

**STRENGTHENING AGRICULTURAL RESEARCH AND TECHNOLOGY DELIVERY  
SYSTEMS IN SUB-SAHARAN AFRICA**

**A SPECIAL REPORT**

To

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## EXECUTIVE SUMMARY

This special report develops a rationale and program strategy to facilitate the adaptation and flow of improved agricultural technologies to farmers through completion of the African Regional Research and Development (R&D) System. A regional project designed to build and strengthen National Agricultural Research Systems (NARS) adaptive research and linkages with their delivery systems is suggested to implement the strategy over a 10 year period. It is motivated by a recent review at the International Institute of Tropical Agriculture (IITA) of programs and initiatives implementing their long-term strategies for the 1990s; and the postulation that these programs, based upon a study of IITA and NARS during 1990, will not impact upon African smallholders unless definitive steps are taken to ensure that the NARS are effectively adapting and linking technologies with their delivery systems.

A functional system for Third World research and development is presented to identify and clarify institutional roles linking research with traditional farming systems. Distinctions are drawn between different stages of research in the generation of appropriate technologies, and the importance of systems integration, economic feasibility, and research - extension linkages is stressed. Donor boundaries are identified relative to institutional roles and support within the system.

A 1990 report of IITA technologies transfer and flow in NARS, done by the writer serving as USAID/Africa Agricultural Research Liaison, concludes that IITA outreach is primarily a lateral transfer of technologies to NARS researchers. It identifies a lack of both adaptive research and delivery linkages within NARS as strategically impeding the flow of these technologies to the farmer and their subsequent impacts.

That report further shows IITA technology transfer and outreach has evolved mostly as a secondary function of its research programs. A review of IITAs outreach program development (part III) indicates the Institute has not developed a professional outreach capability to catalyze and assist NARS in strengthening their adaptive research and extension linkages, which are essential components of the R&D system. IITA's program and organizational structure are consistent with the long established CG support boundaries and can not be expected to change significantly.

Within this structure, a battery of new programs and initiatives implementing IITAs' 1990s strategies do identify a sensitivity to NARS constraints, but will not address the missing components in NARS technology flow. The Institutes' structural modification of research programming, core program reorganization, and special projects are discussed with respect to their outreach potentials.

These provide targets of opportunity and are identified for more effective linkage, through supplemental projects, with NARS development and outreach. Without such supplemental efforts, however, the products of IITA research will not flow productively to African farmers.

A strategy plan, which would build upon Institute programs and utilize its infrastructures, is proposed to build NARS strategic on-farm adaptive research (OFAR) and extension linkage capabilities to complete the African R&D system. The immediate objective is to develop responsive farmer linkages with regional technologies through OFAR and farmer demonstrations. A regional plan addressing generic development issues and providing professional leadership to NARS is favored to implement this strategy.

The basic strategy suggested is to develop a professional adaptive research and development capability attached to IITA as a special and temporary unit. Its role would be to define and assist NARS in developing effective OFAR and research - extension linkage structures, and provide a professional catalyst to adapt technologies and link these with delivery systems through pilot demonstration and information programs. Specific program functions and provisions, such as a collaborative outreach network among NARS with IARCs and farmer seed production promotions, are listed as mechanisms to achieve the R&D goal.

A regional "Adaptive Research And Extension Linkage" project attached to IITA as a special unit, is suggested to implement this strategy plan with the NARS. It would provide professional research and educational leadership to NARS for developing technology transfer and delivery capabilities and operations. A core of 3 to 5 professionals working with minimal discretionary support for NARS operations over a 10 year period is envisioned to make significant progress completing a functional R&D system in the region. Implementation by an American entity, in comparison with IITA, would ensure controls and encourage greater USAID Missions cooperation and support toward success.

## INTRODUCTION

Agricultural development is being exceeded by population growth in most African countries decreasing per capita food production in recent decades. Beginning with the International Institute of Tropical Agriculture (IITA) established in 1967, international research has expanded to provide modern technologies in support of African agriculture. Critical concerns are being expressed by both Donors and Africans over the apparent failure of these efforts to generate greater impact toward resolving sub-Saharan Africa's food deficiencies. Indeed, the International Agricultural Research Centers have expended few resources to document utilization and impact of their many contributions to the region in justification of their investments.

During 1990, while serving as USAID/Africa Agricultural Research Liaison, I reported that regional technologies generated by IITA were being transferred to National Agriculture Research Systems (NARS), but were not flowing through the national systems to the benefit of their farmers. Notable gaps within NARS, and between IITA and NARS, were identified in that study report as strategic to success of the regional Research and Development (R&D) system.

This report is motivated by my recent IITA visit and review of programs and initiatives implementing the Institute's new strategies setting its operational mode for this decade. These programs, however, will not adequately address strategic gaps identified in the system, and special initiatives will be necessary for agricultural research to impact upon African food production deficiencies. The purpose of this report then is to identify IITA activities which provide targets of opportunity for special and supplemental programs, and suggest a program design which would build and strengthen missing NARS links in the African Regional Research and Development system for realization of impact.

The global R&D system model is presented and interpreted to identify roles, responsibilities and limitations in African agricultural research and technology delivery. The evolution of IITA outreach and success in technology transfer is reviewed as a basis for interpreting the potential of new directions and programs to address constraints in the system. IITA initiatives are identified with respect to their outreach potentials and as targets for linkage with special supplemental support projects. Utilizing IITA infrastructures and building upon these program targets of opportunity, a regional strategy plan is outlined to close the R&D structural gaps in NARS and effectively link farmers with technologies appropriate for improving their production systems. An extended regional project is suggested in part VI to implement this strategy plan.

There are six sections identified in the report which may be selectively reviewed according to the readers' immediate interests.

## **I. THE MODEL FOR INTERNATIONAL AGRICULTURAL RESEARCH**

The International Agricultural Research Centers (IARCs) role in Third World agricultural development is modeled on the successes of CIMMYT and IRRI leading to the Asian Green Revolution. Evolution of the Consultative Group (CG) which supports the system is traced in this section with particular emphasis given to boundaries established for IARC interactions with National Agricultural Research Systems (NARS). Limitations of this global (Asian) model for Africa, where the premise that NARS are capable to adapt and diffuse technologies is not valid, are identified as targets of opportunity for supplemental support to catalyze NARS research and development impacts. A schematic representation of the CG global R&D system is presented to conceptualize the IARC and NARS roles and particularly interactions between them for achieving agricultural research impacts.

### **Historical And Evolutionary Perspective**

The Green Revolution in wheat and rice production in Asia established the importance of international agricultural research to regional food security. This success evolved from two bold experiments to intervene and reverse food production trends through application of modern science to agriculture (4). First through the Rockefeller Foundation pioneer Mexican Agricultural Program initiated in 1943, followed by the International Rice Research Institute established in The Philippines in 1962. These successes in Asia were indeed achieved through strong collaboration with NARS to adapt and diffuse productive innovations. Many Asian countries were also receiving agricultural development assistance at that time. Following this Asian model, additional Centers were established world wide beginning with IITA in Nigeria in 1967.

Between 1969 and 1971, when financial support to sustain the first Research Centers was rapidly exceeding the capacities of the Ford and Rockefeller Foundations, a consortium of multinational agency and country donors was organized as the Consultative Group for International Agriculture Research (CGIAR or CG in short) (1). This informal consultation among donors with a Secretariat provided by the World Bank continues to sustain core financial support to the 16 Centers system within a framework of international political consensus.

A Technical Advisory Committee (TAC), with its Secretariat in the FAO, provides technical and managerial guidance for the system interacting with the CG in the formulation and implementation of its broad policy framework. The TAC effectively defines the broad role and relationships between international, regional and national research entities within the political and financial support determined by consensus of the Consultative Group.

### Schematic Model For Regional Research

The regional role of the IARCs and their relationships with NARS responsible for local agricultural development are illustrated in the simplified linkage diagram in Figure 1 (page 20). Research and Development functions are identified on the ordinate and charted against institutions arranged on the abscissa to connect in a linear model. Overlap of functions and institutions is shown to illustrate mutual activities and communications linking institutions and establishing the flow of research and technologies from generation through adoption. These interactions, illustrated by the small squares representing mutual and transfer activities, are critical to continuity of the system necessary to link research with outreach for development. (Sub-system feedback to NARS and the IARCs is not illustrated.)

This diagram illustrates the specific roles which participating institutions must fulfill, because of their global, regional or local mandates, for African agricultural research to effectively impact on economic development. The NARS are not limited to the scope of research identified here, just as agricultural research in industrialized countries incorporates a wide spectrum of activities with a responsibility for integration with development entities. However, NARS first priorities must be those functions within the system, which only they can provide, to ensure technologies are adapted and acceptable to farmers. This model was valid for the Asian Green Revolution where relatively strong and well disciplined NARS carried out effective adaptive research providing reliable technology to an increasingly demand oriented agricultural sector.

### The Global Model And African NARS

In the newly emerging nations in sub-Saharan Africa, however, the lack of breadth and depth in agricultural research and outreach has been well documented and repeatedly emphasized. Consequently "strengthening NARS" is a popular goal among African IARCs. But in reality progress has and will continue to be slow due to limited CG core resources for NARS related activities, and limited national infrastructures to assist with human resource development.

The CG model has been criticized as being too global in design and hence non-responsive to Africa's embryonic agricultural infrastructures. Uniform guidelines for Center research programs and their activities with NARS are established and monitored through the TAC. These are based upon CG consensus which both reflects and protects donor political and economic prerogatives in supporting multi-national programs. The wide global range in NARS evolution is clearly an area for concern in developing regional agricultural research systems to be responsive to their developmental priorities.

This report recognizes these CG guidelines as "research boundaries," rather than constraints, within the CG global system. It identifies opportunities relating to these boundaries for regional strengthening measures which donors may support as special supplementary projects to achieve regional and national development benefits emanating from IARC research. Targets of opportunity are identified specifically where supplemental projects linked with IITA programs would strengthen NARS adaptive research and outreach linkages.

## II. STRATEGIC LINKS MISSING FROM THE R&D SYSTEM

This section draws upon my experiences as USAID/Africa Agricultural Research Liaison based at IITA during 1988-1990, and particularly upon my concluding report for which the flow of technologies from IITA was traced through NARS in some detail. Strategic gaps in the NARS are identified as impeding the Research and Development progression. IITA programs and outreach are discussed with respect to these strategic links and the failure of research to impact on national food production.

### Identification Of Gaps In The System

With an in-depth working knowledge of IITA research and programs with NARS, I visited NARS in West, Central and East Africa during September through November 1990 tracing IITA research products, methodologies and information transfer through the R&D system. My report (2) summarizing that study concludes that these technologies are flowing to NARS, driven mostly by IITA research and supply-pushed mechanisms. There was very little evidence, however, of these technologies flowing through the NARS, as would be anticipated from the model and its assumption, to benefit farmers.

The often quoted limitations of human and operational resources (3) were indeed expressed as generic constraints to this flow of technologies. Several operational gaps linked with these constraints were repeatedly observed; notably 1) a lack of On-Farm Adaptive Research (OFAR) flowing from research stations, 2) an absence of effective seed production supporting varietal releases, and 3) a lack of production potential impact assessments supporting adoption of new technologies. These are critical elements in the NARS research and delivery linkage chain which impede the progress of agricultural research toward impact when absent. (See NARS in Figure 2, page 21). Additionally, the capacity of IITA regional research to generate appropriate technologies is seriously handicapped since it is dependent on NARS OFAR for location specific farmer response and feedback.

## Impact Of IITA Technology Transfer And Outreach

In my 1990 study I found IITA technology flow to the NARS is primarily a horizontal transfer to counterpart station researchers. (See Figure 2, Technology Transfer arrow, page 21). This transfer is consistent with the IITA goal to develop NARS capacities to screen and generate their own technologies. It also demonstrates considerable success of the Institute's research driven outreach efforts to transfer technology to NARS consistent with the CGIAR global model and support.

These IITA programs, however, have neither adequately addressed regional research linkage problems, nor strengthened NARS in either OFAR or research linkages with extension to complete the R&D process. OFAR is clearly in the sphere of NARS; but in the absence of effective programs it should become a program priority of the next unit in the progression, the regional research center and its programs, to strengthen this capacity within NARS. Developing effective Research - Extension linkages should likewise be catalyzed and driven by regional research efforts, when necessary, to carry technologies to impact in justification of the research investment.

In the evolution of its outreach program, IITA has not developed a professional capacity to assist and strengthen NARS to address these deficiencies. The primary reason for this is the CGs focus on regional research to provide technologies and products for NARS adaptation, and its limitations on activities concerned with individual NARS responsibilities. The rationale for these constraints has been reviewed earlier and is not an issue for debate here. IITA program development initiatives are given in part IV with their potential to impact upon these missing components. Within established CG program boundaries, these are considered "targets of opportunity" where supplemental bilateral assistance could effectively mesh IITA regional program efforts with NARS adaptive research and delivery linkages.

### III. EVOLUTION OF THE IITA OUTREACH PROGRAM

This section reviews briefly the development of current IITA activities and interactions with NARS. These program activities identify IITAs relationship with NARS research and technology delivery, and provides a background for new programs (part IV) to strengthen these relationships. IITA has evolved lateral transfer of technologies to NARS scientists within the CG regional boundaries. Outreach has evolved as a secondary function of its research programs, but lacking critical linkages with adaptive research and technology diffusion regionally. Although IITA has implemented major bilateral applied research and extension programs with NARS, it has not developed a professional outreach capability

to regionally catalyze NARS adaptive research and linkages with extension delivery.

### International Cooperation Management

International Cooperation Programs (ICP) provides administrative management for IITAs' international relationships. It is the official communications link with countries which IITA serves, organizing NARS leadership meetings on a regular basis, special regional and subject conferences, and country consultations. ICP has management oversight for special projects with African NARS. The Training Program is a unit of ICP. The new Research Liaison Scientist program is an administrative unit of ICP with technical direction coming from the research programs to which these scientists are attached.

### Training For Strengthening NARS And Technology Transfer

Training was initiated early in IITAs organization and has evolved as the major program for developing NARS human resource potentials strengthening their research capacities. The training unit provides the program structure and management for scientists to communicate technologies and supporting information to NARS scientists and technicians. Group short courses are offered to convey research and technical information. Individual training in special techniques, such as maize streak resistance breeding, is provided through appropriate research programs. Advanced training and research experience is provided by research programs through Visiting Scientists awards to NARS professionals and Dissertation Scholarships for African University scholars. These individual training programs contribute to the IITA research agenda and simultaneously strengthen NARS and provide a technology transfer conduit.

Since its inception, IITA has trained over 6,000 individuals in all categories, and provided many of these with planting materials and other forms of technologies for their programs. Much of this training is in research methodology, but a significant number of courses have addressed crop production methods, seed and planting materials multiplication, and other topics supporting technology transfer. Very little assessment has been done to evaluate NARS utilization and impacts derived from these training efforts.

### The Nigerian Experience

IITA was established encouraging close cooperation with Nigerian Institutes for Agricultural (Food Crops) Research and National Universities, particularly the University of Ibadan. Nigeria benefitted early from IITA research as a result of both this collaborative effort and site-specificity of technologies gener-

ated. IITA research initially addressed regional problems as understood locally. Much transfer and dissemination of this technology to Nigerian farmers took place directly, and continues to some extent today due to demand pressures and weak national infrastructures for seed materials and extension services. During the mid-1980s Nigeria contracted with IITA for hybrid maize development research and seed production.

### Country Projects And Strengthening NARS

Beginning in the late 1970s with the SAFGRAD/USAID project in Burkina Faso, IITA implemented several bilateral contracts (including USAID/-Zaire and Cameroon) for agricultural research and extension. Some required large commitments of manpower, including 50% or more effort on technology adoption, for which the Institute recruited external staff. Although IITA core staff participated in annual reviews and planning and provided technical backstopping to these projects, the research generally was not incorporated into the regional programs. This was particularly true for extension components which have no IITA disciplinary program home and suffered further from a lack of professional extension backstopping. Some small research oriented special projects which relied more fully on Ibadan core administration and management appear to have been more successful in transferring and integrating IITA technologies and strengthening national programs research. As generally intended, these efforts did serve to initiate national programs research.

### Outreach - A Function Of Applied Research

IITAs regional outreach has evolved as a function of its research programs through collaborative NARS projects, international varietal trials, research networking and training. Emanating from IITAs research objectives, these activities generally reflect its scientists' incentives and motivations toward disciplinary and science driven technology achievements. Consequently technologies, and frequently training, have been "Center supply pushed" producing technologies having little ownership by NARS and often considered less than appropriate to NARS needs.

Conceptually, NARS strong in adaptive research and extension linkages would exert a demand pull upon IITA research collaboration, and lead toward development driven technologies appropriate to farmers needs regionally and locally in which NARS would have invested productive ownership. Recognizing these opposing research orientations - science vs. development - is important to understanding both the success of technologies generated by the system and also how the international research system can be most effective in driving agricultural development.

Throughout its history, IITA has evolved neither a professional unit nor staff disciplinary capability to assist and support NARS toward strengthening their adaptive research and linkage with delivery systems for technology adoption. Failure of the Global Research and Development System model to adequately address technology generation in this broad developmental context at the African regional and national levels is discussed in the next part.

#### **IV. IITA INITIATIVES AND OUTREACH POTENTIAL**

IITA is modifying its research programs and introducing several initiatives to implement its long range strategies to the year 2,000. These initiatives, within the CG research boundaries, clearly establish opportunities for effectively linking regional research with NARS development priorities. In its reorganization the traditional programs of training, information publication, varietal trials and research networking are reaffirmed as core outreach functions. Although these have been effective for transferring technologies to NARS, they do not address the missing elements in NARS technology flow. New core and special program initiatives do demonstrate a sensitivity and effort to address agricultural constraints more effectively at the local level, and within the highly integrated traditional farming systems. As in the past, however, these programs identify first with research efficiencies and then repeat the pattern that outreach is a secondary function of research. These strategy and program initiatives are discussed relative to their effective NARS outreach potential.

#### **Structural And Organizational Modifications Of Research**

IITA is restructuring its research organization to implement a strategy focus toward African smallholders and further strengthen NARS capabilities. This reorganization is designed to emphasize a farming system orientation within well defined agro-ecological zones. These initiatives and their outreach potential are presented relative to the importance of adaptive research in the process.

#### **Strategy Plan Focus**

With emergence of its Strategic and Medium Term Plans, IITA research will focus primarily upon the needs of African smallholders. Traditional food production practices are varied and complex, utilizing biological interactions providing a low input system in which changes to any one component may not be beneficial overall. IITA is reaffirming a "farming systems" approach to its

research agenda to ensure generation of technologies which are more appropriate for the majority of farmers in the region.

In recognition of major commodity and management differences between traditional systems of diverse ecologies, IITA is stratifying its applied research and establishing sub-centers to address major agro-ecological specificities. Achievement of these objectives should significantly enhance the transfer potential of resulting technologies. Program modifications implementing these strategies are important, therefore, not only as the framework for achieving these direct objectives, but also for their potential interactions to achieve effective outreach impacting on the small shareholder.

As a continuing thrust in its long-term Strategy Plan, IITA has committed to further strengthening NARS capabilities to screen and generate technologies for their own use. This thrust includes emphasis on Training, Research Networking, deployment of Research Liaison Scientists (RLS) and small Resident Scientist Teams. Among these programs only training receives continuing core support. The RLS scheme was approved as a core activity, but only recently implemented with special project support due to a lack of planned core resources. The Resident Scientist Teams were approved as special projects to be implemented with supplemental support. Consequently any outreach program modifications and or increases in activity appear dependent upon supplemental project support.

### Research Programs Reorganization

Restructuring of research management is shifting focus away from the traditional crop improvement model, which has been the technological basis for much of IITA and the IARC systems success, and increasing focus on systems improvement research. The Crop Improvement Programs (Maize, Grain, Legumes, Roots, Tubers and Plantains) have been combined into one Commodity Improvement Division composed of plant breeders and geneticists. A Plant Health Division combines plant pathologists, entomologists, virologists and weed scientists into Crop Protection and Biological Control units. Resource and Crop Management is strengthened through Division status with the two areas as component program units. Inter-program research thrusts, such as Striga, will be identified through the "systems working groups" and draw scientists from across divisions. Research program development and implementation is the responsibility of these Divisional Directors and the Director General, as Chair, constituting the Research Directors' Committee.

### Agro-Ecological Systems and Working Groups

The agro-ecological systems working groups (within Crop Management) are strengthened through this reorganization as the integrating

units combining technologies into sustainable systems. Commodity and disciplinary research will continue to provide the component building blocks for systems improvement. To achieve this systems goal the objectives for component research must first be set with respect to the total system and then pursued to optimize their interactions within the system. Whether this reorganization of multi-disciplinary scientists can work effectively to resolve interdisciplinary research problems will depend upon IITAs' management strategies, and specifically staff incentives and motivation which foster problem solutions in competition with disciplinary research.

Success in developing appropriate systems for the farmer will depend to a large extent upon interactions with NARS for adaptive research, and how these technologies will be integrated into national systems. For adapting improved systems, NARS can be expected to share an even greater responsibility for applying the technologies within a diverse array of local practices. On-farm system evaluations and demonstrations are more complex and require greater skills than single component trials. These system research requirements pose an additional urgency upon development of NARS OFAR capabilities.

#### **Core Program Initiatives Related To Technology Transfer**

Several core initiatives implementing the Institutes Strategy Plan are expected to enhance the local adaptability of IITA research and continue strengthening NARS research capabilities. These initiatives, within the CG research boundaries, do relate to technology transfer, but do not address the strategic NARS limitations constraining adaptive research and adoption linkages. These strategy and program initiatives are described briefly.

#### **Decentralization of Research**

Decentralization of agro-ecological research is being implemented as a major strategy to develop resource and applied research which will be appropriate for the major systems, and hence more readily adaptable to country location-specific requirements. This decentralization involves collaboration with additional NARS and will bring the research into closer proximity with NARS in the region for identification of problems and collaborative research.

A *humid forest center* in collaboration with the Cameroon IRA became operational at M'balmayo in 1991 and has potential to become the primary African station for addressing resource and applied systems research in this zone since closing of the Belgian Yangambi station in the Congo Basin. A *dry savanna center* at Kano in collaboration with Nigeria's IAR was implemented in 1990 for regional cowpea research in the cereals cropping system. A *moist savanna center* has been identified in Cote d'Ivoire and is being developed in

collaboration with the Ministry for regional maize research. These sub-centers increase IITAs collaborative activities bringing the research into closer regional relevance. These initiatives alone, however, do not establish critical linkages necessary to promote technology adaptation and dissemination.

### Research Liaison Scientists

Research Liaison Scientists are being deployed to three regional locations in West and Central Africa. They will assist their assigned NARS with research management and, through a better knowledge of country programs, link IITA and other technologies with country needs. They will also have responsibility for managing IITA cooperative activities with national programs. The primary RLS goal is to establish better informed IITA partnerships with NARS which will be more responsive to strategic national priorities.

Implemented with one scientist in 1989, the full program was delayed until 1991-1992 when special project funds became available. Given continuity of core support, this program would have potential to strengthen IITA outreach linkages fostering NARS adaptive research and the dissemination of technologies.

### Collaborative Systems Research Network

A Collaborative Network for Systems Research has been established through the Savanna Crop Management Systems Working Group. Their initial focus is on legumes as a replacement for fallow in the maize cereal based systems under intensive land use situations. This collaboration is designed to generate a systems model applicable over the regions wide range of climatic, edaphic, biologic, resource and market variables. Only minimal resources are available to support this core collaboration initiative.

### Agricultural Statistics Database

A Computerized Agricultural Production and Economics Database is being planned by the Resource Management staff to support regional and country agricultural planning and policy research, and for the interpretation of microeconomic information. A reliable data source is essential to IITA economic research for the region, and for NARS economists to evaluate adaptability of technologies into their systems. It is also essential for generating reliable technology impact assessments. The collaborative systems research network described above needs this information to fully evaluate their research options. This statistical database will complement the IITA GIS database and be maintained as a core program activity.

### Special Projects Promoting Technology Transfer

Following established CGIAR support policies, IITA continues to rely upon special projects to implement regional and country outreach and adaptive research. In the past these projects have not provided for either a long-term IITA regional outreach capability, or an adaptive research and delivery linkage system to realize exclusive NARS roles in the research progression toward development. These special projects currently equal about 50% of the Institutes core budget. Building upon IITAs core structure, this level of special project investment should be expected to contribute more effectively to the regions adaptive research and technology diffusion. Current regional projects which have significant potential to assist in development of NARS adaptive research and outreach linkage follow.

### Commodity Research Networks

Commodity Research Networks for maize, cowpea and root crops are important components of IITAs outreach portfolio. Supported by USAID, IITA has provided coordination and management for West Africa maize and cowpea networks through the SAFGRAD program, and for the East & Southern Africa Root Crops Research Network (ESARRN) through the regional SAARFA program. (ICRISAT was supported similarly through SAFGRAD for West African sorghum network and the East African sorghum and millet network.) The maize and cowpea networks, for which support terminated December 1991, were effective in strengthening NARS research capabilities and to screen and generate these commodity technologies. ESARRN, currently funded to August 1992, is making rapid progress assisting NARS in the region to establish research on these neglected staples.

Primary activities in these networks consist of technician training, developing research methodologies, conducting cooperative variety trials and crop breeding nurseries, and conducting workshops and monitoring tours. But research has been limited largely to central experimental stations leaving very apparent gaps in OFAR and linkages leading to dissemination and adoption.

### On-Farm Adaptive Research

On-Farm Adaptive Research for cassava, yams, maize, rice, cowpeas, and soybeans was initiated in the collaborative network mode with 21 countries in 1990. Supported by the EEC, this limited project provides scarce resources for travel and on-farm trial expenses. Limited technical capacities have been identified and somewhat strengthened through workshops, training sessions, monitoring tours and trial evaluations. This project is providing important farmer feedback to NARS and IITA on varietal acceptability. Through field demonstrations and some related seed production schemes, improved materials may move more effectively to the farmer.

## Alley Farming Systems Network

The Alley Farming Network for Tropical Africa (AFNETA) implemented with 17 countries in 1990 is perhaps one of the most successful projects to transfer research technology to NARS, including a critical OFAR component and adoption research. An initial objective of the network was to introduce this relatively new system concept to NARS researchers, and simultaneously study the local adaptation and adoptability of Alley Cropping. Among 76 experimental trials established in 1990, 16 were on-farm evaluations. By the end of 1992, 75% of participating NARS will have on-farm trials to both obtain definitive data and introduce adoption of the system to selected villages.

As a more complex and new technology to NARS, additional technical coordination and backstopping is constraining progress, particularly in on-farm and adoptive research. Proposals are being circulated now seeking support for research in additional countries utilizing information learned from current work. The IFAD has supported this first phase of in-country research along with Canadian IDRC and CIDA support for the network structure. A series of IARC/U.S. University projects supported by a 1989 USAID grant will report progress and results at the AFNETA conference scheduled for September 1992.

## V. A STRATEGY PLAN FOR BUILDING R&D LINKAGES

Beginning with the goal to complete the African Regional Research and Development system, this section outlines a program for building and strengthening NARS strategic OFAR and extension linkage capabilities. A regional program concept is presented to link and extend IITA core programs and technologies effectively to the NARS and their clients. Program functions are identified to assist the NARS evolve effective and development focused research systems. Institutional responsibilities are suggested, functional strategies are elaborated, and continuity with IARC core research is rationalized.

### Goal And Objectives

The primary goal is for the NARS to support their agricultural development on a sustaining basis. Given scarce resources and underdeveloped national economies, it seems logical that this task be approached in a step wise manner to support progressive economic development. The immediate objective is to develop responsive farmer linkages with regionally generated technologies, requiring an orchestrated program of farmer oriented research and communication. This program would focus research toward farmers needs and subsequently ensure farmer adoption through on-farm adaptive

research and demonstration with delivery agencies. How these would be achieved is critical to the formulation and design of the regional effort proposed.

### IITA Targets For Supplemental Initiatives

Current IITA activities and initiatives addressing technology transfer are implementing its long term core outreach strategies. These are the best targets of opportunity for linking NARS effectively with regional research in the longer term. Current core activities which have particular linkage potentials for NARS development are presented in part IV and listed here for focus.

*Research Reorganization Strengthening Systems*  
*Decentralization of Agro-Ecological Research*  
*Collaborative Network for Agro-Systems*  
*Research Liaison Scientist Program*  
*African Statistical Database Development*

Special IITA projects which address NARS research regionally are also presented in part IV and listed here for emphasis.

*On-Farm Adaptive Research Project*  
*Alley Farming Network for Tropical Africa*  
*Regional Commodity Research Networks*

Unless these outreach programs and activities are actively linked into NARS programs, IITAs research will not benefit the African smallholder to whom they are directed. The proposed strategy would maximize the use and contribution of these IITA core and special activities for completing and strengthening NARS roles in the regional research scheme.

### A Regional Strategy For Building NARS Linkages

The functional modalities of this outreach strategy are 1) linking research with farmer needs to first identify and later verify research and technologies appropriate to farmers management systems, and 2) linking research results with the extension community for effective delivery to farmers. OFAR identifying with farmer needs is a direct role of the research system. In the absence of an extension/client demand, the development of research - extension linkages must be research managed to demonstrate achievement in justification of research investments. When further delineated as specific activities, these modalities will determine program formats and procedures in the design of effective interventions. This report suggests only broad objectives and targets of opportunity to address them.

Individual country projects addressing their specific needs would directly establish the links missing from the African research and

development system. These would require considerable technical assistance particularly for those components which must address country wide farmer diversity and outreach. Large projects, however, may lead to an imbalance of targeted components with the overall NARS program development making them less sustainable. The availability of necessary resources to support this approach with large numbers of African countries is perhaps the greatest limitation to this approach.

A regional strategy, therefore, appears more practical for developing NARS capacities and expediting technology transfer for several reasons. First, it will address generic development issues more efficiently and provide some program inputs across the region for benefit of all countries; it will support a balanced growth of NARS favorable to economic development; it will be linked with IITA and other IARC programs to make maximum use of their program efforts; and it will provide an operational framework for donors to develop bilateral projects to build upon and accelerate program development in selected countries.

#### Regional System And Network Roles

This strategy plan essentially provides for an extension of the IITA infrastructure beyond the CGIAR research boundaries to embrace and work directly with NARS toward their outreach goals. Appended and developed as a special project, this strategy plan would be a temporary intervention subject to the need for and continued support of NARS outreach, and consistent with both the research and development objectives of the CGIAR donors.

The program role of this regional outreach development strategy is to define and assist NARS to develop delivery program structures, and provide a professional catalyst to achieve the activities described above through demonstrations and examples. A key mechanism to achieving this goal efficiently is the network model to promote participation and collaboration among NARS and IARCs. This strategy would utilize IARC programs, such as the IITA Research Liaison Scientists, and collaborative research to the greatest extent possible and fully integrate these activities into the R&D system of national programs.

This strategy would complement current NARS research networks with the IARCs and encourage NARS to adapt and integrate component technologies into economically viable farming systems. It would provide an "adaptive systems research network" conceivably integrating, and perhaps replacing, the several commodity networks such as maize and cowpeas. Building upon IITA structures, this "network" would provide the integrating mechanism for adapting commodity and disciplinary research inputs into the NARS. While the IARCs focus on regional aspects of technology generation for driving their research, the NARS would be encouraged and strengthened through this program to develop location specific adaptive research with farmers, and linkages with extension entities to promote delivery and adoption.

## Program Functions And Provisions

This strategy plan primarily provides a professional core leadership to define and assist the implementation of regional and NARS program structures which would absorb and respond to new technologies. It would in principle establish the base and encourage national solicitation for support while directing the resources available into sharply defined strategic activities.

The following are critical activities which this regional strategy would seek to define, develop and promote with NARS.

- 1) An On-Farm Component in the Research-Development System - including an implementation model for integration into NARS and Centers research, and NARS reallocation of research resources to support their adaptive research role. Initially this will require top down effort with the rapidity of success dependent upon reallocation and availability of additional resources for development of essential human capital and operations.
- 2) Economic Analysis and Policy Promotion Research - for evaluation of new technologies through IITA exemplary activities and collaboration with NARS. Most NARS have some trained economists who could contribute to this area given some guidance and encouragement, and provided some operational resources.
- 3) An Effective Collaborative Outreach Network - among NARS and IARCs to generate and promote effective adaptation and delivery of systems technologies to farmers. This network should integrate IARC commodity and factor technologies within farming systems models for adoption research, and could possibly replace these networks within the system.
- 4) Functional Research - Extension Linkages - developed with selected NARS in a skeleton form and which would expand in response to the development of technologies and the availability of their resources.
- 5) Behavioral Change Research and Education - for understanding and promoting extension and farmer adoption of new technologies. Promotion of proven technologies with proven educational methodologies and programs would demonstrate the initiation of behavioral changes leading to farmer adoption.
- 6) Model Programs for Delivery of Proven Technologies - including seed production, on-farm demonstrations, informational materials development and educational programming. These would complement outreach efforts leading effectively to technology adoption.

## **VI. AN ADAPTIVE RESEARCH AND EXTENSION LINKAGE PROJECT**

A regional project is suggested here to establish a professional adaptive research and outreach program attached to IITA as a special project. Building upon program strategies and functions developed in the previous section, the project role, structure, linkage and timeframe are outlined in this section. Project implementation through an American entity is contrast with IITA in this role. Monitoring program progress, responsiveness to USAID initiatives, and linkages to USAID Missions for supplemental support are key considerations in this comparison.

### **Project Description And Operation**

A regional Adaptive Research And Extension Linkage (AREL) program attached to IITA is envisioned. This project would provide professional research and educational leadership to NARS for technology transfer and delivery in much the same way that the IARCs provide research leadership and generate new technologies with NARS. AREL would be designed as a progressive long-term effort to catalyze NARS development. Continued support would be dependent upon need in relation to progress in developing and strengthening NARS sustainable role in the African R&D system.

AREL is represented schematically in Figure 2 (page 21) by dashed lines indicating its temporary relationship and linkage with IITA core programs. Similar to IITA research program units, AREL would transfer adaptive research and education methodologies laterally to the NARS, as indicated by horizontal dashed arrows, and assist them to develop these capacities establishing effective research - extension linkages with their outreach communities. Until such time as these NARS linkages become an effective part of the total system, AREL would provide IITA and other IARCS critical OFAR feedback on country technology and information needs.

### **A Professional Staff Unit**

This AREL project would provide a professional staff and for their direct operations, with collaborative country support coming from NARS and their donors, and utilize IITA and other IARC regional infrastructures already in place. In this way NARS program ownership and the integration of joint activities are ensured through collaborative programs and investments. A regional program staff for West and Central Africa would require 3 to 5 professional and internationally experienced outreach specialists with backgrounds in agricultural development, on-farm research, production and policy economics, and agricultural systems. They would interact with NARS counterparts who would work and be trained to provide similar functions within the national systems.

AREL would supplement the IARCs research through establishing an effective NARS linkage system for adaptation and delivery of appropriate technologies to the farmer. This system, essential to achievement of research impact and assumed by the CGIAR model to arise within NARS, in reality is not now operationally effective in sub-Saharan Africa.

### An Extended Timeframe And Donor Support

The scope and magnitude of this task with NARS is expected to require a minimum 10 years to achieve sustainable progress. Two years should be allowed to establish a fully operational program. Its operation with minor adjustments for a minimum of three years would provide sufficient experience to evaluate progress and determine modifications from lessons learned. Continued operation with annual reporting and work plan adjustments for an additional 5 years should provide reasonable time to establish significant progress. A major review after 10 years would provide the basis for modifying project direction to address evolving development needs relative to donor supports.

Beyond ARELs provision of the basic framework and catalyzing NARS structures, the level of success attained by individual NARS will depend upon supplemental support attracted to their individual programs. Close communication and coordination with SPAAR will be important to donor support of this strategy plan. If such individual NARS support is limited and weak, then this regional effort can be expected to require a longer timeframe for NARS to develop and fulfill their regional R&D roles.

### Project Implementation Entities

This regional AREL unit could be implemented through a grant or contract with either IITA, or an American entity which would work collaboratively with the Institute. Developing AREL through an IITA grant would ensure close operational linkage with its research programs and the fullest utilization of its core outreach related programs. Operating as a unit of the Institute, AREL would enhance IITAs attraction and opportunities for bilateral and multilateral support to extend the program through their international status. There is an inherent risk, however, of the research programs absorbing program efforts and resources as a matter of proximity and orientation. Perhaps less obvious would be the tendency for AREL to become research driven, when the objective is to build a development and demand driven counter focus for research. Although these program implementation elements can be monitored, they are difficult to control.

An American contractor, who would develop and operate AREL collaboratively with the Institute, may have greater attraction for USAID support. This implementation model would be designed to

provide the advantages of close linkages with Institute programs strengthening IITA - NARS linkages, and to provide U.S. oriented management which has been particularly successful in building research - extension linkages. It would ensure appropriate staffing with qualified and experienced American personnel to develop these linkages which were pioneered in our agricultural system. An American entity would be more responsive to USAID initiatives, and more encouraging for USAID bilateral cooperation and buy-in programs, a significant supplement to NARS progress within the project timeframe. An American entity would also provide for stronger USAID identification with the program and its results while allowing for maximum cooperation with SPAAR donors.

The implementation entity should be chosen to provide the most effective regional system and opportunities available for enhancing NARS collaborative evolution of an effective research and development system for sub-Saharan Africa.

#### REFERENCES

1. Baum, W.C. and L.T. Evans. 1985. CGIAR - How It All Began. CGIAR Annual Report. The World Bank, Washington, D.C.
2. Sentz, J.C. 1990. Agricultural Technologies Transfer Between IITA and African NARS - Some Observations on Successes, Constraints and Opportunities. Biannual Report No. 5. U.S.AID Africa Bureau, Technical Resources Division, Washington, D.C.
3. Special Program for African Agricultural Research, SPAAR. 1987. Guidelines for Strengthening National Agricultural Research Systems in Sub-Saharan Africa. The World Bank, Washington, D.C., and ISNAR, The Hague, Netherlands.
4. Stakman, E.C., R. Bradfield, and P.C. Mangelsdorf. 1967. Campaigns Against Hunger. The Belknap Press of Harvard University Press. Cambridge, Massachusetts.

Figure 1. Global Model for Third World Agricultural Research and Development illustrating institutional roles and interactions for the generation and dissemination of information and technology.

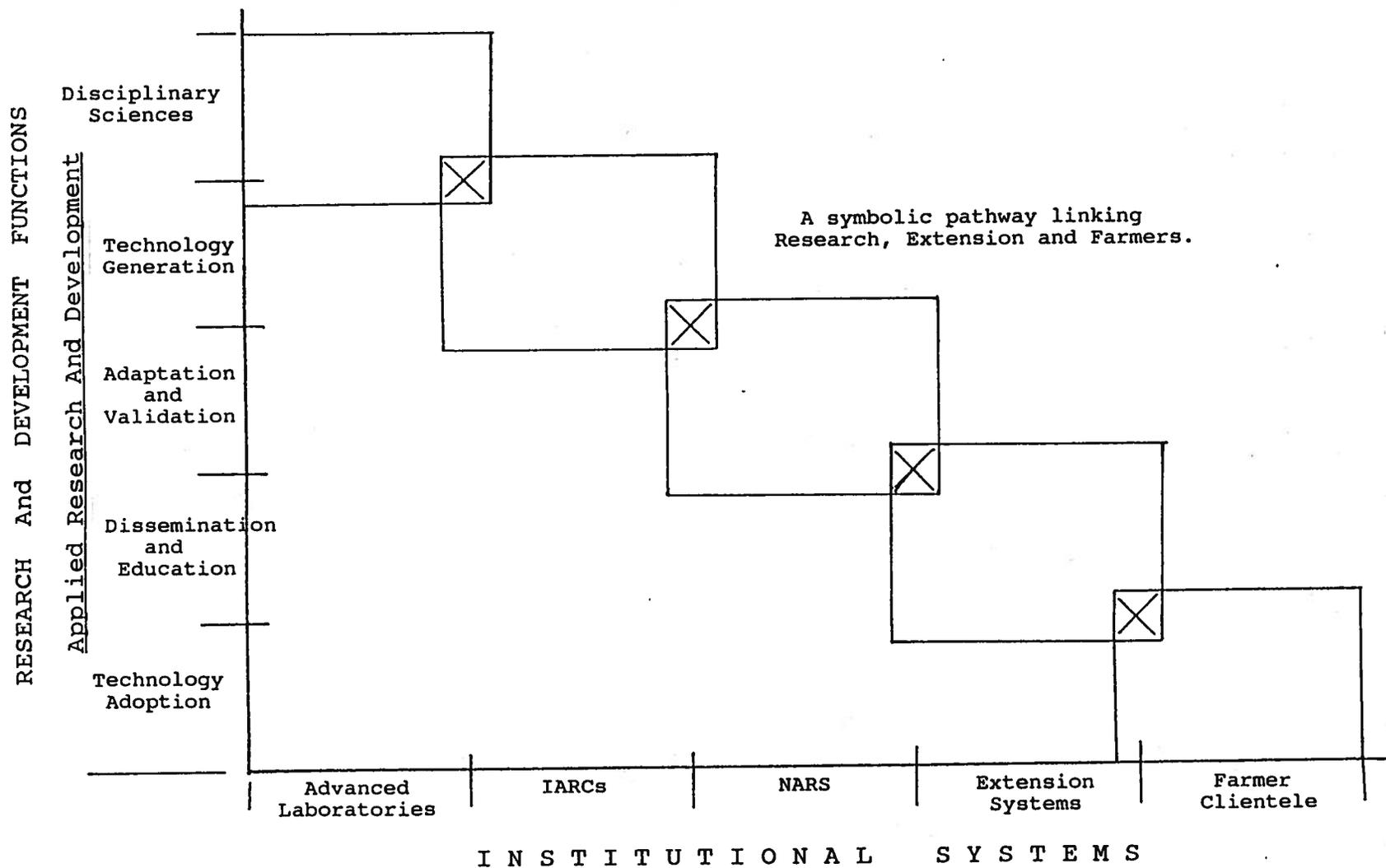


Figure 2. African Agricultural Research and Development Model illustrating IITA technology transfer and proposed Adaptive Research - Extension Linkage (AREL) Program.

