WORKING PAPER No. 9

ORGANIZATIONAL, FINANCIAL, AND HUMAN RESOURCE ISSUES FACING WEST AFRICAN AGRICULTURAL RESEARCH SYSTEMS

isnar

International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands, on September 1, 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing and operations.

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International Service for National Agricultural Research

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CHAPTER 1

A FRAMEWORK FOR STUDYING CURRENT ISSUES OF NATIONAL AGRICULTURAL RESEARCH SYSTEMS (NARS) IN WEST AFRICA

INTRODUCTION

Strengthening national capacities to conduct agricultural research is considered by most developing countries and donor agencies as requisite for economic growth and stability in the agricultural sector. In this paper, we will address problematic issues facing national agricultural research systems in West Africa, including organizational, financial, and human resource issues.

ISNAR recognizes that prescriptions for improving the policy, organization, and management of NARS in West Africa can only be made by taking the specific country context into account. However, donor agencies are sometimes under pressure to act within a broader framework, often regional in nature, which can be justified to their decision-makers. The purpose of this chapter is to suggest an approach to identifying opportunities for improving West African agricultural research which places the recommendations in a policy, organization, and management framework and which takes into account the history of the systems involved. Some understanding of the way in which the systems have evolved to their current state is necessary if recommendations for improvement are to be realistic. This is not a history of West African NARS but rather an interpretation of current issues in an evolutionary context.

The Agricultural Technology Management System (ATMS)

To structure the discussion, we will use the concept of the agricultural technology management system (ATMS). ATMS describes both the broad system and the component parts which affect and encompass agricultural research systems. By definition, the components comprising the technology management system both influence and are influenced by events occurring in the system. The process of agricultural technology management involves the creation of appropriate structures and mechanisms to overcome constraints to the generation and diffusion of improved technologies.

The component parts of the ATMS are:

- the "technology sector", with its subsectors (the technology generating sector, the technology transfer sector, and the technology using sector);

- the "politico-bureaucratic structure", composed of formal representatives of the government and decision-makers, and the channels through which interests of all groups in the system are made known to policymakers;

- the "external sector", composed of donors, international technology generating institutions, and multinational firms engaged in technology generation and transfer;

- the underlying "structural conditions", which include both the resource base of the country and any exogenous constraints imposed by the nature of world markets for outputs and inputs of the agricultural sector;

- the "policy environment", made up of all laws, regulations, customs, and practices which limit the way in which components of the technology sector behave.

In the colonial period, the similarities between the French, British, and Belgian research systems were greater than their differences. While the former British colonies may have been more decentralized in organization and funding, they all concentrated their efforts on the principal export crops, participated in international and intercolonial exchanges of materials, and maintained strong links to the production sector. The current research systems in West Africa, however, are quite diverse, in part because their national objectives now differ from the role assigned to them during the colonial period and because they have responded differently to emerging constraints. It is in this respect that each country becomes a special case, and there is no uniform recommendation for strengthening all systems.

The Review Approach

The approach followed in this report is first to make several observations about the structure and evolution of West African research systems within their broader ATMS environment. The second chapter then concentrates on organizational issues associated with particular functions a system must perform well if it is to be successful. These include the setting of strategic goals and priorities, and the various planning, management, and linkage functions. Chapters Three and Four then deal with the financial and human resource issues which characterize West African systems. The available evidence will present a picture of increasing pressure on research budgets following a period of rapid expansion. This is occurring precisely at a time when the human resources, sent for training during the period of growth, need financial and physical resources in order to be productive. This implies that a sound human resource strategy might better look at the productive use and deployment of scientists in the pipeline than massive training to replace the scientists who leave because of inadequate remuneration and poor working conditions.

A Classification of Countries for the Analysis

For purposes of this report, we have attempted to group countries with common characteristics, analyzing them collectively. Because this report concentrates on organizational and institution-building questions, an initial division separates the British, French, and Belgian systems. Moreover, since the methodology calls for an understanding of the basic structural and environmental conditions facing the NARS, it is useful to separate the Sahelian countries from the humid coastal countries. This

effectively divides the former French colonies into two groups. Finally, it is necessary to treat the large Nigerian system as a special case, since its weight in the total would bias all the indicators for the region if included in regional calculations as just another case. This leads to the presentation of country-level data according to the following taxonomy: 1) Francophone Sahel, 2) Francophone Savannah/Humid Tropics, 3) Anglophone (excluding Nigeria), 4) Nigeria, and 5) Zaïre. With the exception of Nigeria, basically no system in the region is very large, so the discussion of the "small-country problem" is integrated with the discussion of the structural, resource utilization, and management issues that are faced by the research systems of the region.

AN OVERVIEW OF ATMS IN WEST AFRICA

In a report dealing primarily with organizational and management issues, we do not need to spend much time on the macro issues of both a structural and a policy nature. However, they do fix the framework within which the agricultural sector and the agricultural research systems operate. It is useful, therefore, to compare the country groupings with respect to key macropolicy issues, unusual structural or natural events that influenced the evolution of the systems, and any particular policies limited to the agricultural sector which may have impinged on the success or failure of the technology-generation and transfer processes. The evolution of the post-colonial systems can be compared with respect to important changes in:

a) the policy environment;
b) the underlying structural conditions;
c) external influences from donors and the international scientific community;
d) the political-bureaucratic structures.

With respect to the policy environment, it is difficult for an agricultural research system to outperform the economy in which it is operating. Therefore, the stability of its economic environment is crucial to its success or failure. The post-colonial transition of a given research system, therefore, can be expected to parallel the state of the country's economy. One of the most obvious factors distinguishing the former French colonies from either the anglophone countries or Zaïre is the stability of their economies in the post-colonial era.

With the exception of Guinea and Mali (which operated for a period outside the franc zone) the former French colonies enjoyed a stability in their currencies because they were convertible to French francs. These currencies tended, however, to be overvalued, which favored the stronger coastal countries (Ivory Coast, Senegal, and Cameroon) at the expense of the weaker interior countries. In addition, those countries which left the franc zone experienced economic difficulties which are reflected in the relative deterioration of their systems. Apart from the former French colonies, the Zairian system foundered during the political difficulties of the mid-1960s and has not yet recovered. The Ghanaian system enjoyed several good years after independence but suffered from a general economic malaise following the collapse of the cocoa market in

the mid 1960s. The Nigerian research system, always the strongest in West Africa, managed to expand in the post-independence period and even had difficulty absorbing the money that came its way (in large but irregular amounts) during the oil boom. However, the overall Nigerian economy has since suffered an economic retrenchment.

This rather schematic discussion of the economic environment is not meant to raise issues that cannot be dealt with. While national research directors may find the policy environment beyond their reach, donors are able to engage in a policy dialogue at the macro level which can improve the framework within which research functions.

The stability of policies facing the agricultural sector has varied from country to country. The Ivory Coast has been one country that has attempted to maintain favorable terms of trade for agricultural producers. Producer prices for its principal export crops have been fixed at levels which generate tax receipts for the government but also leave incentives for farmers. The maintenance of its export potential in tree crops has been a major concern of the price and investment policy of the government. Similar policies have been in force in Cameroon.

The experience of these cocoa and oilpalm-producing countries is in contrast with that of both Ghana and Nigeria, which failed to protect the terms of trade of their producers during the 1960s and 1970s. In Ghana, the policies of the early 1960s (a concentration of public expenditure on urbanization and industrialization) generated a domestic inflation and overvaluation. This, along with a payment-by-chit system which farmers found unacceptable, led many farmers to abandon measures to protect their cocoa against disease and insects. It was in the aftermath of these policies that the Ivory Coast replaced Ghana in the world cocoa market. In the case of Nigeria, a combination of domestic inflation, overvaluation of the naira, and escalation of public-sector salaries during the oil boom turned the terms of trade against the agricultural producer.

In Zaïre, the deterioration of infrastructure during the rebellion and its continuing state have made it difficult to establish adequate internal marketing systems for both food and cash crops. Therefore, even the recent establishment of more realistic exchange rates will not ensure the success of the agricultural sector without investment in infrastructure. In the years following the rebellion, the successive policies of zairianization, radicalization, and ultimately, retrocession of plantations were evidence of an instability in policy that made investment not worthwhile and research problematic.

In several Sahelian countries, the government used official (usually food) marketing agencies to control the price of basic crops. The result was a worsening of the terms of trade for the producer. Recent measures have led to the liberalization of many of these policies.

With respect to changes in underlying structural conditions, it is obvious that the successive droughts in the Sahel have focused both attention and resources on those countries. Even though the region had previously experienced cycles of extreme low rainfall, in the past the human and animal populations at risk were not so large. In response, the

inflow of donor resources to the agricultural research sector has been large in relation to the size of the systems; large numbers of trainees have been sent abroad; and questions of the sustainability of the systems built on donor money have been raised. Increased attention to Sahelian problems is leading to more emphasis on sustainable production, environmental protection, and factor-based research.

DONOR IMPACT ON SYSTEMS

West African countries rely heavily on external donor assistance to develop and support their national agricultural research systems. Donor assistance most frequently comes through projects, which may take a commodity, regional, or sectoral approach. In spite of the prevalent understanding that research support would be more efficient and effective if donor coordination could be improved, donor procedures often keep this from happening. Funding cycles, internal bureaucratic demands, political objectives and, sometimes, neo-colonialist attitudes and a sense of territoriality keep donors from collaborating, and they instead create independent pieces of the mosaic of the national research system. This is counter-productive to developing a carefully planned and sustainable system. National research administrators often find themselves juggling donor-sponsored projects in the hope that something sensible will fall into place, and something will be institutionalized.

While this has been the situation in many West African countries, it is important to acknowledge that without donor support some countries would have conducted little or no research in the years since independence. One must simply be aware of the "costs" of donor assistance and the inefficiencies in the process, so that lessons can be learned from past experiences and improved modes of operation can be considered. There are some pitfalls that should be avoided.

External donor agencies can be a temporary "easy-out" for research administrators - willing partners who come across readily with much-needed infrastructure, equipment, training, and foreign exchange. Project assistance can provide a temporary alternative to attaining internal political and financial support for a program or institution. Consequently, when external funding ends, securing domestic funds can become a problem.

Another "easy-out" from project assistance is that circumstances may force research administrators to further postpone the exercise of setting priorities and sticking to them. Donors bring their own priorities, which may or may not fit long-term national concerns. In the process of obligating funds, implementing projects on schedule, and satisfying their own political objectives, donors may unduly influence the timing and content of national programs.

Carrying out donor projects may place expensive demands on the limited technical, administrative, and fiscal elements of government organizations. In small countries with limited professional staff, the diverse accounting and reporting requirements of donors may further burden the system.

Donors - because of their own political and bureaucratic constraints - are frequently unable to commit funds for more than a 5-to-10-year period. Projects are designed and implementation plans are developed in conformity with this externally dictated timeframe. Such a small timeframe is not enough for developing or significantly improving a national agricultural research system.

One common mistake of donors has been an extensive and often premature investment in research infrastructure. Perhaps because construction is a relatively easy way to spend money in developing countries - simpler, quicker and more tangible than human resource development, research, policy dialogue, etc. - it is not uncommon to find underutilized or superfluous donor-financed facilities in West African countries. Due to a shortage of expertise or foreign exchange, or perhaps for lack of high-level political interest, the facility often deteriorates after project completion.

Unfortunately, one other consequence of building up infrastructure quickly can be the perpetual drain it places on the government which, for political or technical reasons, continues to support it whether or not it is of national importance. In this case, rather than design a research program around the most pressing technical problems, the program may be biased to use the research station or laboratory available. The national systems with the least resources are the most vulnerable to this kind of burden.

Most West African countries face serious recurrent cost problems, and many must also deal with the additional burden of insufficient foreign exchange. These problems are exacerbated by the demands development projects place on the national system - both during and after project implementation. An AID study of recurrent costs in the Gambia found that the 19 ongoing donor projects within the agricultural sector would consume 140% of the sector's recurrent cost budget for their continued implementation alone. Obviously, in this case either national programs or donor projects will have to be sacrificed when the recurrent cost burden is shifted to the Gambian government. CILSS determined that the average annual operating cost of project activities after donor withdrawal was 15% of the value of the initial investment.

With all of these cautions in mind, national governments still choose to accept project assistance from donors. Whether or not the best course is followed, all parties are gaining enough to perpetuate this mode of assistance. Under a better scenario of collaboration, donors and national governments would move from project assistance to program assistance. A national research system which had gained political commitment from the government, which had clear and realistic research objectives, and which could obtain donor support for these objectives, would certainly have a stronger program. This is perhaps more difficult to accomplish with the competing demands made by the project system, but it is possible if measures are taken step by step.

In the final analysis, however, some recognition must be given to the positive aspects of donor assistance. It is not unrealistic to imagine that in some of the poorest economies no agricultural research would have been conducted without external assistance. The many people educated are

usually not lost to the economy even if they do not remain in research, and much of the appropriate infrastructure built under past projects is also used. Also, inherent in dealing with donor agencies is an interaction among professionals in the field; many ideas, much technical information, and understanding can come out of these discussions. This all contributes to the knowledge base needed for accomplishing technology generation and transfer.

Of great impact have been the associations forged between IARCs, universities, and national research systems. These associations have often been dependent upon donor funding. The level of involvement and the benefits realized, of course, are on a country-by-country basis. There is even greater potential for symbiotic interaction among these elements, and donor financing plays an important role. In addition, donors are increasingly being called upon to support the formation and functioning of scientific networks in West Africa. This mode of assistance offers much potential for information exchange and for collaborative research among scientists who share common problems.

Finally, donor involvement can have positive and negative effects on the level of support research receives from domestic political-bureaucratic structures. There are only a few cases in the region where agricultural interests were important in the struggle for independence, and their influence carried over into policy after independence. An example is the Syndicat Agricole Africain, a union of African planters in the Ivory Coast, which was basic to the creation of the inter-territorial political party (RDA) and which brought French West Africa to independence. In contrast, the cocoa farmers of Ghana were unable to exercise any influence over the policies of the early 1960s which held back the sector. Groups which are unable to protect their own interests are a weak constituency for research services. Therefore donors often play an important role in policy dialogue in many African countries, attempting to secure national support for research.

Conversely, the almost total dependence of many research systems on donor funding makes it easier for research leaders to seek their political support outside the system than inside, leaving the system permanently isolated from domestic support. Such issues are discussed in Chapters 2-4, where the considerations are more operational in nature.

CHAPTER 2

ORGANIZATIONAL ISSUES

INTRODUCTION

Broadly speaking, the structure of any organization can be defined as the institutional forms and mechanisms through which human, physical, financial, and information resources are brought together to achieve certain outputs and tasks. This study examines the past and present structures of agricultural research organizations in West Africa. It attempts to assess their appropriateness for achieving agricultural development objectives on the one hand, and their capacity to plan and manage agricultural research activities on the other. While these aspects of organizational structure are closely interrelated, they will be analyzed separately in this chapter. The final section of this chapter will then address some of the major issues concerning the reorganization of agricultural research in West Africa during the next 20-30 years.

HISTORICAL DEVELOPMENT OF RESEARCH ORGANIZATIONS

The Colonial Period

During the colonial period in West Africa, publicly funded agricultural research was heavily focused on a relatively small number of export crops - oil palm, cotton, cocoa, rubber, and groundnuts. While this was directly in accordance with the dominant economic interests of the colonial powers, the demand for food crop research was also generally limited due to high land-labor ratios, low rates of urbanization, and the general ability of traditional farming systems to meet national food requirements.

The dominant organizational form for agricultural research adopted in both anglophone and francophone West Africa during the colonial period was the regional export crop research institute. Table 2.1 lists the most important of these institutes, plus the three main regional food crops and livestock research organizations. There were, however, other types of organizations, such as ORSTOM, which were disciplinary in orientation, and research stations such as the Institute of Agricultural Research at Samaru in Northern Nigeria and the Centre de Recherche Agronomique at Bambey in Senegal, which were locationally based and which conducted food crops research.

For a number of reasons, the single-commodity research institute was in many respects the most appropriate type of organization for agricultural research in West Africa during the colonial period. They focused on specific commodities and responded to production problems emanating from relatively well-defined groups of specialist producers (including smallholders). Most were part of extensive international research systems and networks and were able, therefore, to draw upon technical and managerial support from other research institutions in the metropolitan countries and elsewhere. They were staffed by multidisciplinary research teams which were capable of responding to most commodity production problems and were large enough to form effective scientific communities.

Finally, each had a network of smaller stations throughout the region in order to ensure wider geographical coverage.

Table 2.1: Main export crop and food research organizations established on a regional basis during the colonial period in West Africa

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Export Crops - British

West African Institute for Oil Palm Research (WAIFOR), Nigeria
West African Cocoa Research Institute (WACRI), Ghana

Export Crops - French

Institute for Research on Cotton and Exotic Textiles (IRCT)
Institute for Research on Oil and Oil Products (IRHO)
Institute for Coffee and Cocoa (IFCC)
Institute for Rubber Research (IRCA)
Institute for Fruits and Citrus (IFAC)
Tropical Forestry and Technology Center (CTFT)

Food Crops/Livestock - British

West African Institute for Rice Research (WAIRR), Sierra Leone
West African Institute of Trypanosomiasis Research (WAITR), Nigeria
West African Fisheries Research Institute (WAFRI), Sierra Leone

Food Crops/Livestock - French

Institute of Tropical Agronomy (IRAT)
Institute for Livestock and Veterinary Medicine for Tropical Countries (IEMVT)

Probably the main disadvantage of the commodity organizational form during the colonial period was the relative neglect of discipline based factor research (in particular in the areas of soil-water-plant relationships, soil conservation, and social sciences).

The Post-independence Period

The Nationalization Process. In anglophone West Africa the complete nationalization of agricultural research organizations was achieved immediately at the time of independence in each country so that neither the British government nor British research institutions continued to have any formal control over these organizations. The regional research institutes were disbanded and became national research organizations. The same decisive break in the control of national agricultural research organizations occurred in Zaïre at the time of independence.

The immediate nationalization of research in anglophone countries was facilitated by the fact that the British had tried to achieve a certain economic and administrative autonomy in each colony. British citizens working abroad were generally responsible to the local government, were often a part of the local government, and were considered a part of the colony. Consequently, at independence - unlike the French - there was an exodus of British citizens who chose to repatriate to the United Kingdom rather than become citizens of the new country. This policy of colonial autonomy, however, had positive effects on the development of the countries involved. More effort had been made to educate the indigenous population, infrastructure had been more widely developed, and Africans had enjoyed fuller participation in the civil service and lower management levels than in former French colonies.

Following independence, there was some loss of momentum in the research programs associated with the repatriation of very experienced British researchers and the dearth of sufficiently trained nationals. In order to revive the program until nationals could assume all of the responsibilities, a new though smaller cadre of British researchers was installed under local hire with salary supplementation from Britain. At the same time, the impending food crisis necessitated a shift in research focus from revolutionary cash crop introductions and techniques to evolutionary change within the food-crop sector with small farmers.

The role of the universities was stronger in former British colonies than in former French colonies. With the exception of the Gambia, every British colony had well-established universities at independence. Those offering agricultural studies were the University of Ibadan (Nigeria), the University of Science and Technology at Kumasi and the University of Ghana at Legon (Ghana), and Njala University College (Sierra Leone). While the numbers of university graduates at independence were far from adequate to assume control over the national agricultural research systems, 150 anglophone Africans were trained between 1952 and 1963. All of these universities conducted some agricultural research. They were integrated to different degrees with the national agricultural research systems.

In francophone West Africa, on the other hand, the nationalization process has been considerably more complex and protracted. As can be seen from Table 2.2, only two countries - Guinea and Mali - took over complete control of the French colonial agricultural research organizations when they gained their political independence. Elsewhere in francophone West Africa, the colonial pattern of organization remained relatively unchanged throughout the 1960s. It was not until the early-mid 1970s that any serious attempts to nationalize and integrate the French institutes into national research organizations were initiated: in Cameroon (1974), Niger (1974), Mauritania (1974), Senegal (1975), Burkina Faso (1981), and Ivory Coast (1986). This process is still to be completed in the last two countries, and four other francophone West African countries (Congo, CAR, Chad, and Togo) still have not effectively nationalized their agricultural research systems.

The nationalization of agricultural research in francophone West Africa has also led to a progressive decline in regional and international agricultural research.

Table 2.2: National agricultural research institutions in francophone West African countries, 1986

Year	Broad Mandate Institutions	Specialized Institutions	Mandate
1960	IER (Mali)		Crop production
1960	INRZFH (Mali)		Animal production
1961		ITA (Senegal)	Food technology
1961	INRA (Guinea)		
1962			
1963			
1964			
1965		INRS (Togo)	Botany, social sciences
1971		CIRES (Ivory Coast)	Social science
1972			
1973	CNERV (Mauritania)		Animal production
1974	INRAN (Niger)		Agricultural production
1974	IRA (Cameroon)		Crop production
1974	IRZ (Cameroon)		Animal production
1974		IHS (Cameroon)	Social sciences
1975		CRTA (Burkina Faso)	Trypanosomiasis
1975	ISRA (Senegal)		Agricultural production
1976	DRA (Togo)		Crop production
1977	LEA (Mauritania)		Entomology
1981	IBRAZ (Burkina Faso)		Crop production
1981	IRBET (Burkina Faso)		Tropical ecology
1984	DRA (Benin)		Agricultural production
1985			
1986*	INIRA (Ivory Coast)		Agricultural production

* under consideration

Table 2.3: Types of nationalization of agricultural research organizations among the francophone West African countries

TYPE	COUNTRIES
1. Creation of a department/ "direction" within a ministry	Benin/CAR/Chad/Congo/Togo
2. Creation of specialized research institutes	Burkina Faso (CRTA) Cameroon (IHS) Senegal (ITA) Togo (INRS)
3. Creation of "transitional" specialized research institutes	Ivory Coast (IDESSA) Senegal (CNRA, CRODT)
4. Creation of several, broad-mandate national research institutes	Burkina Faso (IBRAZ/IRBET) Cameroon (IRZ/IRA) Mali (IER/IONRZFH) Mauritania (CNRADA/CNERU)
5. Creation of single national research institute	Ivory Coast (INIRA) Niger (INRAN) Senegal (ISRA)

As can be observed in Table 2.3, a number of specific organizational arrangements have been devised in undertaking the nationalization process in the francophone West African countries.

1) The creation of departments or divisions of research within a technical ministry. Thus, departments of agronomic research have been given national responsibility for agricultural research, either totally, as in Benin (1984), or partially, as in Togo, Central African Republic, and Chad, on the basis of the integration of the existing French applied research institutes.

2) Establishment of national control of existing specialized research institutes such as CIRES (social science) in Ivory Coast and ITA (food technology) in Senegal. One can also add to this category a number of small research stations and laboratories within production ministries in a number of countries.

3) The creation of specialized institutes (in a commodity or a region), generally based on the reorganization of the responsibilities of the French institutes, such as IDESSA (dryland agronomy) in Ivory Coast, and CNRA (groundnuts and foodcrops), and CRODT (oceanography and fisheries) in Senegal.

   It is likely that this type of organizational arrangement would have been more prevalent if national governments had become more directly involved soon after independence in the management and financing of the French institutes.

   Despite its apparent success, this model has only been considered by the national authorities as a transitional arrangement prior to the creation of more comprehensive national research organizations in which the specialized stations and institutes are integrated. It is not considered a new durable organizational model. In the case of Senegal, CNRA and CRODT have been integrated into ISRA.

4) The creation of several national agricultural research organizations (Burkina Faso, Cameroon, Mali, and Mauritania), where the principal concern of the national research authorities has been to establish crops and livestock research as separate organizations with respect to their mandates. These organizations have two of common characteristics:

   - They are essentially concerned with applied research, having immediately taken over the network of French research institutes. The more basic research activities of ORSTOM have only more recently begun integration into the programs of these national organizations.

   - They have national mandates for all research within their recognized areas of competence.

5) The creation of a single national agricultural research organization as with ISRA in Senegal and INRAN in Niger, and as is being proposed for INIRA in Ivory Coast.

There are a number of important differences between the single and multiple organizational setups:

- When several research organizations are given the responsibility for research implementation, the formulation of research policies and inter-institutional coordination must necessarily be undertaken by the responsible ministry.

- When all research is undertaken by a single research organization, there is a tendency that all responsibilities are confined to an administrative council. The logic of the model, and its interest, is to create an organization which is fully autonomous and which therefore is able to eliminate unnecessary bureaucracy and formulate and implement comprehensive scientific and administrative plans and policies. It is on this basis that ISRA in Senegal has been constituted as "un établissement public à caractère industriel et commercial". A similar organizational status is also envisaged for INIRA in Ivory Coast.

Shift in Research Priorities. During the 1960s major emphasis continued to be given to research on the major export crops in West Africa with very few changes in the organizational structure inherited from the colonial period. However, with the growing concern about the viability of traditional systems of shifting cultivation to satisfy both rapidly escalating national food requirements and targets for industrial and export crops, the appropriateness of the dominant commodity-oriented organizational structure of agricultural research, in particular in the francophone countries, was increasingly called into question. In many respects, the success in the commodity-specific approach to research and development (e.g., cotton in Mali and northern Ivory Coast) brought these countries to a point where the key cash crop was constrained by the limited productivity in the key food crops and called for a more integrated approach, with particular attention to food crops. To some extent, it was this shift in agricultural development (and thus agricultural research) priorities that provided the major impetus for the coordination, and sometimes nationalization, of agricultural research organizations in francophone West Africa from the mid 1970s onwards.

The organizational forms of the main agricultural research organizations in each country in West Africa in the mid 1980s are shown in Table 2.4. It is noticeable that the export crop research institutes continue to play an important role in those francophone countries which have not yet nationalized their research systems, and also in the larger anglophone countries (Nigeria and Ghana). Single-commodity food crop research organizations are relatively rare.

The most important consequences for organizational structure of the shift of research priorities towards food crops have been (1) the establishment of national research organizations with comprehensive mandates for crops and livestock research and, (2) within these organizations, increased emphasis on location-specific organizational arrangements; i.e., research stations or institutes with specific geographical and/or agro-ecological mandate and multidisciplinary teams of researchers undertaking research on a range of commodities. This latter type of organizational arrangement is particularly appropriate for adaptive research with a strong systems perspective requiring considerable on-farm, multidisciplinary research activities. More complex hybrid organizational forms have also appeared, where researchers typically belong to discipline based departments but participate in specific

Table 2.4: Organizational forms of national agricultural research institutes in West Africa, mid 1980s

Country	Disciplinary	Commodity	Location	Hybrid/ Multiple
Benin		IRHO-oil palm IRHO-coconut IRCT-cotton	FCRS-Ina FCR-Nigoulí	
Burkina Faso	IRBET, DSA	IBRAZ (CIRAD commodity insts)		
Cameroon				IRA
C.A.R.		IRCT, ADECAF		
Chad	DRA	IRCT, CILSS-sorghum millet		
Congo	CRAL, CTFT		STARDI	
Gabon		IRCA		
The Gambia	DOA-Yundum (Mechanztn prog)	DOA-Sapu (crop imprv & rice)		
Ghana	Soils RI SRRI Food RI	CRIG OPRI Aquatic RI	CRI-Nyankapala CRI-Kumasi	
Guinea	Inst.Agr (Bordo) Centre Tindo	Yatiga (rice) ONADER (rice)		INRA
Ivory Coast	CIRES (soc.sci)	IRCC, IRHO IRCA, IRFA, IRCT, IRAT	IDESSA	(INIRA)
Liberia	CARI	LORRI (WARDA)		
Mali				IER
Mauritania	CNRADA			
Niger				INRAN
Nigeria	NSPRI	CRIN, NIFOR NRCRI, NIHORT RRIN	IAR, IAR&T	
Senegal		CDH (Horticult.)		ISRA
Sierra Leone	LWDO	Rokupr RRS		
Togo	DEPEG, DPV DRA (varietal imprv)	DNTA, IRAT, IRCT IRCT, IRCC, INPT		
Zaïre	CRAAL	National commodity progs.		INERA

national commodity, systems, and/or locational research programs. While this matrix arrangement permits a flexible use of scarce human resources, it considerably complicates the authority and decision-making structures in a research organization.

EFFECTS ON PLANNING AND MANAGEMENT

The appropriateness of the organizational structures of agricultural research in West Africa must be assessed not only in relation to research strategies and priorities but also in relation to the key planning, management, and linkage functions which must be adequately performed by a national agricultural research system and its constituent research organizations. Three of the most important functions are strategic planning, human resource management, and financial resource acquisition and disbursement. The organizational structures of agricultural research systems and institutions have important implications for the implementation of these functions.

Strategic planning

Strategic planning of national agricultural research involves effective centralized control over the determination of research priorities and objectives, the delineation of research programs and specific institutional arrangements, and the broad allocation of financial and/or human resources to both institutions and programs. Without such control, a national agricultural research system cannot develop and mature.

The degree to which the organizational structure of agricultural research in each country in West Africa is appropriate for strategic planning purposes depends on the pattern of governmental responsibility and, in particular, the extent to which this responsibility is concentrated in a single organization, and the effectiveness of mechanisms which have been developed to coordinate the activities of separately constituted agricultural research organizations.

In practice, the pattern of governmental responsibility for agricultural research is determined by two main types of organizational fragmentation: inter-ministerial, where important areas of agricultural research come under the responsibility of more than one ministry; and intra-ministerial, where a single ministry has sole responsibility but where there is more than one agricultural research organization (with their own separate management, network of research facilities, and budgets) within the ministry. From an analysis of West African organization, three generalizations can be made. First, inter-ministerial fragmentation <u>within</u> each of the research areas is not generally a serious problem. Food crops research in Zaïre is the major exception. Second, with the exception of forestry, inter-ministerial divisions <u>between</u> the different research subject areas are not nearly as widespread as is commonly asserted. Third, intra-ministerial organizational fragmentation is very much more pervasive, particularly <u>between</u> livestock, foodcrops, and export crop research institutions and <u>within</u> export crops. The most important reasons for these patterns of organizational fragmentation are discussed below.

Among the francophone West African countries, the degree of organizational fragmentation is directly related to the degree to which the French commodity-based research institutions continue to operate as individual autonomous organizations outside of the de jure and/or de facto control of the responsible ministry. As noted earlier, there is still considerable variation among this group of countries, depending on the extent to which their governments have attempted to integrate French research institutions into national research organizations. Where this process is relatively well advanced (as in Benin, Cameroon, Mali, Senegal, and Niger), there is much less intra-ministerial fragmentation compared to those countries where the nationalization and integration process has still to be seriously embarked upon (i.e., Chad, Congo, Togo), or where it is still in its early stage (Burkina Faso, Ivory Coast). The point to stress, however, is that this problem has been tackled or is currently being actively pursued by most governments in francophone West Africa and should therefore be effectively resolved during the next 10-15 years.

There is also a colonial legacy of separate crops institutes in Ghana and Nigeria, and a general failure to appreciate the actual and/or potential interconnections between crops, forestry, and livestock production in the majority of farming systems in West Africa. In the past, livestock research has tended to be dominated by veterinarians and thus has been primarily concerned with animal health problems, while forestry research has been oriented mainly towards the commercial plantation sector rather than the development of viable agro-forestry technologies for smallholders.

Non-institutional research. The organizational fragmentation of agricultural research in West Africa, and its implications on strategic planning, has been further complicated by the proliferation of donor-assisted research projects and other development projects with research components. The importance of this latter type of "non-institutional research" activity should not be underestimated. For example, in Niger the main government agricultural research organization, INRAN, employed a total of 57 researchers in 1986, and yet another 130 researchers were also reported as working in development projects outside of the formal agricultural research system. At the regional level, between 1975 and 1985, the World Bank funded 60 agricultural development projects in West Africa which had adaptive research components. Within agricultural research organizations, donor-funded projects have typically enjoyed considerable de facto organizational autonomy, with control over the establishment of research objectives, financial disbursement, training opportunities and, to a lesser extent, conditions of service. Not surprisingly, therefore, this has frustrated attempts to establish effective strategic planning for agricultural research on a national basis.

University research. Ensuring effective strategic planning within national agricultural research systems in West Africa is invariably complicated still further by a second major type of organizational division, namely, that which exists between the ministry(ies) with overall responsibility for agricultural research and the university sector. As will be discussed in greater detail in Chapter 4, most West African countries have university faculties of agriculture and/or science which are staffed by relatively large numbers of staff, many of whom have the training and skills to make significant contributions to the national agricultural research effort. However, given the considerable organizational independence enjoyed by universities in the past, academic staff have enjoyed considerable freedom to pursue their own research interests, largely independent of national research priorities.

Again, there are both inter- and intra-ministerial dimensions to this problem. In the following West African countries, different ministries have responsibility for university education and agricultural research: Benin, Congo, Gabon, Ghana, Liberia, Nigeria, Senegal, and Togo. It is not surprising, therefore, that this has constituted a significant organizational barrier with respect to strategic planning for the NARS as a whole. Where, however, the same ministry has responsibility for both university education and agricultural research, as is the case in an important group of francophone West African countries (Burkina Faso, Cameroon, Ivory Coast, Niger) and Zaïre, the formal organizational barriers are reduced considerably. In practice, though, there is little evidence to suggest that having this organizational arrangement will necessarily lead to more effective participation of the university sector in strategic planning or in the development of complementary programs between universities and research institutes. Serious intra-ministerial problems may persist which perpetuate the isolation between them.

Agricultural extension, services, and production. The third major type of organizational characteristic which has had important implications for the ability of national agricultural research systems in West Africa to plan effectively has been the nature of the organizational linkages and relationships between agricultural research institutions and the other major government-funded extension, service, and production organizations. Effective linkages are required in order to obtain information on priority problem areas for agricultural research that are indispensable for the strategic planning process, to ensure effective operational coordination in the verification of agricultural technologies (mainly on the basis of on-farm trials), and to disseminate these technologies to the producers themselves.

In West Africa, considerable attention has been focused on the separation of agricultural research and extension and production organizations among different ministries. This situation prevails in the following countries: Burkina Faso, Cameroon, Congo, Ghana, Guinea, Ivory Coast, Nigeria, and Zaïre. Note that most of the largest countries in West Africa are included in this group. The main reason for this type of inter-ministerial fragmentation is the existence of separate ministries of science and technology which were established from the late 1960s onwards in West Africa.

Ministry of science and technology model. While there has been widespread criticism of this organizational arrangement in West Africa, few attempts have been made to analyze the specific historical and institutional contexts which gave rise to the establishment of these ministries of science and technology (MST). It is well known that this organizational model for science and technology was actively endorsed and promoted by UNESCO. However, it is equally important to understand why it was adopted by so many governments in West Africa.

First, at a general level, the MST model, by emphasizing the important and unique role of science and technology in the development process, complemented the efforts of local agricultural and other research institutions to improve the organizational status of their activities. Second, the MST model fitted in well with the traditional conception of the agricultural research process in West Africa, which was essentially top-down, focusing on applied research with limited concern with the technology dissemination and adoption processes *per se*.

Finally, in most of the francophone West African countries, agricultural research institutes had already developed strong, direct relationships with producers and parastatal production agencies, and these relationships remained largely unaffected by the establishment of ministries of science and technology.* Existing extension services and production activities within ministries of rural development and agriculture were, on the other hand, generally poorly developed. Furthermore, both institutionally and politically, these ministries were not considered to be sufficiently strong to effectively integrate the French commodity research institutes into a national research system. Consequently, a new ministry of science and technology was often regarded as the most appropriate organizational vehicle for the rationalization of agricultural research during the 1970s and 1980s in both francophone and the larger anglophone countries. It is noticeable that the MST model has not been adopted in those francophone West African countries where the influence of the French research institutes has been comparatively weak.

A different set of research-extension-production linkage issues tends to predominate in the remaining West African countries, most of which are very small (i.e., population of less than 2 million). While a single ministry of agriculture or rural development is usually responsible for research, extension, and services, these activities are still organized in separate departments. However, given the very small numbers of specialist professional personnel available, agricultural researchers often become heavily involved in both direct extension activities with farmers and other service responsibilities (most notably, seed multiplication, soil testing, and plant protection services). There is a danger, therefore, that these "other" activities may excessively encroach on the research work of agricultural researchers, thereby reducing the potential effectiveness of the agricultural research effort.

Inter-institutional coordination mechanisms. Table 2.5 summarizes the main types of organizational arrangements which have been devised by governments in West Africa with the objective of coordinating the activities of agricultural research institutions in each country. In practice, few of the agricultural research committees and councils which have been established have been able to successfully perform this coordinating role. The most prevalent reasons are:

- Most are only advisory bodies and therefore lack direct control over resource acquisition and disbursement. They often have weak links to key policymakers and politicians and therefore have tended to become marginalized in the decision-making process.

- They generally lack the necessary technical expertise and other institutional resources to be able to carry through rigorous and comprehensive strategic planning exercises.

- In small countries they can quickly become excessively large and unwieldy.

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* And, as previously noted, a relatively large amount of adaptive research had been undertaken directly by agricultural development projects and organizations themselves.

Table 2.5: Agricultural research councils and committees in West Africa 1985*

COUNTRY	TITLE	COMMENTS
Benin	National Agricultural Research Committee	Limited effectiveness.
Cameroon	Committee in MESRES	Reviews programs and budgets of IRA and IRZ.
CAR	National Committee on Agricultural Research	In practice, few efforts have been made to formulate national research plans.
The Gambia	Agricultural Research Advisory Board	Established in 1984 Limited role to date.
Ghana	(1) Council for Scientific and Industrial Research has five committees on agriculture.	Committee has never functioned.
	(2) Agricultural Research and Development Committee in the Ministry of Agriculture	Meets on regular basis and is reasonably effective.
Liberia	Agricultural Research Council	Rarely meets.
Mali	Agricultural Research Councils in Ministry of Agriculture & Rural Development	Councils convened every two years but chairmen meet more regularly.
Sierra Leone	National Agricultural Research Coordinating Council	Originally independent but now directly integrated into MANR. Recently established but not yet operational.
Togo	National Institute for Scientific Research	Official responsibility for coordination of agricultural research but ineffective.
Zaïre	Legal provision for National Science Council but still unnamed.	

* incomplete list.

Human Resource Management

It is commonly argued that scientific research organizations should have sufficient autonomy from central government control to be able to implement their own human resource policies and practices. The basic proposition underlying this argument is that scientific research is a sufficiently unique and creative activity that the normal human resources policies and practices typically prevailing in central government bureaucracies are inappropriate.

Most national agricultural research organizations in West Africa have very limited organizational autonomy with respect to the main areas of human resources planning and management, namely, recruitment, contractual obligations and control over the dismissal of personnel, training activities, and conditions of service. Thus, regardless of their precise institutional location and title, these organizations have been directly subject to civil service or other public administration regulations and procedures. As noted earlier, only ISRA in Senegal has achieved the semi-autonomous legal status of "un établissement public à caractère industriel et commercial" which, in theory at least, allows sufficient organizational autonomy to determine its own human resource policies. The issue of autonomy in resource procurement and disbursement which is needed to ratify these human resource policies is discussed below.

The other major exception has been within the university sector, in particular in the anglophone West African countries. In general, universities have enjoyed sufficient organizational autonomy to be able to more effectively control recruitment, dismissals, training, and promotion practices.

Financial Resource Acquisition and Disbursement

Again, it is argued that the special planning and operational requirements of agricultural research organizations require that they should be given considerable organizational autonomy with regard to both the acquisition and disbursement of financial resources. Logistically, agricultural research involves a highly complex set of operations, requiring precise scheduling of a large variety of inputs for activities often dispersed over extensive and remote geographical areas. Thus, financial disbursement procedures must be flexible and must allow for a considerable degree of decentralized decision-making.

The evidence from agricultural research organizations in West Africa indicates that the large majority have had to cope with highly restrictive government financial regulations which have seriously affected their ability to undertake agricultural research activities. As discussed in Chapter 3, few have their own independent sources of income (such as a cess on export earnings or other earmarked taxes). Financial disbursements are highly erratic, both over time and in actual amounts received, and virtually all expenditures must be authorized in advance by the central financial authorities, with very limited scope for reallocation.

REORGANIZATION ISSUES

What type of organizational structures are likely to be most appropriate for ensuring the development of effective national agricultural research systems in West Africa during the next 20-30 years?

While there are a number of common themes and problem areas in West Africa concerning the organization of agricultural research, it is equally clear that there are no simple solutions that can be prescribed for every country. In other words, no one type of organizational structure is universally most appropriate or desirable. Appropriate structure can only be determined after detailed analysis on a country-by-country basis. Only in this way is it possible to appreciate the all-important historical-political context that has shaped the development of specific organizations, and to assess how these have affected the ability of the research system to pursue specific research strategies and to undertake the necessary range of planning and management functions. Too often in the past, proposals for organizational change have been based on an inadequate understanding of these complex, interrelated issues.

There has also been a tendency to regard organizational change as a panacea. Donors have been attracted to the idea of major reorganization as the basis for comprehensive improvement strategies, in particular, because such changes are regarded as an indicator of government commitment to agricultural research. What needs to be recognized, however, is that the need for organizational change is often less urgent than the need to improve other functional aspects of agricultural research organizations. This is likely to be the case in many West African countries, where chronic resource problems have become so serious that differences in organizational structures have ceased to have any significant impact on the performance of researchers and organizations as a whole.

The last fifteen years or so has been a period of unprecedented organizational change for many national agricultural research systems in West Africa. As was discussed earlier, these changes have often been part of longer-term strategies to create or strengthen national agricultural research systems. This is particularly the case with regard to the nationalization of agricultural research in the francophone West African countries. Thus, initiating a new round of system-level organizational changes is likely to be highly counterproductive in the majority of West African countries. In short, the need for major reorganization is more likely to be the exception than the rule. And, even where organizational improvements are required, these can often be achieved by relatively minor modifications in existing decision-making structures, usually involving only small changes to existing legislation and/or internal government regulations.

Research Planning and Coordination

As noted earlier, an essential precondition for the creation of an effective national agricultural research system is strong, centralized control and coordination of agricultural research activities via the strategic planning process. Given that agricultural research organizations in most West African countries are under the direct responsibility of a single ministry, there already exists the potential to ensure the required level of centralized control and coordination. There

seems little point, therefore, in fundamentally altering existing organizational arrangements. What is most urgently required is to improve the degree of collaboration and coordination between research organizations in those countries where there still exists considerable intra-ministerial organizational fragmentation. Thus, steps need to be taken to establish or strengthen the coordinating mechanisms within each ministry, and to improve the capacity to set research priorities and allocate resources. If effective coordination and collaboration cannot be achieved, the only alternative may be to merge the separate agricultural research organizations into a single institution. For the smaller countries in West Africa, this is probably the most desirable organizational arrangement in the longer term.

In the past, considerable emphasis has been placed on the role of national agricultural research councils as the primary organizational focus for the strategic planning of agricultural research. It has been argued above that in most countries in West Africa these bodies should be firmly located within the ministry which has primary responsibility for agricultural research. Furthermore, it is unrealistic to expect extension and farmer representatives on these councils or committees to be able to articulate with sufficient precision research requirements and priorities for the country as a whole. This can only be undertaken on the basis of detailed analyses of existing farming systems by the research organizations themselves. Finally, in the very small countries of West Africa it is unlikely that a specialized agricultural research council can be justified, and a more appropriate body would be one that covers all the key areas of agricultural research and development.

The fragmentation of the agricultural research effort caused by donor-assisted projects must also be eliminated or, at least, significantly reduced, if national agricultural research systems are to be able to plan their research activities systematically. The increased willingness of donors to coordinate their support to national agricultural research programs is likely to be one of the most promising solutions to this problem in the future.

Using major organizational restructuring to achieve greater control over agricultural research undertaken by university personnel is neither desirable nor feasible in the majority of West African countries. It is essential, however, that the main ministry or ministries responsible for agricultural research be able to strongly influence the university research effort. In practice, there is considerable scope for developing more informal control mechanisms which effectively channel available resources for agricultural research through a central planning and coordinating body. Greater centralization of these resources will allow the responsible ministries to contract university personnel to undertake specific research. Under present conditions, donors could play a key role in fostering the development of linkages of this type.

Organizational Autonomy

Most agricultural research organizations in West Africa have very limited organizational autonomy in relation to the main areas of human and financial resources management. Given the serious problems this lack of autonomy has created for agricultural research organizations, workable solutions must be found as quickly as possible. The most common proposal has been for the creation of autonomous or semi-autonomous research

organizations. While this proposal is superficially very attractive, in practice there are a number of major problems associated with it. First, evidence from other countries indicates that where organizations of this type have been created, they have only rarely been able to exercise the full degree of organizational autonomy that was originally envisaged. This has been due to both political and financial constraints. Only in exceptional circumstances has it been possible to generate and sustain the levels of political support necessary for organizational arrangements of this kind to function properly. Second, the corollary of greater organizational autonomy is likely to be greater organizational isolation. In particular, this can create serious problems in developing effective linkages with other public-sector extension, service, and production organizations. Granting privileged organizational status to agricultural research may aggravate rather than improve relationships with personnel in these other organizations. Third, organizational autonomy increases the need for high-quality research management. Where this is deficient, serious problems can arise which may precipitate central government intervention. In other words, a research organization will need to have developed a competent and mature cadre of research managers before it is in a position to cope with the additional managerial demands of an autonomous organization.

It may be possible to alleviate some of the most serious constraints to the utilization of human and financial resources without creating a semi-autonomous institution. Management's room for maneuver will depend on a range of factors. Of particular importance, however, is the ability of research managers to identify precisely the main problem areas and, with the concerted support of other key organizations (including the major donors), to present a strong case to the relevant government authorities. If important concessions cannot be achieved through negotiation of this kind, it is probably naive to expect that government will be prepared to go even further and sanction major reorganizational changes to the research system as a whole.

Linkages with Extension and Production

It is commonly argued that agricultural research and extension should be part of the same ministry. For this reason much concern has been expressed about the pervasiveness of separate ministries of science and technology in West Africa. However, as was pointed out earlier, it is by no means certain that incorporating agricultural research organizations into ministries of agriculture or rural development will improve the technology dissemination process. Indeed, some would argue that extension services are often so inefficient that it is in fact better to keep agricultural research activities separate from them. More realistically, however, it seems clear that serious attention needs to be given to the precise nature of the interface between research, extension, and production. At the operational level, the impetus for this will be especially strong where research and extension personnel are jointly involved in the implementation of on-farm research and extension trials which are of central importance to location-specific adaptive research strategies. Similarly, extension methodologies such as the training and visit system call for very close organizational links between research ad extension.

In the very small countries of West Africa, the most satisfactory organizational arrangement may well be the complete elimination of separate research and extension institutions, with professional staff being formally employed with both adaptive research and extension responsibilities. The attractiveness of this arrangement would be considerably enhanced where there is also a relatively well-developed university faculty of agriculture, whose staff could be contracted to conduct more specialized research.

Specific Organizational Arrangements

Having discussed some of the main organizational considerations concerning the overall planning, management and linkage functions of agricultural research systems in West Africa, the appropriateness of more specific organizational arrangements for agricultural research in the region can now be examined. As was emphasized earlier, it is only possible at this level of generalization to identify some of the major issues that will need to be addressed by comprehensive and detailed country-level reviews.

Agricultural research in West Africa must be specifically organized so as to facilitate the implementation of national and regional agricultural research strategies during the next 20-30 years. It is generally agreed that these research strategies will be based on two main types of research activity:

(1) The development of clearly focused applied research programs for the major commodities and agro-ecological areas in the region. This research will be mainly undertaken by agricultural research organizations in the larger countries (Ghana, Nigeria, Cameroon, Ivory Coast, Senegal, and Zaïre) in addition to regional research organizations (most notably the international agricultural research centers for food crops). To avoid unnecessary duplication of effort and to ensure that major research problems are effectively covered, there should be close collaboration and coordination between these research organizations.

(2) Strong emphasis on adaptive research throughout the region, in particular in the countries with populations of less than five million. These countries will need to rely heavily on the applied research generated by the larger national research systems and regional organizations as the primary source of new technologies for their adaptive research activities.

What are the organizational implications of such a research strategy? First, steps must be taken to develop a coherent regional organizational framework for agricultural research which will provide the basis for the necessary direct collaborative work, especially among those organizations engaged in applied research. In addition, this framework will ensure the effective dissemination of information, in particular to and from the smaller countries that will have to rely on imports of agricultural knowledge and technology from elsewhere in the region. The most appropriate organizational arrangement would likely be the development of carefully conceived regional research programs delineated on both a commodity and disciplinary/factor basis. Clearly, numerous political and financial problems are involved in designing and implementing regional programs of this kind. From past experience, it seems likely that these programs will have to be funded and coordinated largely by external

donors. This may be particularly so for some export commodities, because the pressures of international competition and self-interest may make it difficult for agricultural research organizations in some countries to directly collaborate or share information with each other. Where this problem is particularly serious, the only solution may be the establishment of a regional research organization which will ensure the free dissemination of new knowledge to all interested parties.

Second, the dominant organizational form for most of the more applied research institutions (at both the national and regional levels) should continue to be commodity based, although there will be a need for a few disciplinary research organizations e.g., soil and water conservation for the Sahel region.

Third, the most appropriate organizational form for adaptive research within the national research systems is likely to be the location-specific research station or institute which has a multi-commodity mandate based on well-defined systems approaches, with a complement of researchers covering the main agricultural and scientific specializations. Among the smallest countries in West Africa such location-specific research institutions may also need to be directly responsible for extension and service activities.

Finally, regardless of the specific organizational arrangements, each national agricultural research system should have clearly defined national research programs to provide the unifying organizational framework which overlays all institutional activity. These programs should be based on sound management of financial and human resources, preferably through a system of program budgeting.

CHAPTER 3

FINANCIAL RESOURCES

INTRODUCTION

The following discussion summarizes the funding of agricultural research in West Africa for the last 20 years. It must be pointed out, however, that the quality of the available data is generally poor, so that considerable caution is required in interpreting them. Expenditures on agricultural research in the university sector, in agricultural development projects, and at regional or international agricultural research organizations have not been included in the national totals.

Major Trends, 1965-1985

Given the paucity of continuous time series data, total agricultural research expenditure (including both national and donor contributions) in each West African country has been averaged over five-year intervals between 1965 and 1985. It can be observed in Tables 3.1 and 3.2 that there have been sizeable increases in real expenditures on agricultural research in all countries during this period as a whole with the exception of Mauritania, Niger, Benin, and Zaïre. However, it would appear that there has been some deterioration in total financial provision (measured in real terms) in the following countries since the early 1980s: Benin, Ivory Coast, Togo, Niger, Liberia, and Nigeria. On the other hand there have been significant increases in Cameroon and Ghana, and probably Burkina Faso and The Gambia.

In the mid 1980s, external sources of funding constituted between 40 and 85% of total national budgets in the francophone West African countries (see Table 3.3) but appreciably smaller percentages (with the exception of Liberia) in the anglophone West African countries. Unfortunately, data concerning major trends in donor funding are not available. Until recently, donor funding has been concentrated in specific agricultural research projects and has been generally confined to three types of expenditure: capital investments, training, and technical assistance.

Income derived from the sales of agricultural products (including seeds) appears to be of minor importance in most countries, with the notably exception of Ivory Coast and, to a lesser extent, Benin.

EXPENDITURE BREAKDOWNS

The breakdown of expenditures into capital investment and recurrent costs is presented in Table 3.4. Most countries have been heavily dependent on donor funding for capital investments in agricultural research facilities, equipment, and vehicles. Although time series data are unavailable, it seems clear that the proportion of total expenditure allocated to recurrent costs has increased significantly in many countries during the last 10-15 years. This is mainly attributable to an increase in the numbers of agricultural researchers and staff employed, which requires an ever-increasing proportion of financial resources for salaries and other personnel costs. While the breakdown between operating and salary expenditures does not appear at first sight to be as unbalanced in many countries as is commonly suggested, total expenditures per researcher have declined appreciably in many agricultural research organizations in recent years (see Chapter 4).

Table 3.1: Five-year averages of agricultural research expenditures in millions of constant 1980 US$

Sub-region and Country	1965-1969	1970-1974	1975-1979	1980-1984	Latest Year Available	
FRANCOPHONE-SAHEL						
Burkina Faso	0.720	0.585	N.A.	6.282	7.885	(2)
Cape Verde	N.A.	N.A.	N.A.	0.179	0.179	(3)
Chad*	0.890	1.146		1.602	0.622	
The Gambia*	0.037	0.041	N.A.	0.360	N.A.	
Guinea Bissau	N.A.	N.A.	N.A.	0.408	0.408	(2)
Mali	1.519	3.384	N.A.	7.819	7.819	(2)
Mauritania	N.A.	0.848	0.175	0.142	0.142	(4)
Niger	N.A.	2.283	1.163	1.622	1.142	(1)
Senegal	4.328	5.405	8.166	9.767	13.369	(1)
FRANCOPHONE-SAVANNAH/ HUMID TROPICS						
Benin	N.A.	2.019	2.298	1.430	1.271	(2)
Cameroon	2.032	2.121	4.567	9.200	11.289	(1)
CAR	N.A.	N.A.	N.A.	N.A.	N.A.	
Congo	0.521	N.A.	N.A.	3.967	3.967	(1)
Eq. Guinea	N.A.	N.A.	N.A.	N.A.	N.A.	
Guinea	N.A.	N.A.	N.A.	N.A.	N.A.	
Gabon*	N.A.	N.A.	N.A.	0.583	2.642	
Ivory Coast	N.A.	11.165	N.A.	27.326	20.600	(1)
Togo	N.A.	N.A.	N.A.	3.655	2.386	(1)
ANGLOPHONE (Excl. Nigeria)						
Ghana	5.419	5.166	9.437	17.966	25.803	(2)
Liberia	0.388	0.648	N.A.	3.297	3.236	(1)
Sierra Leone	0.386	N.A.	N.A.	0.987	0.987	(1)
Nigeria	14.338	N.A.	99.302	94.129	62.889	(2)
Zaïre*	N.A.	8.230	8.608	5.098	5.016	

Note: In latest year available, number in figure denotes year referred to: 1984 = (1), 1983 = (2), 1982 = (3), 1981 = (4).

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

* Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

Table 3.2: Financial growth indices for agricultural research in West Africa, 1965-69 - 1980-84

Sub-region and Country	1965-69	1970-74*	1975-79	1980-84
FRANCOPHONE - SAHEL				
Burkina Faso	123	100	N.A.	1073
Chad	78	100	N.A.	140
The Gambia	90	100	N.A.	878
Mali	45	100	N.A.	231
Mauritania	N.A.	100	N.A.	17
Niger	N.A.	100	51	50
Senegal	80	100	151	181
FRANCOPHONE-SAVANNAH HUMID TROPICS				
Benin	N.A.	100	114	71
Cameroon	96	100	215	433
Congo	100	N.A.	N.A.	761
Ivory Coast	N.A.	100	N.A.	245
ANGLOPHONE (excl. Nigeria)				
Ghana	105	100	183	348
Liberia	60	100	N.A.	508
Sierra Leone	100	N.A.	N.A.	255
Nigeria	100	N.A.	692	656
Zaïre	N.A.	100	105	62

*1970-74 = 100 unless otherwise indicated
Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 3.3: Breakdown of total expenditures by source of funding (%)

Sub-region and Country	Year	National Budget	Sale of Products	Internal Sources (Total)	External Sources
FRANCOPHONE - SAHEL					
Burkina Faso	1982	N.A.	N.A.	14	86
Chad	N.A.	N.A.	N.A.	N.A.	66*
Guinea Bissau	1983	65	0	65	35
Mali	1983	40	0	40	60
Mauritania	1985	55	2	57	43
Niger	1984	N.A.	N.A.	52	48*
Senegal	1984	19	13	32	68
FRANCOPHONE - SAVANNAH/ HUMID TROPICS					
Benin	1983	60	20	20	80
Cameroon	1984	N.A.	N.A.	49	51
CAR	N.A.	N.A.	N.A.	N.A.	N.A.
Congo	1984	N.A.	N.A.	38	62
Ivory Coast	1983	18	41	59	41
Togo	1984	44	7	51	49
ANGLOPHONE (excl. Nigeria)					
Ghana	1983	80	10	90	10
Liberia	1984	55	6	61	39
Sierra Leone	1984	N.A.	N.A.	82	18
Nigeria	1983	90	10	100	0

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

This source includes sale of products, cess on export commodities.

*Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

The seriousness of the recurrent cost burden has resulted in an increasing willingness of donors to meet some or most of the recurrent costs of agricultural research projects in West Africa. This has always been the case among the GERDAT/CIRAD and ORSTOM research institutes, where the expatriate researcher was accompanied by an operating budget, and the institutes were closely tied to their metropolitan headquarters.

FUNDING STABILITY

Available data on the annual percentage fluctuations in agricultural research expenditures at the country level in West Africa between 1975 and 1985 are presented in Table 3.5. For the majority of countries, financial provision has been highly erratic, which has had highly adverse consequences on the ability of research organizations to sustain and develop their research activities in an orderly manner. Clearly, the main reason for these fluctuations is the increasingly severe fiscal crises confronting most governments in West Africa. In addition, the sporadic and lumpy nature of most donor-assisted agricultural research projects, coupled with often dramatic currency devaluations (especially in more recent years), have also been important factors.

INTERNATIONAL EXPENDITURE COMPARISONS

As can be observed in Table 3.6, total expenditure per agricultural researcher in West Africa appears to be significantly higher than elsewhere in the developing world. In anglophone West Africa, however, drastically over-valued exchange rates are likely to be a major explanatory factor. If shadow exchange rates are used, expenditures per researcher measured in U.S. dollars would be at least half the nominal estimates for the early 1980s. In other words, much of the seemingly high research cost in these countries is illusory. A major factor in francophone West Africa is the relatively high percentage of expatriates employed - 23% in the Sahel countries and 54% in the humid tropics. The total cost of employing these foreign personnel is generally very high.

Local salaries for researchers in West Africa are not, in real terms, however, considerably higher than elsewhere in the developing world, as has sometimes been suggested. The conditions of service of national research personnel in West Africa have not been adequately studied. In particular, it is very difficult to get the agreement of national governments to look into non-salary benefits (housing, car, various premiums paid by donor projects). However, based on personal communications with people working in the field, we assert that local salaries for agricultural researchers in West Africa are not, in real terms, higher than elsewhere in the developing world. Nigerian salaries were once very high, but today they are quite low in real terms.

Table 3.4: Distribution of total expenditures (%) by major category

Sub-region and Country	Year	Capital Investment	Recurrent Costs	Operating Costs	Salaries & Related Costs
FRANCOPHONE - SAHEL					
Burkina Faso	1982	27	73	49	51
Cape Verde	N.A.	N.A.	N.A.	N.A.	N.A.
Chad	N.A.	N.A.	N.A.	N.A.	N.A.
The Gambia	N.A.	N.A.	N.A.	N.A.	N.A.
Guinea Bissau	1983	40	60	33	67
Mali*	1983	19	81	14*	86
Mauritania	N.A.	N.A.	N.A.	N.A.	N.A.
Niger	1984	0	100	15	85
Senegal	1984	18	82	35	65
FRANCOPHONE - SAVANNAH/ HUMID TROPICS					
Benin	1983	14	86	47	53
Cameroon	1984	48	52	73	27
CAR	N.A.	N.A.	N.A.	N.A.	N.A.
Congo	1984	19			
Equatorial Guinea	N.A.	N.A.	N.A.	N.A.	N.A.
Guinea	N.A.	N.A.	N.A.	N.A.	N.A.
Gabon	N.A.	N.A.	N.A.	N.A.	N.A.
Ivory Coast	1983	40	60	33	67
Togo	1984	20	80	25	75
ANGLOPHONE (excl. Nigeria)					
Ghana	1983	13	87	46	54
Liberia	1984	0	100	N.A.	N.A.
Sierra Leone	1983	0	100	25	75
Nigeria	1983	30	70	47	53
Zaïre	1983	2	98	29	71

Notes: Recurrent costs are taken at 100 in calculating the percentage distribution between salaries and operating costs.

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

*Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

Table 3 5: Annual fluctuations of agricultural research expenditures in West Africa, 1975-1976 - 1984-1985

Sub-region and Country	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85
FRANCOPHONE - SAHEL										
Burkina Faso	NA	NA	NA	NA	NA	NA	NA	-34	NA	NA
Mauritania	NA	NA	NA	-23	-5	NA	NA	NA	NA	NA
Senegal	NA	3	-1	0	-19	33	16	93	11	
FRANCOPHONE-SAVANNAH/ HUMID TROPICS										
Benin	-9	-1	-10	6	-34	-2	NA	NA	NA	
Cameroon	34	30	-24	3	38	28	24	28	10	NA
Ivory Coast	NA	NA	NA	NA	NA	NA	03	4	-19	NA
Togo	NA	NA	NA	NA	NA	NA	NA	NA	06	NA
ANGLOPHONE (excl. Nigeria)										
Ghana	62	-31	-28	28	-22	NA	NA	NA	NA	NA
Liberia	NA	NA	NA	NA	NA	NA	NA	NA	-2	NA
Nigeria	NA	51	1	-23	12	-5	019	11	NA	NA

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 3.7 below summarizes empirical information for some of the West African systems. Field work would be required to obtain more precise information and to integrate the non-salary benefits. However, it is clear that high base salaries of national researchers do not account for the high cost per researcher in West Africa. This is even more evident when one recognizes that in many of the poorer countries of the region the governments are in arrears in the payment of even these low salaries to their research personnel.

The apparently high cost of researchers may be associated with two other factors. First, there may be a tendency to employ excessive numbers of unskilled and semi-skilled personnel, which seriously inflates recurrent costs. Second, in the larger francophone countries, the research infrastructure was inherited from a colonial system which had different goals and different resources. Because each of the commodity institutes functioned separately, each had its complete complement of scientists, laboratories, and disciplines in order to perform commodity research whose results were exchanged on an inter-territorial basis. When the systems became nationalized, and the commodity institutes were fused into multicrop national institutes, the now excessive infrastructure was left as it was. In Zaïre, a serious effort is under way to adjust the INERA system. A national study team recommended the reduction of the system from 21 stations to 10. In Nigeria, the large staff and infrastructure of NIFOR is an example of the imbalance between tasks to be done and resources employed accounting for high costs. In short, the problems of high costs in West Africa appear to be associated more with management of resources than with the high real costs of researchers.

Table 3.6: Total expenditures per researcher (1980-84 average) in constant 1980 US$

Region	1980 US$
Central America and Caribbean	54,104
South America	52,062
Southeast Asia	25,792
Pacific	76,702
Middle East	27,256
North Africa	17,112
East Africa	38,860
Southern Africa	46,415
West Africa	79,802
Francophone - Sahel	42,388
Francophone - Humid	89,396
Anglophone - Humid	104,297
Nigeria	93,720

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 3.7: Monthly salaries of national agricultural researchers*

	LCV	Junior	Middle	Senior
Burkina Faso (1982)	CFA	-	50,000 ($166)	-
Senegal (1986)	CFA	166,000 ($553)	-	291,000 ($970)
Nigeria (1986)	N	916 ($203)	1,250 ($277)	-
The Gambia (1986)		($85)	($105)	($125)
Zaïre (1983)	Z			
National Program		3,000 ($83)	5,500 ($152)	8,000 ($222)
INERA		1,945 ($54)	2,625 ($73)	7,775 ($216)

* Figures are likely to be imprecise because they are based on personal communication.

CHAPTER 4

HUMAN RESOURCES

INTRODUCTION

The success of agricultural research in West Africa is, as elsewhere, dependent on the quantity and quality of the human resources which are deployed. Of particular importance are the skills, attitudes, and commitments of relatively small national and international groups of professional agricultural researchers and their technical and administrative support personnel. This chapter has two objectives. The first is to describe the main characteristics of the personnel employed at national and regional research institutions in West Africa, and to then consider some key issues which have affected their utilization and overall productivity. The second is to outline some of the desirable features of a human resources strategy for agricultural research in West Africa for the next 20-30 years.

The paucity of data on human resources in agricultural research in West Africa poses a serious problem for a review of this kind. Primarily for this reason the following discussion focuses mainly on the employment of agricultural researchers. This is not completely satisfactory, however, in that insufficient analysis is devoted to the critical role played by technical and administrative support personnel.

QUANTITATIVE OVERVIEW OF AGRICULTURE RESEARCHERS

Three main groupings of professional personnel undertake agricultural research in West Africa: a core group comprised of full-time researchers employed by institutions directly under the responsibility of central government ministries; members of university faculties who are normally involved in undertaking agricultural research on a part-time basis; and researchers employed by international and regional agricultural research institutions. The national totals for each of these groups in West Africa are presented in Table 4.1.

Central government institutions. Table 4.2 shows that the numbers of agricultural researchers employed by government institutions increased from around 750-800 in the late 1960s to 2500 in 1984-85; i.e., a three- to four-fold increase in a fifteen-year period. In addition, sizeable numbers of researchers have been employed independently by agricultural projects. Data on the overall size and country breakdown of this more highly dispersed group of researchers are unavailable, although there are likely to have been at least 150-200 in francophone West African countries in the early 1980s.

There have also been significant changes in the intra-regional distribution of agricultural researchers, notably a doubling (from 15.0%

Table 4.1: Agricultural researchers* in West Africa by main institutional grouping, 1983/84

Sub-region and country	Government	University	Regional/ International	Total	Govt. as % total	University as % total	Regional/International as % total
FRANCOPHONE - SAHEL							
Burkina Faso	110	46	13	169	65.1	27.2	7.7
Cape Verde	14	-	-	14	100.0	-	-
Chad	28	-	-	28	100.0	-	-
The Gambia	23	-	-	23	100.0	-	-
Guinea Bissau	8	-	-	8	100.0	-	-
Mali	185	72	21	278	66.5	25.0	7.6
Mauritania	15	-	-	15	100.0	-	-
Niger	57	44	16	117	48.7	37.6	13.7
Senegal	233	125	7	365	63.8	34.2	1.9
SUB-TOTAL	673	287	57	1017	66.2	28.2	5.6
FRANCOPHONE-SAVANNAH/ HUMID TROPICS							
Benin	56	28	2	86	65.2	32.6	2.2
Cameroon	176	75	11	262	67.2	28.6	4.2
CAR	26	11	-	37	70.3	29.7	-
Congo	20	-	-	20	100.0	-	-
Guinea	35	416	-	451	7.8	92.2	-
Gabon	24	-	-	24	100.0	-	-
Ivory Coast	202	56	2	260	77.7	21.5	0.8
Togo	58	25	-	83	69.9	30.1	-
SUB-TOTAL	597	611	15	1223	48.8	50.0	1.2
ANGLOPHONE (excl. Nigeria)							
Ghana	168	74	-	242	69.4	30.6	-
Liberia	35	41	17	93	37.6	44.1	18.3
Sierra Leone	54	108	5	167	32.3	64.7	3.0
SUB-TOTAL	257	223	22	502	51.2	44.4	4.4
Nigeria	739	722	109	1570	47.0	46.0	6.9
Zaïre	111	21	4	136	81.6	15.4	3.0

Note *: Includes national and foreign personnel with first degree university qualification.

Source: Preliminary data from the ISNAR data base on agricultural research indicators (June 1986), and P. Bennell "Agricultural Researchers in Sub-Saharan Africa: An Quantative Overview". ISNAR Working Paper No.5. The Hague, 1986. Annual reports of CGIAR centers.

Table 4.2: Five-year averages of full-time government researchers in West Africa

Sub-region and country	1965-1969	1970-1974	1975-1979	1980-1984	Latest year available*	% Total 1965-69	% Total latest year
FRANCOPHONE - SAHEL							
Burkina Faso	9	10	33	120	110	1.2	4.4
Cape Verde	0	0	0	14	14	0.0	0.6
Chad	20	25	N.A.	28	28	2.7	1.1
The Gambia	7	5	10	20	23	0.9	0.9
Guinea Bissau	0	0	N.A.	8	8	0.0	0.3
Mali	21	37	N.A.	185	185	2.8	7.4
Mauritania	4	5	4	16	18	0.5	0.7
Niger	0	13	16	50	77	0.0	3.0
Senegal	51	121	148	233	233	6.8	9.3
SUB-TOTALS	112	216	N.A.	702	696	14.9	29.3
FRANCOPHONE - SAVANNAH/ HUMID TROPICS							
Benin	10	19	32	45	56	1.3	2.2
Cameroon	81	93	0	163	176	10.9	6.9
CAR	19	22	0	0	54	2.6	2.1
Congo	29	29	26	0	50	3.9	2.0
Equatorial Guinea	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Guinea	0	17	N.A.	N.A.	35	0.0	1.3
Gabon	N.A.	N.A.	N.A.	N.A.	24	N.A.	1.0
Ivory Coast	80	120	N.A.	210	232	10.8	9.1
Togo	0	11	0	47	54	0.0	2.1
SUB-TOTALS	219	311	N.A.	N.A.	681	29.4	26.7
ANGLOPHONE (excl. Nigeria)							
Ghana	126	137	160	168	176	17.0	6.9
Liberia	28	18	23	35	38	3.8	1.5
Sierra Leone	29	32	N.A.	N.A.	54	3.9	2.1
SUB-TOTALS	183	187	N.A.	N.A.	268	24.7	10.5
Nigeria	192	333	N.A.	N.A.	739	25.8	29.0
Zaïre	37	66	N.A.	111	111	5.0	4.4
TOTAL	743	1113	N.A.	N.A.	2495	100.0	100.0

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

to 29.3%) in the proportion of Sahelian country researchers between 1965-69 and 1980-84, and a corresponding percentage decline among the anglophone countries (excluding Nigeria). This is also indicated by the relatively higher research growth indices among most of the Sahelian countries. (See Table 4.3). Recent trends in the overall growth of researchers are more difficult to discern from the available data, but it would appear that while growth rates are still generally high, there has been some leveling off, particularly in the larger countries.

The national breakdowns between national and expatriate* agricultural researchers employed by central government institutions in 1970 and 1983/84 are presented in Table 4.4. What is particularly striking about the francophone West African countries is that it was not until the early 1970s that nationals were recruited as researchers in any significant numbers. In the Sahelian countries, while there were only 11 national agricultural researchers in 1970 (just 11% of the total), the figure had increased to 477 by 1983, representing 73.3% of all government agricultural researchers. Similarly, in the francophone savannah-humid tropics subregion, the number of national agricultural researchers increased from 33 in 1970 to 310 (excluding Guinea) by 1983. In both regions the numbers of expatriate researchers increased slightly in absolute terms during this period.

In anglophone West Africa there were already sizeable numbers of national agricultural researchers by 1970, which was largely the outcome of active localization policies coupled with major training programs. In the two largest countries, Ghana and Nigeria, 46% and 80% respectively of all agricultural researchers employed in government organizations were nationals in 1970. In these countries the proportions continued to increase steadily thereafter, so that by 1983 expatriate researchers comprised less than 10% of the total number in both countries.

When expressed in terms of researchers per million total rural and rural economically active populations, the number of full-time agricultural researchers employed by government institutions in West Africa as a whole compares favorably with the corresponding figures for east and southern Africa, as well as south and east Asia (see Table 4.5). If Zaïre (which has an exceptionally small researcher/rural population ratio) is excluded, then the West African figure is considerably higher. However, it should also be pointed out that in industrial countries the number of agricultural researchers per million of the agricultural labor force is typically in the region of 2000-4000, or 40-80 times the aggregate West African figure.

Universities. Universities are the other major institutional component of national agricultural research systems (NARS) in West Africa. While the faculties of agriculture and veterinary science (which have been established in 16 countries) are of particular importance, there is a wide range of other disciplinary areas in both the sciences and social sciences which are of direct relevance to agricultural research activities.

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* working for national agricultural research organizations; i.e., not for international or regional institutions.

Table 4.3: Index of five-year averages of full-time government agricultural researchers in West Africa

Sub-region & country	1965-1969	1970-1974	1975-1979	1980-1984	Latest year available*
FRANCOPHONE - SAHEL					
Burkina Faso	90	100	330	1200	1100*
Cape Verde	87	100	N.A.	175	189*
Chad	80	100	N.A.	N.A.	112**
The Gambia	140	100	200	960	1440**
Mali	57	100	N.A.	500	500*
Mauritania	80	100	80	320	360
Niger	N.A.	100	123	385	592
Senegal	42	100	122	193	193*
TOTAL	52	100	N.A.	325	344
FRANCOPHONE-SAVANNAH/ HUMID TROPICS					
Benin	53	100	168	237	295*
Cameroon	87	100	0	175	189**
CAR	86	100	0	N.A.	N.A.
Congo	100	100	90	N.A.	172
Ivory Coast	67	100	N.A.	175	193
Togo	N.A.	100	N.A.	427	490*
TOTAL	70	100	N.A.	N.A.	219
ANGLOPHONE (excl. Nigeria)					
Ghana	92	100	117	123	128
Liberia	156	100	128	194	211**
Sierra Leone	91	100	N.A.	N.A.	169
TOTAL	98	100	N.A.	N.A.	143
Nigeria	58	100	N.A.	N.A.	221
Zaïre	56	100	N.A.	168	168

Note: *1985, unless otherwise specified: (*) = 1983; (**) = 1984

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 4.4: National and expatriate researchers employed by government agricultural research organizations in West Africa, 1970 and 1983/84

Sub-region & Country	1970 N	1970 F	1970 Total	1970 Nationals % Total	1983 N	1983 F	1983 Total	1983 Nationals % Total
FRANCOPHONE - SAHEL								
Burkina Faso	0	9	9	0	78	34	112	70
Cape Verde	NA	NA	NA	NA	11	3	14	79
Chad	1	11	12	8	20	8	28	71
The Gambia	0	4	4	0	18	5	23	78
Guinea Bissau	NA	NA	NA	NA	7	11	8	88
Mali	7	15	22	32	174	11	185	94
Mauritania	0	6	6	0	NA	NA	NA	NA
Niger	0	10	10	0	22	26	48	46
Senegal	3	35	38	8	147	86	233	63.1
SUBTOTALS	11	90	101	11	477[A]	174[A]	657[A]	73.3
FRANCOPHONE-SAVANNAH/ HUMID TROPICS								
Benin	NA	NA	NA	NA	52	4	56	93
Cameroon	13	84	97	13	109	67	176	62
CAR	0	22	22	0	13	41	54*	24
Congo	9	20	29	31	16	4	20	80
Guinea	9	8	17	53	NA	NA	NA	NA
Gabon	0	5	5	0	12	12	24	50
Ivory Coast	2	133	135	1	64	152	216	30
Togo	2	7	9	22	44	14	58	76
SUBTOTALS	33	272	305	11	310	294	604	51.3
ANGLOPHONE (excl. Nigeria)								
Ghana	76	87	163	47	161	7	168	96
Liberia	9	18	27	33	26	9	35	74
Sierra Leone	12	11	23	52	NA	NA	54	NA
SUBTOTALS	97	116	213	46	187[A]	16	203[A]	92[A]
Nigeria	242	61	303	80	NA	NA	739	70
Zaïre	15	16	31	48	111	0	111	100

Notes: N: Nationals F: Foreigners
*: Figures includes national and foreigners
[A]: Totals exclude NA: WAARR/Oram Report

Source:
1970 figures: Association for the Advancement of the Agricultural Sciences in Africa "Towards Trained Manpower for Agricultural Research in Africa", Mimeo, Addis Ababa, 1970
1983 figures: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 4.5: Number of agricultural researchers per million total population, rural population, and economically active population, 1985

Region	Agric.res./ total population	Agric.res./ agric. population	Agric.res./ economic active population	Expatriate researchers as % total
Central America & Caribbean	19	48	155	2.7
South America	29	93	294	1.0
Southeast Asia	13	21	55	1.3
Middle East	23	44	143	7.4
Africa	20	30	81	30.0
North Africa	41	74	255	0.2
East Africa	12	16	43	13.7
Southern Africa	14	20	49	37.5
West Africa	14	23	56	19.1
Francophone Sahel	22	27	62	24.7
Francophone Humid-Savannah	23	33	71	48.7
Anglophone Humid-Savannah	15	27	74	10.7
Nigeria	13	16	51	10.0 (est)
Zaïre	4	5	12	3.0 (est)

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

The total number of national and expatriate academic staff members of faculties of agriculture and veterinary medicine in West Africa in 1976 and 1983 are presented in Table 4.6. Among the francophone West African countries, it was not until the 1970s that any significant development of university-level agricultural training capacity was initiated. However, by 1983 university-based agricultural science professionals typically represented between 20 and 30% of the total national stocks of these personnel in most francophone West African countries (see Table 4.1). While this represents a potentially sizeable pool of skills which could be utilized for agricultural research in the future, at their present early stage of development, most of these institutions are focusing their efforts on building-up teaching capacity at the undergraduate level.

In anglophone West Africa, on the other hand, a network of agriculture faculties was already well established by the late 1960s. In Nigeria there was also further major expansion in university-level agricultural education from the mid 1970s, with a three-fold increase in professional staff between 1976 and 1983. It can be observed in Table 4.1 that, in simple numerical terms, university agriculture faculty members in each of these countries now represent sizeable proportions (30% in Ghana, 40-50% in Liberia and Nigeria, and over 65% in Sierra Leone) of agriculture professionals potentially capable of undertaking research activities.

Expatriates make up roughly the same proportion of agriculture faculty professionals in francophone West African countries as in government agricultural research institutions (approximately 40% in aggregate terms). In the anglophone West African countries, while only around 5% of agricultural researchers employed by government agricultural research institutions are expatriates, this figure rises to 15% in the agriculture faculties.

International institutions. Slightly over 200 researchers were employed in West Africa by the CGIAR international agricultural research centers in 1983/84 (see Tables 4.6 and 4.7). Among these, IITA accounted for nearly 60%, WARDA/IRRI 18%, ICRISAT 14%, and ILCA 10%. The geographical distribution of these researchers was as follows: francophone-sahel 27.5%, francophone-savannah humid tropics 7.2%, anglophone West Africa (excluding Nigeria) 10.6%, Zaïre 1.9%, and Nigeria 52.6%. It can be observed from Table 4.1 that CGIAR researchers normally comprise less than 10% of the total stock of agricultural scientists in those countries where they are working. From a global perspective, the per capita number of CGIAR researchers in West Africa is approximately 4-5 times the average for all the continents combined (excluding China).

HUMAN RESOURCE DEVELOPMENT

University training and recruitment. The following discussion briefly examines the extent to which agricultural research institutions in West Africa have been able to recruit the required number of university graduates with the intellectual capacities, technical skills, and attitudes needed to become productive agricultural researchers.

Table 4.6: Professional staff members of faculties of agriculture and veterinary medicine in West Africa, 1976 and 1983

	1976							1983							
	FOA		FOVM		TOTALS			FOA		FOVM		TOTALS			%
SUB-REGION AND COUNTRY	N	F	N	F	N	F	All	N	F	N	F	N	F	All	increase
FRANCOPHONE SAHEL															
Burkina Faso	-	10	-	-	-	10	10	29	17	-	-	29	17	46	360
Mali	53	16	-	-	53	16	69	60	12	-	-	60	12	72	4
Niger	2	7	-	-	2	7	9	10	6	-	-	10	6	16	78
Senegal	6	6	-	-	6	6	12	30	93	-	-	30	93	123	925
SUB TOTAL	61	39	-	-	61	39	100	129	128	-	-	129	128	257	157
FRANCOPHONE-SAVANNAH / HUMID TROPICS															
Benin	2	4	-	-	2	4	6	18	10	-	-	18	10	28	200
Cameroon	45	24	4	2	49	26	75	45	16	6	8	51	24	75	0.0
C.A.R.	1	12	-	-	1	12	13	2	9	-	-	2	9	11	-18
Congo	N.A	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Gabon	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Ivory Coast	15	18	-	-	15	18	33	37	19	-	-	37	19	56	70
Togo	21	10	-	-	21	10	31	18	7	-	-	18	7	25	-19
SUB-TOTAL	84	68	4	2	88	70	158	120	61	6	8	126	69	195	23
ANGLOPHONE (excl. Nigeria)															
Ghana	76	6	-	-	76	6	82	73	1	-	-	73	1	74	-10
Liberia	35	7	-	-	35	7	42	34	7	-	-	34	7	41	-2
Sierra Leone	30	6	-	-	30	6	36	86	20	-	-	86	20	106	94
SUB TOTAL	141	19	-	-	141	19	160	193	28	-	-	193	28	221	38
Nigeria	188	58	13	9	201	61	262	443	97	155	23	598	120	718	168
Zaire	34	43	-	-	34	43	77	29	3	26	23	55	26	81	5
TOTALS	527	235	20	24	547	259	806	945	347	194	54	1139	401	1540	91

*Note: N = nationals F = foreigners

Sources: 1976 figures: Association of Faculties of Agriculture in Africa, Comparative Study of All Institutions of Higher Agricultural Education in Africa, 1982. Parts II and III.
1983 figures: Paul Bennell. Agricultural Researchers in Sub-Saharan Africa: A Quantitative Overview, ISNAR Working Paper No. 5. Table 5 and FAO Directory of Agricultural Education and Training Institutions in Africa.

Table 4.7: Agricultural researchers employed by the CGIAR international agricultural research centers in West Africa 1978-1984

Year	IITA HQ	IITA Outreach	WARDA HQ	WARDA Outreach	ICRISAT HQ	ICRISAT Other outreach	ILCA Arid & semi arid (Mali)	ILCA Humid & sub humid (Nigeria)	CIMMYT	TOTAL CENTERS
1978	91	2	13	21	1	12				140
1979	80	7	15	20	1	12				131
1980	67	13	15	22	1	13				155
1981	76	14	18	25	5	13	9	11		171
1982	65	29	19	23	6	13	11	15	2	183
1983	87	18	17	23	11	16	10	10	1	193
1984	97	23			15	14	11	9	2	171 (excl.WARDA)

Source: Annual reports of CIMMYT, ICRISAT, ILCA, IITA and WARDA.

With regard to undergraduate training, the following factors have been of particular concern:

- The quality of university entrants to agriculture and science degree programs. In most of West Africa these subjects are much less popular first-career choices than medicine, engineering, law, and commerce. Consequently, agriculture and science faculties have not been able to attract the highest-quality students.

- Type of training. Much of the concern about the type of training received by agriculture and science graduates relates more generally to wider issues of the role of universities in fostering national development. More specifically, however, agricultural degree training in West Africa has been criticized as being too academic, with insufficient emphasis on promoting skills and attitudes that will enable graduates to work effectively for their main clientele, namely farmers. Furthermore, in more recent years, standards of instruction have suffered mainly as a result of acute shortfalls of resources.

The ability of agricultural research organizations in West Africa to recruit the required numbers of agriculture and other graduates has depended to a large extent on the degree of competition from other potential employers. In West Africa as a whole, agricultural research organizations typically employ between 10 and 20% of all national agricultural professionals, most of whom are confined to the public sector. In the past the relative size and growth of the university sector, especially in the anglophone West African countries, has strongly influenced the ability of government research organizations to recruit outstanding graduates and to retain the more experienced researchers. In the francophone countries, on the other hand, the main competition has come from agricultural development projects which usually pay higher salaries and provide attractive fringe benefits.

In more recent years, many governments in West Africa have had to contend with a surplus of agricultural and science graduates in relation to the financial capacity of public-sector institutions to productively employ them (i.e., effective demand). This poses a potentially serious problem for agricultural research organizations because they may be required to employ more graduates than they need and thus lose control over the recruitment process.

Career preparation: The professional apprenticeship. Before he or she can become a productive agricultural researcher, the university recruit must undergo a relatively prolonged period of structured training. In the past, major emphasis has been placed on learning by doing and on-the-job training under the supervision of experienced researchers. Such an approach is concerned as much with ensuring the proper socialization of the graduate recruit as with the acquisition of the technical skills required by specific disciplinary specializations. The major problem with implementing this approach in most West African countries has been the shortage of sufficiently experienced and competent senior researchers to provide the kind of intensive on-the-job training and supervision that is required to complement the academic training received with training in techniques of conducting research. This has been further exacerbated by the dependence on expatriate researchers who, although usually experienced

and technically competent, have not always been successful in bringing along younger researchers. Expatriate researchers often do not stay long enough to supervise an apprentice or they have discipline-based interests which are oriented to their scientific advancement in the developed world.

Postgraduate degree training. The postgraduate degree is widely regarded as a key quality indicator of the competence of agricultural researchers. Available data on the postgraduate degree profiles of national agricultural researchers in West Africa are represented in Table 4.8. In the anglophone West African countries it can be observed that over 50% of agricultural researchers have received postgraduate training, which compares favorably with equivalent qualification profiles for agricultural researchers elsewhere in the developing world (see Table 4.9). For Zaïre this figure is nearly 37%, which is also relatively high. However, except for a few institutions, these countries have generally been unable to build up sizeable cadres of Ph.D.-level researchers, mainly because of the relatively high attrition among this group. In extreme cases, such as in Ghana, the relative size of this group has fallen considerably in recent years - from 28.2% of the total in 1981 to 20.8% in 1985.

Data limitations prevent qualification profiles being compiled for the francophone West African countries. One of the reasons for this is the difficulty in distinguishing between strictly first-degree training (up to the ingenieur agronome level) and subsequent, more specialized, postgraduate degree programs (M.Sc., DEA, troisième cycle, of Ph.D., doctorat d'état). However, with the rapid growth in recruitment of national personnel in these countries from the early 1970s, a large proportion of agricultural researchers have been sent overseas for postgraduate training, with the result that probably 25-40% are qualified at this level in the majority of francophone countries. Furthermore, considerable numbers of West African agricultural researchers are currently undertaking postgraduate training (e.g., 20 Niger, 11 Sierra Leone, 11 Ghana, 12 IER/Mali, 15 Liberia) so qualification profiles should improve considerably during the next five years.

The postgraduate qualification profiles of members of faculties of agriculture and veterinary medicine in West Africa are presented in Table 4.10. The relatively large concentrations of Ph.D.-trained personnel in these faculties in the anglophone countries serve to underline the potentially important role the university sector could play in the development of agricultural research in these countries in the future.

Manager and researcher attitudes. Agricultural research managers in West Africa have consistently maintained a strong commitment to postgraduate degree training for all professional research personnel. At a general level, this has been based on the view that first-degree training in agriculture, science, and social sciences cannot, except under exceptional circumstances, provide the knowledge and skills needed for a productive career in agricultural research. Moreover, research managers have only had to look at agricultural research institutions in the developed countries, where most of their researchers have Ph.D.-level qualifications, for further confirmation of this view. Two additional factors, however, have also been important: Where it has been difficult to provide experienced supervision for trainee researchers, there has been a tendency to rely more heavily on formal postgraduate training as a

Table 4.8: Formal degree profiles (percentage) of national researchers employed by central government agricultural research organizations in West Africa, 1984/85

Country	Ph.D./T.C.	M.Sc.	B.Sc./I.A.
Cape Verde	9.1	36.4	54.5
Guinea Bissau	0.0	71.4	28.6
Mali	3.1		68.9
Benin	11.5	59.6	28.8
Cameroon	14.6		85.4
Ghana	20.2	50.4	21.4
Liberia	17.8	39.2	42.9
Sierra Leone	7.7	61.5	30.8
Nigeria	26.4	43.7	29.9
Zaïre	9 9	27.0	63.0

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 9: Formal degree qualification profiles of agriculture researchers by major geographical region, early 1980's

Region	% Ph.D	% M.Sc.	% B.Sc.
Central American & Caribbean	5.5	20.8	73.5
South America	8.9	35.9	55.3
South and East Asia	8.8	34.0	57.2
Middle East	7.7	9.7	82.6
Pacific	16.3	22.4	61.2
North Africa	26.0	34.3	39.7
East Africa	4.8	42.6	52.6
Southern Africa	8.0	26.3	65.7
Francophone Sahel	NA	NA	NA
Francophone Savannah & Humid	NA	NA	NA
Anglophone(exc. Nigeria)	20.4	45.5	34.0
Nigeria*	26.4	43.7	29.9
Zaïre	9.9	27.0	63.1

*includes IAR and IAR&T

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

Table 4.10: Qualification profiles of professional staff (national only) employed by faculties of agriculture and veterinary medicine in West Africa, 1984

Sub-region and Country	Agriculture Ph.D. TC	Agriculture Other	Veterinary Medicine Ph.D. TC	Veterinary Medicine Other	Totals Ph.D. TC	Totals Other	All
FRANCOPHONE - SAHEL							
Burkina Faso	26	20	0	0	26	20	46
Chad	2	5	0	3	2	8	10
Mali	14	58	0	0	14	58	72
Niger	5	11	0	0	5	11	16
Senegal	11	114	0	0	11	114	125
SUBTOTAL	56	203	0	0	56	203	259
FRANCOPHONE - SAVANNAH/ HUMID TROPICS							
Benin	18	10	0	0	18	10	28
Cameroon	33	28	7	7	40	35	75
Guinea	-	-	-	-	34	382	416
Ivory Coast	4	52	0	0	4	52	56
Togo	15	10	0	0	15	10	25
SUBTOTAL	70	111	7	7	111	500	611
ANGLOPHONE (excl. Nigeria)							
Ghana	38	36	0	0	38	36	74
Sierra Leone	50	58	0	0	50	58	108
Liberia	11	30	0	0	11	30	41
SUBTOTAL	99	124	0	0	99	124	223
Nigeria	350	190	89	89	439	279	718
Zaïre	14	18	15	34	29	52	81

Source: Paul Bennell. Agricultural Researchers in Sub-Saharan Africa: A Quantitative Overview, ISNAR Working Paper No. 4. The Hague, 1986.

partial substitute for on-the-job training. Where first-degree standards have declined appreciably, postgraduate training is seen increasingly as a remedial measure.

The demand for postgraduate-degree training by agricultural researchers themselves has also been high throughout the West African region. However, the underlying motives are invariably difficult to disentangle. On the one hand, there is the genuine desire by young researchers to receive whatever training is required in order to become fully productive. On the other hand, there is quite often a strong element of more limited self-interest which can seriously undermine the potential value of such training. Of particular concern is the very high prestige value of the postgraduate degree, with the result that obtaining the Ph.D. is regarded as the pinnacle rather than the starting point of the researcher's career. Such an attachment to paper qualifications has also been commonly associated with a progressive escalation of minimum qualification requirements which become, therefore, increasingly divorced from the actual skills required for effective performance. While this is not to suggest that postgraduate training for agricultural researchers is unnecessary, there is an urgent need to comprehensively review the past effectiveness of this type of training in West Africa before embarking on any major expansion in the future.

There is very limited postgraduate training capacity in the main agricultural science disciplines in West Africa. Only Nigerian universities had any significant number of doctoral and master's degree graduates in these areas in the early 1980s (see Table 4.11). While the absence of postgraduate training programs in the more recently established faculties of agriculture in francophone West Africa and Nigeria is not surprising, the older faculties have also faced serious difficulties in institutionalizing training at this level. There are several reasons for this:

- There has been insufficient national demand for regular master's degree programs, even in broad areas of specialization. The demand for postgraduate training in agricultural sciences stems from two main sources - the agricultural research institutions and the faculties themselves. Given the small size of these institutions in most West African countries, there seems little alternative but to organize postgraduate training on a regional basis using, wherever possible, faculties which have already developed some postgraduate training capacity.

- The attitude of agricultural research managers and researchers towards local postgraduate programs has been lukewarm or ambivalent. This is because opting for overseas training allows greater scope to select universities with high teaching and research standards, which local universities (and especially those just starting postgraduate degree training) find it hard to match. Faced with this preference for overseas training, there is a danger that local agricultural and science faculties which offer postgraduate degree programs come to be regarded as "training institutions of the last resort" by both research managers and researchers.

- There is often difficulty in maintaining the commitment of a national university to serve as a regional training center. Financial crises,

Table 4.11: Numbers of agricultural and veterinary medicine graduates in West Africa, 1982

Sub-region and country	Fac. of Agriculture and Forestry			Fac. of Vet. Med. and Livestock			TOTAL		
	Ph.D.	M.Sc.	B.Sc.*	Ph.D.	M.Sc.	B.Sc.	Ph.D.	M.Sc.	B.Sc.
FRANCOPHONE - SAHEL									
Burkina Faso	0	0	57	0	0	29	0	0	86
Mali	0	0	105	0	0	52	0	0	157
Niger	0	10	4	0	0	2	0	10	6
Senegal	0	0	55	0	0	13	0	0	68
SUBTOTAL	0	10	221	0	0	96	0	10	317
FRANCOPHONE - SAVANNAH/ HUMID TROPICS									
Benin	0	0	38	0	0	7	0	0	45
Cameroon	0	0	152	0	0	24	0	0	176
Guinea	0	0	354	0	0	40	0	0	394
Gabon	0	0	8	0	0	0	0	0	8
Ivory Coast	0	0	134	0	0	15	0	0	149
Togo	0	0	35	0	0	0	0	0	35
SUBTOTAL	0	0	721	0	0	86	0	0	807
ANGLOPHONE (excl. Nigeria)									
Ghana	0	4	47	0	2	39	0	6	86
Liberia	0	0	53	0	0	0	0	0	53
Sierra Leone	0	0	107	0	0	0	0	0	107
SUBTOTAL	0	4	207	0	2	39	0	6	246
Nigeria	23	148	440	7	44	97	30	192	537
Zaïre	0	0	36	0	0	102	0	0	138
TOTAL	23	162		7	46		30	208	

* B.Sc.: Includes Ingenieur agronome/agricole

Source: FAO, Directory of Agricultural Education and Training Institutions in Africa. 1984.

political problems, or simply the drawing off of senior staff by other sectors (or new universities offering higher rank and rapid promotion) have hampered such concentration strategies in the past. As West Africa's leading university, the University of Ibadan was once selected for development as a center of postgraduate education in agriculture for Nigeria and for surrounding countries. However, its senior staff were drained off by the creation of new state universities, and the absence of a federally funded research station held back its development. This example clearly points out that the problem of agricultural research and training for research cannot be solved in isolation, and any future initiative to develop national and/or regional postgraduate training capacity must squarely address these issues.

Overseas Postgraduate Training. For the reasons discussed above, the majority of agricultural researchers in West Africa who have received postgraduate degree training have attended overseas universities. However, there is an increasing awareness of certain problems that are commonly associated with or exacerbated by excessive reliance on postgraduate training overseas.

- Relevance issues: Overseas postgraduate programs often lack sufficient relevance for students who wish to work in tropical environments. Similarly, research theses are often based on topics that are of little direct or indirect value to research priority areas in the student's own country.

- Degree of specialization: A high degree of specialization, especially when this involves sophisticated equipment and large teams of support personnel, is often undesirable because developing-country research institutions neither require nor can they support research of this type. This can result in a distortion of research priorities if the researcher is allowed to pursue his/her area of specialization or simple frustration if they are not. Postgraduate training should also enable the student to adopt a holistic approach to the role of agricultural technology in the development process. Undue specialization can undermine this, since it encourages a partial and reductionist scientific approach to agricultural research.

- Selection and sequencing: In West Africa, overseas postgraduate training has increasingly become to be regarded as the right of every agricultural researcher, with the result that candidate selection now tends to be based more on seniority than merit. The selection process has also been seriously constrained by the fact that the bulk of overseas postgraduate training has been tied to specific donor-assisted projects. This has prevented agricultural research organizations in West Africa from implementing comprehensive postgraduate training plans which would allow all researchers to embark on this training at the appropriate point in their careers. In the past, limited training opportunities have often meant that candidates have had to wait much longer than was desirable. More recently, however, an increasing number of organizations have experienced the opposite problem as the result of a rapid increase in the availability of donor-funded postgraduate training opportunities. Here trainee researchers are sent for training before they have received sufficient on-the-job training and experience.

- Duration and costs: Agricultural researchers in West Africa have typically had to spend relatively long periods overseas in order to obtain their postgraduate degrees (a minimum of 2 years at the master's level and another 2-4 years at the doctoral level). This problem is further compounded when instruction has been in a foreign language, or when students have had to repeat years and/or courses as remedial or preparatory training. Others have succeeded in prolonging their stay overseas for personal reasons. While there is no precise information, there is general concern that the longer individuals are overseas the less likely they are to return to or remain in the research organization sufficiently long to yield an acceptable return on their training. This has led some West African governments to impose fairly stringent restrictions on the number of years of overseas training that will be permitted.

  The cost of overseas postgraduate training has also become an increasingly important issue. In recent years, total annual costs have been in the range of US$20-30,000 at most universities in Europe and North America. Even when these have been met by donors, opportunity costs have not been zero, simply because the funds could have been utilized for other purposes. Of greater concern is where the agricultural research organization has itself financed the training, as is the case under loan-funding arrangements.

- Overseas training linkages: Agricultural research organizations can enhance the effectiveness of their postgraduate training programs by developing "special relationships" with one or ideally a number of overseas universities. Targeting postgraduate training in this way encourages the development of close links with teaching and research personnel at the overseas institution(s) which provide the basis for a more effective training effort. However, arrangements of this kind have not been common in West Africa. An important reason for this has been that donor-supported agricultural research projects have generally been too limited in scope and too short in duration to seriously contemplate the development of such links. And agricultural research organizations have themselves often preferred to send trainees to a dispersed group of universities. This shotgun approach is justified on the grounds that it enables the specific needs of the trainee to be matched with the specific competencies of overseas universities in different subject areas.

  Recognition of the drawbacks of overseas postgraduate training has led to renewed emphasis on the need to strengthen regional and national training capacities; to date, this has mainly focused on increasing the role of the international agricultural research centers, and in particular IITA. There have also been increased instances of "split degree" postgraduate vraining, where the student completes some of the required coursework at an overseas university and the remainder at a local university; and, as another means of improving upon the drawbacks of overseas training, financial provision is increasingly being made to allow trainees to return to their national research organizations to undertake the research required for dissertations and theses, which can be based on priority research topics.

The increase in the number of national agricultural research projects has allowed more comprehensive postgraduate-degree training plans to be formulated. And, where a donor has been prepared to make a relatively long-term commitment to a specific research project, it is then feasible to introduce more stringent minimum service eligibility conditions for postgraduate training overseas. For example, researchers who belong to the Government of Ghana - GTZ Project at Nyankapala Research Station must have five years of experience with the project before they are eligible for Ph.D.-level training.

In-career training. Agricultural researchers must receive regular training throughout their careers if they are to remain fully productive. This training can take a variety of forms - formal courses, seminars, workshops, conferences, study tours, and visits and attachments to other research institutions. Equally important, activities of this kind enable agricultural researchers who generally work in small groups and are geographically isolated to maintain essential contact with other researchers overseas and the international scientific community in general.

The opportunity to benefit from regular training courses and contact visits has varied considerably among agricultural researchers in West Africa. In general, more dynamic and hardworking researchers have been able to procure the resources from local or foreign sources to fund their in-service training. And, for those researchers who are part of donor-assisted projects, there have usually been plenty of opportunities to attend short-term training activities. The international agricultural research centers have played an important training role for researchers.

For many researchers in West Africa, however, in-service training opportunities have been particularly scarce. Typically, they have had to rely on training courses offered by and paid for by national and international organizations which frequently have been too general and didactic to be able to satisfy their specific training requirements. This has tended to encourage the view that such courses and meetings merely provide the opportunity for "scientific tourism".

Experience profiles and attrition. From the limited available data, the typical work experience profiles of national agricultural researchers employed in government institutions in the early 1980s in West Africa were roughly as follows:

Years of Work Exprience	Anglophone W.A. %	Francophone W.A. %
0 - 5	40 - 50	50 - 70
6 - 10	25 - 35	20 - 30
10+	10 - 20	10 - 15

It can be observed that even in the anglophone West African countries, where the first nationals were recruited 25-20 years ago, it still has not been possible to maintain a cadre of experienced agricultural researchers. The weakness of these experience profiles has had a profoundly negative impact on the institutional development and general productivity of NARS in West Africa. Most significantly, it has not been possible to develop experienced and stable "critical masses" of researchers in the key disciplines and commodities. Equally important, graduate recruits have frequently not received the kind of expert supervision and mentorship which is normally expected from experienced colleagues in scientific communities. Faced with shortages of experienced national agricultural researchers, there has often been little choice but to rely on expatriate personnel to fill key positions.

There are numerous reasons for the inability of NARS in West Africa to develop experienced research cadres. The first reason is high attrition levels, especially among the brightest researchers who have received postgraduate training overseas. During the 1960s and 1970s, local and regional labor markets for agricultural researchers in West Africa expanded rapidly, so that the few more-experienced government researchers were in high demand. Many were attracted to the university sector (as in Nigeria and Ghana), while others left agricultural research altogether in order to take up senior management positions in the public and private sectors. In more recent years, the marked decline in real incomes of government researchers in most West African countries has become a critical factor in maintaining high attrition levels among more experienced personnel. A second reason is the rapid expansion in graduate recruitment during the 1970s and early 1980s which dramatically weakened the overall experience profiles of national agricultural research cadres at a time when it would have often been more appropriate to consolidate the existing staff.

Managers and administrators. While the success of agricultural research in West Africa depends on the calibre of research managers and administrators, there is virtually no detailed information about these critical groups of personnel. Steps should be taken to rectify this situation as soon as possible. Despite this paucity of information, the following observations can be made about agricultural research managers in West Africa.

First, it is important to distinguish clearly between the different types and levels of agricultural research managers. A rough breakdown of the numbers in each of the main management categories in West Africa is as follows:

National and Assistant Directors	50
Heads of large research facilities (31+ researchers)	35
Heads of medium-sized research facilities (11-30 researchers)	100
Heads of small research facilities (1-10 researchers)	120

In addition, heads of departments and commodity programs should also be included, but the necessary data are not available. In total, however, probably 10-15% of agricultural researchers in West Africa have significant management responsibilities. This is a sizeable group which reflects the management intensiveness of agricultural research.

Second, research managers in West Africa are relatively young, with limited research experience. Often the most talented researchers are promoted upwards into management positions, without having received any management training. The quality of general management training courses available in West Africa has been generally low. Specialized management training for agricultural research managers has been virtually non-existent. Many research managers are, therefore, ambivalent and unsure about their roles as managers.

Finally, research managers in West Africa have been recruited exclusively from the ranks of agricultural researchers, with no sustained attempts to utilize other types of professionals, in partiuclar those who have received specialized management and administrative training. Typically, the key administrative roles in agricultural research organizations are performed by mainly clerical staff, especially in anglophone West Africa.

Technical support personnel. Three main groups of technical support personnel can be identified in agricultural research organizations: field technicians, laboratory technicians, and station/farm managers. Between them they are responsible for carrying out the bulk of experimental activities undertaken by agricultural research organizations. It is particularly surprising, therefore, that so little attention has been devoted to analyzing the performance of these groups of technical personnel in agricultural research in West Africa. As with research managers, a concerted effort should be made to rectify this situation as soon as possible.

The available data aggregate all technical support staff into a single "technician" group. This is unsatisfactory, because as noted above, it does not allow us to analyze the specific human resource situation for each of the separate types of technical support personnel. Most attention has been focused on the adequacy of the overall ratio of technicians to researchers. In Table 4.12 it can be observed that this ratio is higher than one for all but two countries in West Africa but still lower than two in the majority of countries. From the limited amount of time series data available it would appear that this ratio has improved in some countries (Burkina Faso, Chad, Senegal, Congo, Togo, and Zaïre) but deteriorated in others (Mali, Ghana, Liberia, Nigeria) during the last decade.

Job evaluation exercises need to be undertaken in order to assess the tasks that should be undertaken by different types of technical support personnel, and the numbers that are optimally required. This will then provide the basis for detailed evaluations of the training, career structure, and on-the-job performance of technical support personnel who are currently employed. Evidence indicates that there is an urgent need for a new group of more highly qualified technical support personnel in the most agricultural research organizations in West Africa.

Table 4.12: Ratio of technicians to research workers in countries of West Africa

Sub-region & country	Researchers	Technicians	Techn./Res. ratio
FRANCOPHONE - SAHEL			
Burkina Faso	110	173	1.6
Cape Verde	14	22	1.6
Chad	28	41	1.5
The Gambia	23	81	3.5
Mali	185	442	2.4
Mauritania	15	N.A.	N.A.
Niger	77	97	1.3
Senegal	233	296	1.3
SUBTOTAL	685	1152*	1.68
FRANCOPHONE - SAVANNAH/ HUMID TROPICS			
Benin	56	124	2.2
Cameroon	176	217	1.2
CAR	N.A.	30	1.15
Congo	50	112	5.6
Guinea	35	7	0.2
Gabon	24	3	0.1
Ivory Coast	202	61	0.3
Togo	58	132	2.3
SUBTOTAL		649*	1.3
ANGLOPHONE (excl. Nigeria)			
Ghana	168	408	2.3
Liberia	38	56	1.5
Sierra Leone	54	118	2.2
SUBTOTAL	268	582	2.2
Zaïre	111	240	2.2
Nigeria	739	1371	1.8

Note: * Totals exclude countries without corresponding researcher or technician figures.

Sources: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).
Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

In-service training opportunities for technical support personnel have generally been limited. The major exceptions have been the production courses organized by the international agricultural research centers.

Attrition among technical support personnel has also been particularly high as a result of the high demand for individuals with practical field and laboratory skills. Clearly, the departure of an experienced station manager or field technician can have a major impact on the performance of research activities. Again, there is an urgent need for more detailed analysis of the recruitment, utilization, and attrition among these categories of personnel.

HUMAN RESOURCES PLANNING AND UTILIZATION

Having described the key characteristics of agricultural researchers, managers, and technical support personnel in West Africa, the following discussion will focus on how these human resources have been planned and utilized. Ideally, one would like to be able to draw upon comprehensive surveys and analyses of the determinants of the performance and productivity of agricultural research personnel in West Africa, but unfortunately, these have never been undertaken. There is no alternative, therefore, but to rely on the limited data that are available in order to reach general conclusions. Although there is a wide range of factors which have affected the utilization of agricultural research personnel in West Africa, three can be singled out as being of particular importance: deployment patterns; operating resources and support personnel; and grading, promotion, and pay schemes.

In general terms, human resource planning is concerned with the assessment and provision of the types and amounts of skills required for the attainment of predetermined tasks over a specific time period in the most cost-effective manner. However, there is little evidence to suggest that agricultural research organizations in West Africa have ever undertaken comprehensive planning activities of this kind. While occasional statements and submissions have been made which include recommendations for future staffing levels, these have rarely been based on any detailed planning exercise.

The absence of human resources planning for agricultural research activities in West Africa is symptomatic of the overall weakness of the planning and programming functions at both the system and institutional levels. Also, agricultural research organizations, in their eagerness to build up their cadres of professional researchers and support personnel, have generally paid insufficient attention to specific recruitment targets and priorities and to the capacity of their organizations to productively utilize these additional personnel in the future. However, there have been other key factors. The chronic instability of the planning environment has effectively prevented research management from making detailed estimates of human resource requirements and projects; it is noticeable that the only major exceptions have been where donor-supported national agricultural research projects have been implemented which have provided sufficient financial stability and certainty of future resource provision to enable meaningful staff projections to be made. Lack of control over recruitment and excessive fragmentation caused by donor

projects have also complicated human resources planning. Within organizations, occupational categories based on rigidly enforced formal qualification requirements have limited the scope to deploy personnel in a more flexible manner; and limited in-house expertise and inadequate human resources information systems have hampered good planning.

The deployment of agricultural researchers. The institutional development of agricultural research in West Africa, as elsewhere, has hinged on the ability to create appropriate-sized groupings of researchers in terms of both disciplinary and commodity specializations within specific geographical domains. The desired characteristics of these groupings or "critical masses" of researchers and other support personnel are the product of a number of factors. At one level, they will vary according to the type of national agricultural research strategy that is being pursued. Thus, for the larger NARS in West Africa, where there will be a continuing need to undertake applied agricultural research, it has been variously estimated that most comprehensive commodity improvement programs require between 20 and 40 researchers in order to be viable. In the remaining NARS where the emphasis should be on adaptive research, critical masses can be much smaller, although it is estimated that most commodity improvement programs will still require substantive involvements from between 8 and 15 researchers. It is important to recognize, however, that there are economies and diseconomies of scale (or agglomeration) which are likely to apply regardless of the specific research strategy adopted. Most notably, groupings of researchers need to be large enough to allow adequate on-the-job training of trainee researchers by experienced researchers and, more generally, to permit effective intra- and inter-disciplinary interaction among the professional research cadre.

To what extent have agricultural research organizations in West Africa been able to deploy critical masses of agricultural researchers? The absolute and relative size distributions of agricultural research facilities in West African countries, measured in terms of the numbers of researchers employed, are presented in Table 4.13. A significant proportion of these facilities can be seen to have ten or less researchers, particularly in the Sahel (44.4% of the total), francophone humid-savannah (57.9%), and Zaïre (60.0%). This proliferation of small research stations in West Africa is frequently regarded as a direct legacy of the colonial period, when relatively large, dispersed networks of experiment stations were established. While this is true to some extent, many NARS in West Africa have been obliged (both technically and politically) to maintain extensive research station networks in order to cover the major agro-ecological areas in the country. Furthermore, while many research facilities are small in terms of the number of researchers working at them, the majority of agricultural researchers are still usually concentrated in a small group of larger research facilities.

The deployment of crops researchers by main area of commodity specialization in each country in West Africa is shown in Tables 4.14 and 4.15. Relatively sizeable groups (i.e., 10+) of researchers can be identified as working on one or more of the major food crops in six countries - Nigeria, Ivory Coast, Senegal, Zaïre, Burkina Faso, and Mali. However, it can be observed that a number of other countries where these crops are of some considerable importance have fewer than five researchers per major crop. On a regional basis, this situation appears to be

Table 4.13: Percentage distribution of agricultural research facilities in West Africa by number of researchers employed, 1984/85

Sub-region/Country	Number of Researchers							
	1-5	6-10	11/15	16-20	21-25	26-30	31-50	50+
Francophone-Sahel	23.3	21.0	23.3	13.9	11.6	2.3	4.6	0.0
Francophone-Savannah/Humid Tropics	34.2	23.7	13.1	10.5	10.5	5.2	0.0	2.6
Anglophone (excl. Nigeria)	25.0	12.5	18.75	18.75	6.25	0.0	18.75	0.0
Nigeria*	0.0	0.0	0.0	0.0	0.0	11.1	33.3	55.6
Zaïre	40.0	20.0	0.0	30.0	0.0	0.0	10.0	0.0

Note: *Nigeria data are incomplete and are likely to be biased towards larger research facilities.

Source: Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

Table 4.14: Size distribution of agricultural researchers in West Africa by main area of commodity specialization, 1984/85

Commodity	Number of Countries	Number of Researchers 0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	50+
Wheat & Barley	4	3	1								
Rice	15	10	1	2	1		1				
Maize	14	10	1	1	1			1			
Sorghum & Millet	11	6	1	1	1		1	1			
All Cereals	17	2	5	2	1	1	1	2		1	2
Potato	2	1		1							
Sweet Potato & Yam	3	1	1					1			
Cassava	6	3		1			1			1	
All Roots	12	7	1	2			1				1
Cowpea or Beans	9	8				1					
All pulses	15	13	1						1		
Soya and Other Annual Oilseeds	9	8	1								
Groundnut	10	8	1		1						
Coconut	6	4	2								
Oil Palm	6	2	2							1	
Sugar Cane	5	4	1			1					
Fruit (incl. Banana)	11	8	1				1			1	
Vgegetable	13	12							1		
Coffee and Tea	7	3	2	2							
Cocoa	7	3		2			1		1		
Rubber	7	4	1		1		1				
Cotton & Other Fibres	13	5	6	1			1				
Other Crops[A]	13	7	2	2	2						
Pasture & Fodder	14	9	5								
Animal Husbandry	15	6	4	2	2						1
Vet. Medicine		7		2	4	1					1
Total Animals	17		4	4	2		2	1	2		2
Forestry	11	4	1	1		4					1
Fisheries	11	5	2			1		2			1
Grand Total[B]	18			1	1		2		3	1	10

Source: Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

Table 4.15: Main concentrations of commodity research by country, in West Africa 1983/84

Commodity	Number of researchers			Other countries where commodity is of major importance
	20+	11-19	6-10	
Rice	Nigeria	Ivory Coast	Liberia Senegal Zaïre	Ghana, The Gambia, Mali, Guinea Bissau, Guinea, Sierra Leone
Sorghum & Millet	Burkina Faso Mali Nigeria	Senegal	Niger	Chad, The Gambia, Mauritania, Cameroon, Ghana, Togo
Maize	Nigeria	Ghana	Ivory Coast Zaïre	Burkina Faso, Cameroon, CAR, Benin, Togo
Cassava	Nigeria Zaïre	Congo		Cameroon, CAR, Ghana, Ivory Coast
Cowpea and Beans	Nigeria			Burkina Faso, Chad, Niger, Cameroon, Zaïre, Ghana
Fruits	Ivory Coast Nigeria		Cameroon	Senegal, Zaïre, Ghana Guinea
Groundnut	Nigeria		Senegal	The Gambia, Chad, Burkina Faso, Guinea-Bissau, Mali, Niger, Cameroon, CAR, Zaïre, Ghana, Guinea
Palm Oil	Ivory Coast Nigeria		Cameroon Zaïre	Congo, Benin, Ghana, Guinea, Liberia, Sierra Leone, Togo
Coffee		Cameroon Ivory Coast	Nigeria Zaïre	
Cocoa	Ghana Nigeria	Cameroon Ivory Coast		
Cotton	Senegal	Mali	Burkina Faso, Chad, Cameroon, CAR, Ivory Coast, Togo	Nigeria, Zaïre, Benin,

Source: Data from P. Oram, Report on National Agricultural Research in West Africa, IFPRI, 1986.

particularly serious with regard to the pulses, vegetables, fruits, and groundnuts which are grown in most countries but which are not usually of sufficient national importance to justify a major research program.

Unfortunately, comprehensive data on disciplinary breakdowns of agricultural researchers at the country level are not available.

Total expenditure per researcher. Expenditure data for agricultural research activities are of poor quality and must, therefore, be treated with considerable caution. Furthermore, since time series data on the availability of operating resources per researcher are unavailable, total expenditures per researcher (including recurrent costs and capital investments) have had to be calculated, which is a much less precise indicator.

In Table 4.16 the percentage changes in total expenditure per agricultural researcher between 1970-74 and 1980-84* have been calculated in both local currency units (LCU) and U.S. dollars at constant 1975 prices for the countries in West Africa where data are available. In the francophone countries, where there is reasonable correspondence between LCU and dollar estimates, there were sizeable percentage reductions in total expenditures per researcher in Mali, Niger, and Benin, but large percentage increases in Cameroon and the Ivory Coast during this period, and virtually no change in Burkina Faso and Senegal. The situation in anglophone West Africa is more difficult to interpret, since in both Ghana and Nigeria the percentage change in expenditure per researcher is highly negative when measured in local currency units but strongly positive when measured in constant U.S. dollars. The most obvious cause of this disparity is the progressively serious overvaluation of these two countries' currencies during this period. Consequently, the LCU currency is likely to yield more reliable estimates of changes in total expenditure per researcher.

Where sizeable percentage decreases in expenditure per researcher have occurred, this has inevitably resulted in increasingly severe difficulties in ensuring the effective deployment and utilization of agricultural researchers. While there has been either an improvement or virtually no change in total expenditure per researcher in an important group of francophone countries, it is not possible to say with any certainty the extent to which there have been corresponding changes in actual operating expenditure per researcher. This is because it is quite likely that these increases in total expenditure per researcher were largely accounted for by very large increases in the recruitment of support personnel and/or capital investment.

Motivation: Grading, promotion, and pay schemes. The generally poor motivation of national agricultural personnel in West Africa has had a highly adverse impact on research output and productivity. Numerous factors influence the motivational needs and responses of individuals in general and research scientists in particular. In West Africa the serious deficiencies of the prevailing grading, promotion, and pay schemes have given the greatest cause for concern. This is not to deny that non-financial "extrinsic" rewards (such as the need for professional

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* Five-year averages have been calculated, given the large annual fluctuations in funding during both these periods.

Table 4.16: Percentage change in total expenditures per researcher between 1970-1974 and 1980-1984 measured in local currency units and U.S. dollars (constant 1975 prices)

Country	Change % LCU/researcher	Change % US$/researcher
Burkina Faso	-12.1	-1.0
Mali	-45.5	-53.1
Niger	-81.0	-81.4
Senegal	14.7	-0.3
Benin	-74.3	-70.6
Cameroon	100.1	150.0
Ivory Coast	14.3	39.4
Ghana	-54.8	177.8
Nigeria	-57.3*	24.5*

* 1965-69 to 1980-84.

Source: Preliminary data from the ISNAR data base on agricultural research indicators. (June 1986).

recognition, work autonomy, and opportunities for achievement and self-actualization) are unimportant. However, the material rewards for most agricultural researchers and their support personnel have become so inadequate as to render these other types of rewards of increasingly marginal importance.

In spite of the lack of data, a number of common problems can be identified with the grading, promotion, and pay schemes for agricultural researchers in West Africa. These problems stem from the fact that most agricultural researchers are subject to the same terms and conditions of employment as apply to all other professionals employed in the civil service. Over the years, most agricultural research organizations have tried to convince governments that the special nature of scientific research requires that agricultural research personnel should be rewarded differently. However, faced with similar sets of demands by other professional groups, coupled with increasingly serious fiscal crises, West African governments have not been prepared to accede to these requests for special treatment.

Public-sector grading, promotion, and pay schemes are generally unable to provide the agricultural researchers in West Africa with attractive promotion and financial incentives throughout their careers. Thus the typical age/income profiles of agricultural researchers in West Africa are relatively linear and flat, with relatively limited dispersion of incomes around median income values. There are several underlying reasons for these income profiles: There are relatively small income differentials between commencement and highest attainable salary levels (usually less than 250 percent), and this differential has progressively declined during the last 25 years; seniority dominates as the main advancement criterion, and the absence of regular objective assessments of on-the-job performance in determining financial rewards has been a major factor in stifling motivation, resulting in little correspondence between the rates of growth of personnel income and research output and productivity; there are only a limited number of major promotion opportunities during the research career, and existing promotions are not generally associated with significant increases in income; and in some situations, researchers reach the highest attainable grade and salary level relatively early in their careers, with limited prospects for further advancement unless they become managers.

The grading, promotion, and pay schemes for university professionals in anglophone West African countries have been generally better than those prevailing for equivalent professionals in the civil service. Not only have salary levels been higher but career advancement has been based on merit as opposed to seniority. The most important advancement criteria have been postgraduate degree qualifications and publications output. However, concern has been expressed when these same criteria have been employed in mainstream agricultural research organizations (as, for example, in Zaïre).

Income levels. In recent years, the serious deficiencies in the grading, promotion, and pay schemes for agricultural researchers have become of secondary importance when compared with the problems associated with the

generalized and, in many cases, dramatic decline in the level of real incomes. This decline has been due to the inability and/or unwillingness of West African governments to give sufficiently large pay increments to compensate for increases in the cost of living caused by inflation. Faced with such falls in real income, the motivation of agricultural researchers has generally slumped. Many of the most able and experienced have resigned, and those who remain have often been obliged to find additional income-earning opportunities so that, in effect, they have become part-time researchers. Another important consequence is that donors have frequently been obliged to offer salary supplements to local research personnel working on specific research projects which, while understandable, has resulted in the emergence of significant income differentials.

HUMAN RESOURCES STRATEGY FOR AGRICULTURAL RESEARCH IN WEST AFRICA

Human resource development is an integral part of a long-term institution-building process. Given that most agricultural research organizations in West Africa only seriously embarked on this process during the last 10-15 years, they are still very much in the early stages of their efforts to create strong cadres of national research personnel. Thus, while much has been achieved already, the human resources base for agricultural research in West Africa is still generally weak.

The central objective of a human resources strategy for agricultural research in West Africa is the development of personnel in the quantities and with the skills, attitudes, and motivations which will fulfill, as effectively as possible, national and regional agricultural research strategies. Since these strategies are likely to be considerably different than in the past, it is necessary to seriously consider to what extent new types of agricultural researchers, research managers, and support personnel will be required. Probably the most serious criticism of agricultural researchers has been the inappropriateness of their skills and attitudes to undertake adaptive research, which requires high levels of commitment to ensuring effective communication with extension personnel, farmers, and among themselves. In the future, however, it will be precisely this type of researcher who will be needed in the greatest numbers, in particular in the smaller countries of West Africa with populations of less than five million people. On the basis of fundamental considerations of this kind a human resources strategy for agricultural research in West Africa must be developed.

Human Resource Planning: Consolidation versus Expansion

The adverse consequences of the rapid growth of agricultural researchers in West Africa during the 1970s and early 1980s have already been discussed in some detail. For most agricultural research organizations in West Africa, the overriding need during the next 10-15 years will be to concentrate on consolidating and strengthening the present cadres of researchers and support personnel with expansion confined to limited numbers of specific high- priority research areas. Only in this way will it be possible to develop cores of expertise which can be effectively utilized. Maintaining this commitment to consolidation will be difficult, particularly as the number of university graduates seeking employment continues to increase. In addition, the emphasis on highly location-specific adaptive research could

also generate demands for large-scale increases in graduate recruitment in order to ensure effective coverage of all major farming systems and recommendation domains. Curbing these expansionist tendencies will require considerable management expertise and discipline and, in many cases, political courage.

Human resources requirements for agricultural research personnel can only be derived on the basis of carefully formulated national research strategies and program objectives. There is therefore no human resource planning methodology that can circumvent the necessity of undertaking the detailed planning and programming of agricultural research activities. Thus, estimates of future requirements of researchers and other personnel which are based on statistical ratios and extrapolations (such as numbers of researchers per million dollars of agricultural gross domestic product or as percentages of extension personnel) are simply too crude and arbitrary to be of any operational value in the planning and programming processes. In practice, they merely serve to legitimize largely unsubstantiated demands for large increases in the numbers of agricultural researchers, which in the past have had profoundly counter productive consequences for agricultural research in West Africa.

In the first instance, human resource planning for agricultural research in West Africa should concentrate mainly on analyzing how currently employed researchers and support personnel are being utilized and what exactly is being produced. Where possible, comprehensive job evaluation exercises should be carried out, in particular to establish support personnel requirements and substitution possibilities for different sets of tasks. In addition, reasonably precise estimates of operating resource requirements for researchers engaged in different types of activities should be established. With these data it will then be possible to analyze the capacity of agricultural research systems and organizations to utilize specific numbers of agricultural researchers and support personnel under different resource scenarios*. Another type of constraint which must be carefully assessed is the availability of experienced researchers to supervise inexperienced colleagues.

Once all financial and other constraints have been analyzed, it is then possible to derive detailed net addition, recruitment, and training schedules for each category of research personnel. Recruitment and training targets are highly sensitive to estimates of future attrition. It is important, therefore, to ensure that these are as accurate as possible. In the past, the lack of data about researcher and support personnel attrition has tended to result in overinflated estimates. However, given the growing situation of excess supply in most of the relevant labor markets in West African countries, annual rates of attrition are likely to be only between 2 and 4% for most categories of personnel.

Recruitment Policies and Practices

The key precondition for the success of the human resource strategy is that agricultural research organizations in West Africa be able to control both the quantity and quality of recruits of every category of

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* This is sometimes referred to as a "constrained demand" approach.

personnel. Assuming this can be achieved, steps must be taken to attract the most promising candidates in terms of both intellectual capacity and attitudes and commitment. This will generally involve some diversification in the sources of graduate recruitment with social science backgrounds (as opposed to continued reliance on agriculture graduates).

Selection procedures must be comprehensive and rigorous, and their effectiveness should be monitored at regular intervals. Wherever possible, student vacation placement schemes should be introduced so that potential recruits can be assessed and, where desirable, steps taken to attract them to a career in agricultural research.

Professional Apprenticeship: Creating the New Agricultural Researcher

Creating agricultural researchers with the skills and attitudes that will enable them to provide viable technologies for the extension services and farmers is at the very center of a human resources strategy for agricultural research in West Africa. This would entail creating a carefully structured period of professional apprenticeship during which the trainee researchers not only acquire fundamental research skills and knowledge but, of greater significance still, develop an understanding of and enduring commitment to serving farmers.

The professional apprenticeship would provide a protracted period of intensive learning-by-doing on the job under the supervision of an experienced researcher, after having obtained at least master's-level postgraduate-degree training. This apprenticeship would apply to trainee researchers based at research stations, as well as trainees destined for on-farm research, and would emphasize working with and learning from farmers on a day-to-day basis. Doing this will require strong support from the NARS and close supervision by the more experienced researchers. The shortage of appropriately skilled and experienced researchers to perform this role will likely require trainee researchers to be deployed in groups. Management must take the necessary steps to ensure that supervisors are themselves fully committed to their training and supervisory roles.

Developing the commitment to work with farmers and the necessary skills to do so should be assessed before a researcher trainee completes the probationary period. The initial period of on-the-job training would normally last at least 2-3 years. As noted earlier, the tendency in recent years has been increasingly towards shortening this period in order to allow trainee researchers to assume line responsibilities or to begin postgraduate degree programs. Shortening the probationary period undermines the advantages of learning-by-doing on the job and does not provide an adequate period in which to evaluate potential researchers.

Additional training could be provided if resources were made available for short intensive training courses specifically designed and programmed to meet their needs for additional knowledge and skills. These training courses could be organized on a regional basis in West Africa, using a network of both international and national research institutions. While the international research centers might play an important role, it is both unrealistic and undesirable that they should shoulder the total burden. Other institutions will need to be assigned major areas of

responsibility. Finally, greater efforts should be made to develop distance learning training techniques using a wide range of teaching materials and technologies in order to provide continuous training opportunities for researchers on their research stations.

Postgraduate Degree Training

While postgraduate degree training at least to a master's level is essential for most trainee agricultural researchers it is not a panacea. The necessary skills and attitudes needed to help farmers are acquired not only at university but also by working intensively with the farmers themselves. Consequently the first priority must be to ensure the success of the on-the-job training process described earlier rather than the provision of additional postgraduate fellowships at foreign universities.

Assuming that this can be achieved, NARS in West Africa need to develop comprehensive policies and plans for postgraduate degree training. Training must be relevant, of high quality and cost effective, and provided in such a way so to minimize disruption of ongoing research activities. Selection for such training should be strictly according to merit criteria.

Most postgraduate training needs to be undertaken at the master's level in order to provide the methodologies, skills, and knowledge which will encourage the researcher to adopt a holistic, cross-disciplinary approach, while at the same time ensuring adequate specialization. Considerable emphasis should be given to the completion of a research project. Training would be more relevant and might disrupt ongoing research programs less if master's-level degree training in the main areas of specialization were institutionalized at West African universities within the next 10-15 years. A number of universities in the anglophone West African countries already have considerable potential to offer this training. In francophone West Africa and Zaïre more fundamental decisions need to be made concerning the specific form of postgraduate training. However, in light of the recent introduction of M.Sc. and Ph.D. programs in French universities, the obstacles to the introduction of these types of postgraduate training programs in francophone West Africa are likely to be less than before. An immediate start should be made toward establishing basic master's programs (agronomy, plant protection, economics, soil science) at two universities in francophone West Africa - one covering the Sahel and Savannah regions, the other the humid forest zone. National surveys of present and projected future demand for postgraduate training in key subject areas should be completed as soon as possible.

Doctoral-level training should be provided for the most competent researchers. The largest demands for this training will come from the larger countries in the region, where more applied research programs are likely to be concentrated. Wherever possible this training should be completed within the region. The international agricultural research centers have a critical role to play in this respect by cooperating with universities on degree research projects. The previous arrangement in which a trainee would spend three to six years at an overseas university should only be relied upon in exceptional circumstances.

For the immediate future, there will be no option but to continue to place major reliance on overseas universities for postgraduate training. However, the research project undertaken should, wherever possible, be based on problems of direct local relevance. Furthermore, at those universities in West Africa where postgraduate programs are to be developed, special relationships with one or more overseas universities could be established, to benefit from mutual guidance and even staff exchange.

In-Career Training and Retraining

A major training effort will be needed in order to ensure that experienced agricultural researchers and research managers also have the skills and attitudes to fulfill the objectives of national and regional agricultural research strategies in West Africa during the next 20-30 years. It is important not to underestimate the magnitude of this retraining strategy. Generating understanding and commitment to the new research strategies will generally require a series of carefully designed national workshops and seminars, often involving extension personnel and policymakers. Resources will need to be available for appropriate outside personnel to make inputs into these events. Clearly, there will also be a continuing need for researchers to receive specialist training and to maintain effective contacts with researchers undertaking similar research at other institutions in the region and elsewhere to remain current in their fields of specialization. As researchers become more experienced, the most effective "training" input is not so much attendance at formal group courses but rather the opportunity to visit and learn from researchers at other institutions, as and when the need arises.

Management Training

Well-designed management training programs could help considerably in creating a more competent professional cadre of agricultural research managers in West Africa. Given the different types of manager involved in the planning and implementation of agricultural research and the variety of specialist management functions which must be performed, these training programs will have to be carefully targeted. Wherever possible it will be desirable to establish national research management training programs, although clearly this will not be feasible for most of the smaller NARS. And, training in more specialized areas of management will also have to be undertaken on a regional basis.

Conditions of Service: Improving the Reward Structure

The proposed human resources strategy for agricultural research in West Africa is unlikely to succeed unless there is a significant improvement in the reward structure for researchers and key categories of support personnel. A detailed survey of the grading, promotion, and reward structures in a sample of West African NARS should be undertaken so that comprehensive but realistic proposals can be made.

While the need for improvement is urgent, the actual room for maneuver is likely to be limited, mainly because public-sector salary policies and practices are of such central importance, both economically and politically, that governments are understandably reluctant to make changes.

The most ambitious proposal is to create new agricultural research organizations with sufficient autonomy to devise their own personnel policies, including conditions of service. As a second option, a separate agricultural research service could be established within the framework of existing public-sector grading and salary structures. A more selective approach would be to focus on making specific changes to existing grading, promotion, and pay schemes, some of which could have only limited cost implications. Such a pragmatic approach may provide the best opportunity to introduce improvements in, for example, evaluation procedures, extension of salary scales in order to create dual-track career structures for both researchers and research managers, additional monetary and non-monetary allowances and fringe benefits, and modification to the grading structure. In addition, the results of salary surveys of other professional and technical groups in the public sector may provide valuable ammunition in presenting the case for across the board income increases for researchers and support personnel.

Donors are understandably reluctant to meet local personnel costs. However, in many countries in West Africa this is likely to be the only realistic option if there are to be any significant improvements in the real incomes of agricultural researchers and other categories of support personnel. One of the most interesting possibilities is the introduction of a system of supplements or bonuses which would be awarded annually strictly on the basis of performance and merit. For such a scheme to be effective it would need to have guaranteed funding for at least a ten-year time period, be applied throughout each NARS so that all agricultural researchers are eligible to benefit, be competently administered by local management with relatively limited assistance and supervision from donors, and provide sufficiently large financial incentives to local research personnel. Donor assistance should also be used to improve housing, transport, and other facilities for research personnel.

CHAPTER 5

SUMMARY AND CONCLUSIONS

We have attempted to provide an overview of key issues facing the agricultural research systems of West Africa. While recognizing that each country must be analyzed as an individual case, and solutions prescribed accordingly, we have attempted to group similar countries and address their common issues. The starting point was the placing of the existing systems in the broader framework of the agricultural technology management system. This provided a structure for discussing the way in which underlying structural conditions, policies, external influences, and domestic political structures have an impact on the structure and behavior of the agricultural research system. The paper then went on to look at key organizational, financial, and human resource issues which must be resolved if national systems are to be effective. It is clear that there is no unique formula for building national systems. Different organizational structures can be combined with appropriate mechanisms to perform the essential planning, management, and linkage functions a research system must do well.

From the review of the way in which research systems in West Africa have evolved, it is clear that the systems are relatively young and fragile. The economic problems affecting the countries at large can and are having detrimental effects on NARS, as financial resources in real terms and per researcher continue to decline in most countries. Institution-building efforts require stable funding and political environments in order to succeed. Donor strategies aimed at strengthening national research systems will be successful only if the donors maintain a long-term commitment. While there are logical arguments for developing regional organizations, in the past national governments have not maintained a commitment to them.

The nationalization of research in West Africa has taken different forms. The process was immediate in the anglophone countries and unexpectedly rapid in Zaïre, but took longer in the rest of francophone Africa. In spite of this, there have been some common elements in the process:

- The changing objectives for research in a national context have required organizational changes.

- There has often been a need to rationalize the system, including the retirement of excessive infrastructure or infrastructure which served goals no longer relevant to the current system.

- There has been some interruption of linkages with the outside world and reduction in the flow of information. This is being overcome in recent years by the intermediation of international centers and donor-funded networks.

- There has been a continuing need for technical assistance, and donors have increased their support through various mechanisms.

- The increasing priority given to food crops and food production systems has favored the creation of more comprehensive national institutes, but the commodity institutes have retained an important role.

This had led to a situation in which there is a de facto fragmentation of the national agricultural research systems. This occurs within ministries with sole responsibility for agricultural research as well as among ministries with competing or overlapping responsibilities. The thesis of this document is that it is important to have the various organizations coordinated for strategic planning, but it is not essential to have them unified within one operating command structure.

A further thesis of this paper is that at the present time it is less urgent to have organizational change than to improve the functioning of the existing structures. Organizational change is often used as a "new beginning" which encourages donors and justifies special effort, but it is also clear that frequent reorganizations produce degradation of the system.

Autonomy of a research organization is often sought as an end in itself. Flexibility in strategic planning, as well as in the selection and control of scientific personnel, is essential. This does not necessarily mean that the autonomous institute is the only structure which achieves this. Autonomy is not always accompanied by the resources needed. Autonomy may also foster isolation from and jealousy within the political-bureaucratic structures needed to support research. The frequent result is increased dependence on external support, which may be easier to obtain.

With respect to the relationship between research and extension, this paper argues that combining the two functions within the same ministry is not essential. What is important is to define the interface between the two functions.

Turning to the evolution of funding - both sources and uses - we note a tendency towards a decline in the real level of support for research beginning in the early 1980s. This followed a period of rapid growth in support over the period 1960-80. External support continues to be essential to many of the West African systems. There is likely to be some pressure on the francophone countries as France reduces its institutional support to African institutes and concentrates on program support.

Stable funding is important for research planning. Fluctuations in domestic funding follow the evolution of the national economy. Surges and contractions of funding prevent rational project planning. Donors on occasion solve the problem and on occasion exacerbate the problem.

Research in West Africa is often considered expensive relative to other regions of the developing world. This may be due to the high cost of expatriates and the maintenance of excessive infrastructure inherited from the colonial era. It does not appear to be due to high real compensation of national scientists compared to the cost of scientists elsewhere.

Turning to human resources, the region experienced a four-fold increase in scientific manpower from the late 1960s to 1984/85. The Sahel has increased its share of the total manpower significantly in response to donor interest. In the francophone countries a significant training effort begun in the 1970s and continuing to the present is swelling the

supply of young scientists beyond what the systems will be able to absorb. The need to create employment should not impinge on the productive employment of those already on the job.

There is increasing pressure from salaries on investment budgets and operating budgets as new scientists, trained abroad during the years of expansion, return to the national system. The growth in such personnel exceeds any realistic growth in expected expenditures on research by national governments. In response to this situation, donors may be required to protect their investment in training by supporting operating costs of the returned scientists.

In this softer labor market, the attrition of scientists is likely to fall as jobs outside become more scarce. Attention will have to be given to upgrading, motivating, and using productively the scientists who are already in the system, many of whom are young and are likely to remain for some time. Increased attention to the management of human resources will be required, including analysis of their deployment into groupings of critical masses on a regional, commodity, or disciplinary basis.

A human resources strategy is an integral part of the long-term process of institution building. Given the changing needs of national systems, this paper calls for:

- consolidation rather than expansion;
- rationalization of the use of scientists;
- diversification in the recruitment of new scientists, drawing on candidates from the basic and social sciences;
- creation of career paths and reward structures that retain the good scientists;
- institution of professional apprenticeship programs to select candidates with a true vocation for research;
- training within the region at the M.S. and Ph.D.-levels, recognizing that agricultural education cannot be developed in isolation from general university education and the parallel development of research systems;
- in-career training and retraining, with some attention to management training.

The improvement of agricultural research in West Africa is a long-term process. Institution-building requires commitment of resources in a stable fashion over a prolonged period of time. Research systems will have to be developed as part of a larger agricultural technology management system in which higher education of all types, research, and technology transfer mechanisms are improved simultaneously. Nevertheless, while waiting for these major investments to take place, significant improvements can be made in the organization and management of the human and financial resources already at the disposal of the national agricultural research systems.

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