the special project. The trend toward increase used of special project financing which was detected in last year's Integrative Report has been confirmed by more recent data. Special project financing in 1982 increased by 36% in current terms, and an estimated 30% in constant terms, representing 20% of total core expenditures. Before the transfer of special projects into restricted core in 1983, such projects increased by a further 30% in current terms, or an estimated 20% in constant terms. If the transfer had not taken place, they would have represented about 23% of

total core expenditures. The transfer reduced this ratio to about 16%. The actual figures for 1983 may vary when final reports for the year are made.

135. Special projects have one particular advantage over core financing, namely that the donor usually commits funding for the life of the project, so there is no competition with other activities following project approval. There are probably three broad categories of reasons why a particular activity may receive special project rather than core financing:

(a) it meets the criteria for special project treatment set forth in the Second Review of the system;

(b) the project could not be put through the system's budget process in timely fashion to meet the schedule of the center, the donor or both; or

(c) the type of donor funds being used are not available for core financing to the CGIAR.

136. The rapid growth of special project financing seems to be a response to the scarcity of core funds, and can be welcomed to the extent that it is consistent with center mandates and draws on sources of funding not normally available to the Group. But there is evidence that in 1982 and 1983, as mentioned above, substantial amounts of funds pledged for use as core were actually diverted to special projects. There is also a concern that since special projects are not normally reviewed by the TAC, some of them may not be consistent with center mandates and should not have been accepted. Even if all special projects are within center mandates, however, there is still the possibility of too many such projects drawing management and other resources away from core research activities and thus distorting the program to a significant extent. The importance of TAC including special projects in the ambit of external program reviews is therefore greater than ever, given the extraordinary growth of this form of financing.

137. The perception that a growing number of special projects met the criteria for core financing was one reason the Group decided last November to ask TAC to conduct a review to determine if substantial numbers of these projects could be transferred to restricted core. As mentioned above TAC recommended and the Group approved in May a transfer of 50 projects (out of a total of 126 examined by the TAC) with a value in 1983 of $12.5 million. In keeping with the pattern of project financing the anticipated contributions and expenditures associated with these projects in later years are:

1984	$9.8 million
1985	5.9 million
1986	3.9 million
1987	2.8 million

138. The exercise therefore confirmed the impression that special project funding was actually playing a relatively large role in replacing core funding during the years in which core funding had become particularly scarce. The TAC urged, and the Group agreed, that a wholesale transfer exercise not be undertaken again until there had been careful study of the implications of both special project and restricted core financing for the management of the centers' programs.

139. At the same time, the effort was judged to have been worthwhile, because it revealed the extent of the problem, because it means that core budgets will now give a more accurate picture of center programs that meet core criteria, and because donors that calculate their core contributions on a matching basis will have a more accurate picture of the size of core programs for use for this purpose.

140. Given the declining funding level of the projects transferred, it is unclear whether or not the transfer will lead to a permanent increase in the size of core programs.

141. The discussion of special projects at Paris revealed quite clearly the positive role that special projects have in permitting centers to experiment both with new program directions and with new sources of funding. There was no tendency in the discussion to reject special projects as an appropriate form of center activity, but some concern over the implications of their growing size relative to the core programs of the centers.

PART III -- FINANCIAL NEEDS FOR 1984

1984 BUDGET PROPOSALS

142. For 1984, the TAC again recommends to the Group a budget for centers in the form of a bracket. Net contributions to centers of $191 million are required at the top and $178 million at the bottom of the bracket. The details by center are given in Table 4. This recommendation is based on the assumption of a stabilization mechanism disposing of approximately $5 million as a minimum, so the net contribution requirements in total are $196 million and $183 million respectively. These represent increases of from 6 to 13% over the expected level of $173 million in 1983. The bottom of the bracket represents an increase of only $5 million or 3% in nominal core program levels over 1983. Without considering transferred special projects, the figure would be $8 million or 5%.

Table 4

Centers' 1984 Core Budget Proposals for Programs as Recommended by TAC
(1984 $'000)

	At Top of Bracket				At Bottom of Bracket			
Center	Operations	Capital	Gross	Net	Operations	Capital	Gross	Net
CIAT	23,823	982	24,805	24,588	22,819	460	23,279	23,062
CIMMYT	23,043	570	23,613	23,234	20,975	400	21,375	20,996
CIP	10,984	500	11,484	11,334	10,555	465	11,020	10,870
IBPGR	4,655	-	4,655	3,991	4,319	-	4,319	3,655
ICARDA	16,491	5,910	22,401	22,076	15,812	4,901	20,713	20,388
ICRISAT	20,503	3,162	23,665	23,376	19,276	3,071	22,347	22,058
IFPRI	4,145	300	4,445	4,425	4,145	50	4,195	4,175
IITA	22,467	1,081	23,548	23,283	20,867	554	21,421	21,156
ILCA	12,805	890	13,695	13,545	12,287	537	12,824	12,674
ILRAD	9,992	727	10,719	10,519	9,512	393	9,905	9,705
IRRI	23,041	1,132	24,173	23,573	22,456	634	23,090	22,490
ISNAR	3,770	16	3,786	3,736	3,570	16	3,586	3,536
WARDA	2,917	240	3,157	3,157	2,917	-	2,917	2,917
Total	178,636	15,510	194,146	190,837	169,510	11,481	180,991	177,682

143. All of the above figures include the budgets for special projects which the Group approved for transfer into restricted core at the May 1983 meeting in Paris. The current estimates for the transferred projects are $12.5 million in 1983 and $9.8 million in 1984. Table 5 indicates the expenditures related to transferred projects in 1984 by center. In fact, the center submissions and the TAC budget discussions for 1984 were based on the levels of program before the transfer was made. At the request of TAC, the secretariat and the centers will continue to track the evolution of the transferred projects and attempt to assess the impact of the transfer. From the point of view of total CGIAR finances, however, the relevant figure is the one including the transfers.

Table 5

Centers' 1984 Transferred Special Projects
as Recommended by TAC
(1984 $'000)

Center	Operations	Capital	Total
CIAT	1,791	266	2,057
CIMMYT	747	-	747
CIP	467	22	489
IBPGR	-	-	-
ICARDA	269	-	269
ICRISAT	2,416	1,886	4,302
IFPRI	330	-	330
IITA	614	-	614
ILCA	335	12	347
ILRAD	-	-	-
IRRI	669	1	670
ISNAR	-	-	-
WARDA	-	-	-
Total	7,638	2,187	9,825

144. The top and bottom levels were chosen to make it possible for donors to provide funding within the bracket, rather than below, and still to leave room for a reasonable start with a stabilization mechanism. Should the pledges made during Centers Week suggest that the bracket is unrealistic, it may be necessary to consider amending the budget recommendations or reducing funding for the stabilization mechanism.

145. The TAC recommendations were made after study of submissions from each center with a base approximating the level of operations implied by the bottom of the bracket approved by the Group for 1983, and including a price factor which varied substantially among centers, but averaged 10.3% for the system as a whole. Centers offered data supporting possible program increases of up to 10% and identified priorities for reductions, if necessary, amounting to 7%. (All figures in this paragraph exclude special projects transferred into core.) Aside from one particular case related to a concurrent external program review, the recommendations for individual centers at the bottom of the bracket range from 7% below the base up to the base level. The recommendations at the top of the bracket range from 2.5% below the base to 8.2% above. The width of the bracket also varies, from 10.8% to 4.4% of the center program. It is evident, therefore, that TAC exercised considerable discrimination, and found room to do so within the budget submissions.

146. The substance of programs included in the bracket, which are at risk depending on the level of contributions, is also quite varied. Details are found in the program and budget documents of the centers and in the secretariat commentaries, but some highlights are:

(a) Significant research staffing at a number of centers. In the case of CIMMYT, for example, substantial steps toward meeting the Group's recommendation based on the quinquennial review to expand scientific capacity at headquarters. In the case of ICRISAT, significant additional scientific staffing in West Africa. In other cases additional senior scientific research fellows and research support staff.

(b) Substantial amounts for needed replacements, and capital expenditure both to move construction along faster and to provide essential equipment, all of which can be deferred only at a cost in both money and program effectiveness.

(c) In two cases, working capital which is sorely required.

147. The bottom of the bracket, which is 4.5% below the presently estimated core operating expenditures of the centers in constant terms in 1984, is clearly not the desired program level. TAC's recommended program, the top of the bracket which is a 0.5% increase in constant terms over the estimated 1983 operative level, is itself severely constrained by the expected level of contributions. Note that both these figures are approximately two percentage points less favorable than they would be if calculated without including transferred special projects.

STABILIZATION MECHANISM

148. The difficulty of effective center management caused by a lack of certainty about fund availabilities persisting until quite late in the operating year, has been documented extensively, among other places in the paper on a stabilization mechanism submitted by the CGIAR Secretariat to the Group in May 1983. In order to be able to give each center at the beginning of the year a firm budget figure against which it could operate, we would need a very substantial reserve to smooth out the impact of changes in the international economic scene and donor behavior. In the absence of such a substantial reserve, we hope to be able to make a modest start in 1984 with a mechanism that can meet unexpected losses arising from devaluation of non-dollar currencies in which contributions are made, unexpected price increases in host countries, and other events outside the control of the system and donors. The sources so far identified for financing of the mechanism are the increased contribution of the World Bank, funds held over from the World Bank contribution in 1983 if not required for its function as donor of last resort, and windfall gains by centers during the year from similar events.

148. The amount ultimately available for financing the stabilization mechanism in 1984 will depend heavily on the actual total amount of contributions to the core programs of the centers. It is hoped that it will be large enough so that through combined use of the World Bank's contribution under the last resort concept, and the stabilization mechanism, it will be possible to assure centers of an adequate minimum operating level early in the year. A separate paper, prepared at the request of the Group, deals with the operations of the stabilization mechanism. (ref. ICW/83/28)

BUDGET AND ACCOUNTING STUDY

149. One of the recommendations of the Second CGIAR Review was that there should be a thorough study of the budget process used by the Group. Another was that the system of budget review adopted should be reconsidered after three years of experience.

150. Nothing specific has yet been done to mount the budget study, although both the Stabilization Mechanism and the Special Activities Account are to some extent responsive. The third year of experience with the system of budget review is 1983, so the time fixed for reconsideration is at hand. It seems clear that these two recommendations need to be looked at as dealing with two aspects of the same overall problem.

151. While doing a thorough and careful job of sorting out the budget issues and making recommendations to the Group for 1984, the TAC was restive about the amount of budget detail they had to cope with, the lack of a satisfactory basis for scientific comparison between center programs, and the degree to which process and administrative considerations dominate the budget discussion to the exclusion of issues of priorities and scientific judgement where TAC has a comparative advantage. Centers and both secretariats are also aware of the reiterative nature of the process, the amount of detailed staff preparation involved, and particularly the need to refashion much documentation following the TAC decisions.

152. The number of issues that a budget and account study might cover is too large to list them all here. Some of the more important are:

1. Ensuring that TAC can approach annual budget decisions in the light of scientific and program priorities and appraisal of program quality.

2. Providing donors with better insights into the needs of centers.

3. Means of allocating costs according to research objectives, to provide more comparability among centers.

4. The implications of special projects and restricted core financing.

5. Various contingency provisions, or possible liabilities, and alternatives for making provision for them at center or system levels.

6. Reducing the amount of redundant paperwork on the part of all involved.

7. Tracking the results of Group budget decisions.

8. Increasing the compatibility of accounting systems among the centers to promote equal treatment in the budget process.

9. Measuring and, if possible reducing, the impact of currency variations.

10. How to assess the impact of inflation on center costs.

11. The possible use of accrual accounting (as recommended in the CIP Management Review).

12. Handling capital expenditures, and provision for future replacement and maintenance costs.

13. Can the two-year budget process be made to work?

153. The secretariat is seeking a consultant to help design the study, which is complex. How much can be done in time to include changes in the 1985 budget round is unclear, but it will probably not be a great deal. Thus the principal target will be changes to be approved in 1985 and implemented in 1986. This would mean delaying reconsideration of the budget review system, but it seems sensible to conduct that review in terms of an improved version of the system rather than the one now in existence.

PART IV -- LONGER TERM FINANCIAL PLANNING

154. In the years since 1979, when the Group first adopted a five-year rolling indicative plan, there has been an annual process of downward adjustment of the targets, detailed in the Integrative Report for 1982, to reflect the steadily worsening realities of grant development assistance. In practice, the Group has done quite well over this difficult period, maintaining a pace of increase in nominal contributions of 10% or above (permitting a small rate of growth in real terms), and balancing a number of negative influences such as depreciation of currencies in which donations are made against favorable ones such as the easing of price rises in developing countries when expressed in dollars. The number of new donors has dropped off to a trickle, and there are very few if any potential large donors not already in the circle. With one or two exceptions there is little room for a major relative improvement in the performance of individual donors.

155. Increasingly, donors have reported a variant of the same problem: the CGIAR contribution is a rising element within a budget item which is not rising or in some cases, particularly among international organizations, is going down. As the annual 10% increases are compounded, the CGIAR item becomes a larger and larger share of the budget in which it fits, and thus more of a target for supporters of other programs. Moreover, some major multilateral donors face overall funding difficulties that may call into question the level of their contributions in the future. Great dedication and ingenuity have been exercised by individual donors to meet the critical needs of the system under these difficult conditions. Some donors have provided more than the normal increase when they could, to make up for problems faced by others.

156. The need for expanded resources to be invested in well conceived, problem oriented research on food production in developing countries is clear enough. Within the Group, successive evaluations of individual center programs have identified additional requirements, while validating the basic work of the center. Studies of the requirements of national research systems rarely, if ever, call for a transfer of resources from the international to the national level. Much more often they call for additional output from international centers to support the growing national programs. The existence of unresolved problems to which research of the CGIAR is particularly relevant is undoubted. Moreover, investigations of the return to investment in research continue to demonstrate that good research produces very positive results.

157. Faced with increasing signals that the present course may be difficult to sustain, the Group has been moving toward longer term solutions. The work of the TAC on strategic considerations is intended to lay out more confidently the priorities for use of resources in the medium and longer term. The impact study will collect objective data on what has resulted from the effort made to date, and suggestions about the areas where pay-offs are most likely to be realized in the future. But it will be at least one and more probably two years before these efforts bear fruit. What does one do in the meantime about longer term planning?

158. In recent years, the movement of exchange rates and the pace of inflation have been on such a scale that they have obscured the relatively small increments of program growth that have been characteristic of the CGIAR long term plan. We have been in a situation where contributions have been limited by the overall availability of development assistance funds, and the outcome in program terms has been strongly influenced by major economic trends over which the Group has no control.

159. Pending the completion of the TAC strategic exercise, which will lay the basis for a new demand-based approach to program planning, and recognizing the uncertainty that exists about economic trends, it

seems best at this time to move temporarily to a supply-driven rather than a demand-driven plan. Table 6 presents such a plan forecast, which is limited to three years, in recognition of its interim nature. The figures for 1984 represent the program bracket recommended to the Group by TAC including funds set aside for the stabilization mechanism. Both ends of the bracket are then projected forward to 1985 and 1986 on the basis of a 10% annual growth in contributions expressed in current dollars. The result for each year is a range of figures, with a good possibility that the actual result will be somewhere in between, if recent experience is a guide.

Table 6

Interim Three-Year Plan

current $ in millions (% gain from previous year)

1981 Actual	1982 Actual	1983 Est. before Transfer	1983 Est. after Transfer	1984 Recommended Bracket	1985 Projected Bracket	1986 Projected Bracket
				183 (6%)	201 (10%)	221 (10%)
131 (10%)	144 (10%)	160 (11%)	173	196 (14%)	216 (10%)	237 (10%)

160. The program implications of the projections, which might be characterized more correctly as resource management rather than a program plan, will of course depend on what happens to inflation and exchange rates. If the price factor presently built in to our 1984 budget turns out to be close to accurate for the three years involved (an unlikely event) the lower set of figures would represent continuation for three years of the 5% program reduction from 1983 which is built into the bottom of the bracket in 1984. The top set of figures would represent a program growth of 2% in 1985 and 1986 which is substantially below the levels projected for those years by the centers. Improvements in this rather bleak outlook could occur if capital requirements can be reduced from their present level, if the stabilization mechanism builds up sufficient reserves so that the annual increments can be reduced, or if price inflation in practice is lower than 10%.

161. The projection of likely resource availabilities is not a satisfactory means of planning in the long run. It appears, however, to be the best choice available for the present. It is, of course, consistent with the way we actually construct our budgets for the year ahead, namely to estimate the range of resources likely to be available, and to budget within that range, trying to ensure that the priority choices made in the budget process are focused around the actual margin where decisions will have to be made.

162. This approach will only work for 1985 and 1986, if the targets are accepted by donors as ones they can reasonably hope to achieve. It is to be hoped that they can be so accepted, as they seem close to the very minimum levels required to maintain the momentum and the quality which are at the heart of the values the CGIAR brings to the cause of development.

ANNEX 1

International Research Centers

and Programs Supported by the CGIAR

September 15, 1983

CIAT	-	Centro Internacional de Agricultura Tropical Cali, Colombia
CIMMYT	-	Centro Internacional de Mejoramiento de Maiz y Trigo El Batan, Mexico
CIP	-	Centro Internacional de la Papa Lima, Peru
IBPGR	-	International Board for Plant Genetic Resources Rome, Italy
ICARDA	-	International Center for Agricultural Research in the Dry Areas Aleppo, Syria
ICRISAT	-	International Crops Research Institute for the Semi-Arid Tropics Hyderabad, India
IFPRI	-	International Food Policy Research Institute Washington, D. C. U.S.A.
ILCA	-	International Livestock Center for Africa Addis Ababa, Ethiopia
ILRAD	-	International Laboratory for Research on Animal Diseases Nairobi, Kenya
IITA	-	International Institute of Tropical Agriculture Ibadan, Nigeria
IRRI	-	International Rice Research Institute Los Banos, Philippines
ISNAR	-	International Service for National Agricultural Research The Hague, Netherlands
WARDA	-	West Africa Rice Development Association Monrovia, Liberia

ANNEX 2

Membership of the Consultative Group on International Agricultural Research

September 15, 1983

A. Continuing Members

Countries

Australia	Germany	Netherlands	Sweden
Belgium	India	Nigeria	Switzerland
Brazil	Ireland	Norway	United Kingdom
Canada	Italy	Philippines	United States
Denmark	Japan	Saudi Arabia	
France	Mexico	Spain	

International Organizations

African Development Bank
Arab Fund for Social and Economic Development
Asian Development Bank
Commission of the European Communities
Food and Agriculture Organization
Inter-American Development Bank
International Bank for Reconstruction and Development
International Fund for Agricultural Development
OPEC Fund
United Nations Development Programme
United Nations Environment Programme

Foundations

Ford Foundation
International Development Research Centre
Kellogg Foundation
Leverhulme Trust
Rockefeller Foundation

B. *Fixed-Term Members Representing Developing Countries, 1983-84

Asia:	Indonesia Pakistan	Southern and Eastern Europe:	Greece Romania
Africa:	Tanzania Senegal	Near East:	Libya Iraq
Latin America:	Cuba Colombia		

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* The countries of the five major developing regions of the world participate in the Consultative Group through representatives elected for a two-year term by the FAO members in each region. Two countries are elected from each region, one serving as member and the other as alternate, as they may decide, in the Group's deliberations.

ANNEX 3

CGIAR CONTRIBUTIONS TO CENTERS' CORE PROGRAMS
($ millions)

	Actual											Est[1]/	Est[2]/
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1983
AfDB							.025	.030	.040	.045	.046	.050	.050
Arab Fund						.310	.310		.255	.239	.239	.230	.230
AsDB				.300		.500		.700					
Australia		.005	1.015	1.215	1.745	1.790	2.580	2.650	2.955	3.298	3.773	4.060	4.204
Belgium	.140	.600	.380	.620	1.740	2.250	2.720	3.085	3.265	2.373	1.823	2.040	2.088
Brazil												.750	.750
Canada	1.160	1.780	4.675	4.340	5.390	6.800	7.370	7.544	6.875	7.550	8.287	9.910	9.910
Denmark	.250	.225	.370	.400	.455	.615	.760	1.045	1.210	1.051	.945	.930	.930
EEC						2.500	2.240	3.790	4.545	4.296	4.721	5.440	5.440
Ford Fndn.	5.315	3.675	3.000	2.800	2.000	1.590	1.000	1.000	1.300	1.300	1.000	1.000	1.157
France			.130	.410	.510	.415	.340	.675	.855	.844	.891	1.000	1.000
Germany		1.805	3.040	3.935	4.475	5.350	6.760	8.475	10.100	8.368	7.919	8.110	8.309
IDB			2.030	4.120	5.000	5.700	6.185	6.200	6.700	7.400	8.100	8.700	8.700
IDRC	.175	.345	.645	.990	1.780	1.305	1.045	.818	1.530	.961	1.059	.780	2.157
IFAD								1.550	3.570	5.927	5.937	7.710	8.687
IFDC													.190
India										.500	.488	.500	.500
Iran					1.975	2.000	1.000						
Ireland									.200	.180	.212	.260	.260
Italy					.100	.030	.100	.100	.700	.965	1.577	4.780	6.516
Japan	.105	.230	.265	.675	1.200	2.500	3.500	4.845	7.000	8.400	8.850	10.000	10.200
Kellogg Fndn.	.155	.290	.280	.290	.300	.310	.320						.625
Leverhulme									.490	.585	.654	.752	.752
Mexico									.495	.948		1.000	1.000
Netherlands	.375	.430	.555	1.235	1.500	1.720	1.785	2.430	2.600	2.997	3.212	3.390	3.676
New Zealand					.105	.025	.025	.025	.025	.021	0.018		
Nigeria				.645	.645	.620	.790	.825	1.976	1.142	1.205	0.970	0.970
Norway	.075	.185	.445	.810	1.120	1.510	1.880	1.975	1.995	1.902	1.874	1.850	1.910
OPEC Fund									.900	1.000	3.548	3.200	3.200
Philippines									.150	.500	.500	.600	.600
Rockefeller Fndn.	3.990	4.545	3.500	2.885	2.165	1.595	1.250	1.220	1.600	1.000	.800	.500	.522
Saudi Arabia					1.000	1.000						1.500	1.500
Spain										.500	.500	.500	.500
Sweden	1.000	.150	1.490	2.290	2.255	2.240	2.725	3.115	3.390	3.315	3.173	3.050	3.050
Switzerland		.410	.140	.460	.855	1.205	1.350	1.850	2.450	2.605	2.752	3.090	5.680
U.K.	.690	1.110	1.920	2.410	2.890	3.515	4.765	6.395	6.790	6.031	6.342	5.800	5.800
UNDP	.850	1.000	1.465	2.165	1.930	3.500	4.400	3.995	4.615	5.065	6.088	5.160	8.273
UNEP				.600	.340	.340		.150			.183	.130	.130
U.S.	3.770	5.390	6.805	10.755	14.870	18.140	21.145	24.800	29.000	35.000	40.785	43.750	44.550
World Bank	1.260	2.780	2.375	3.195	6.525	7.850	8.675	10.200	12.000	14.600	16.300	19.000	19.000
Others													
Kresge	.750												
TOTAL	20.060	24.955	34.525	47.545	62.870	77.225	85.045	99.487	119.576	130.904	143.800	160.492	173.016

Note: 1/ As of September 1983.
2 As of September 1983 and inclusive of transferred special projects.

Source: Centers' Program and Budget Papers and accounts, 1974-1982.

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ANNEX 5

ACRONYMS

ACSN	Asian Cropping Systems Network
AICRIP	All-India Coordinated Rice Program
AMN	Agricultural Machinery Network
ARNAB	African Research Network on Agricultural Byproducts
CEAREP	CIMMYT Eastern African Regional Economics Program
CRRI	Central Rice Research Institute
FAO	Food and Agricultural Organization
IBYAN	International Bean Yield and Adaptation Nursery
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
INSFFER	International Network on Soil Fertility and Fertilizer Evaluation on Rice
INTSOY	International Soybean Program
IRAEN	International Rice Agro-Economics Network
IRTP	International Rice Testing Program
MARDI	Malaysian Agricultural Research and Development Institute
PRACIPA	Proyecto Andino Cooperativo de Investigacion en Papa
PRAPAC	Programme Regional Pour Amelioration de la Pomme de Terre en Afrique Central
PRECODEPA	Program Regional Cooperativo de Papa
PROCIPA	Programa Cooperativo de Investigaciones en Papa
SAPPRAD	South Asia Program for Potato Research and Development
UNDP	United Nations Development Program
WAFSRN	West African Farming systems Research Network