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Statistical Brief on the National Agricultural Research System
of
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ISNAR INDICATOR SERIES PROJECT: PHASE II
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ISNAR INDICATOR SERIES PROJECT PHASE II

Decision making in the agricultural research policy area in either domestic, regional, or international fora can only be aided by access to reliable and comprehensive data on these systems. It is for this reason that ISNAR initiated its Indicator Series Project in 1986. The major objective of this project is to collect, process, and analyze reliable and comprehensive time-series data on national agricultural research systems (NARSs) throughout the world in order to identify and report on major trends and emerging policy issues with regard to the development of NARSs. To this end a database has been developed that contains time-series data on agricultural research expenditures and personnel for more than 150 developing and developed countries. These data provide a quantitative basis for more in-depth research policy studies by ISNAR and others.

During the first phase of the project (1986-91), the Indicator Series project team produced two major publications published by Cambridge University Press, namely:

Pardey, P.G., and J. Roseboom. (1989) *ISNAR Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems*, 547 pp.; and

Pardey, P.G., J. Roseboom, and J.R. Anderson, eds. (1991) *Agricultural Research Policy: International Quantitative Perspectives*, 462 pp..

The first publication is a statistical reference volume that provides system-level data on agricultural research personnel and expenditures for 154 countries. The second publication draws on the database to report on the major policy dimensions of agricultural research, with a primary focus on less-developed countries.

Phase II of the Indicator Series Project was initiated in 1992 and seeks to update the database and the policy analyses that accompany it. New ISNAR survey data are being used in conjunction with a large variety of published and "informal" reports in order to produce reliable as well as up-to-date information and statistics about the NARSs.

The country-level data are being published in a series of NARS Statistical Briefs. These briefs include more detailed descriptive information about the institutional structure of the NARS as well as a more comprehensive set of statistics than were reported in the 1989 Indicator Series volume. It is envisaged the country-level data will be assembled and analyzed in a series of regional research reports.

These statistical briefs are not official ISNAR publications; they are not edited or reviewed by ISNAR. The information and data presented have been collected and compiled with due care and all reasonable efforts have been made to ensure their accuracy. Comments, corrections, and additions to the material reported in this brief are welcomed. These briefs may be cited with due acknowledgment.

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Acronyms

ARI	Animal Research Institute	NRC	National Research Council
CDB	Cotton Development Board	OECD	Organization of Economic Coordination and Development
CDS	Centre of Development Studies	OPRI	Oil Palm Research Institute
CGIAR	Consultative Group on International Agricultural Research	RUB/FD	Research and Utilization Branch / Fisheries Department
COCO-BOD	Ghana Cocoa Board	SRI	Soil Research Institute
CRI	Crops Research Institute	SSD	Scientific Services Division
CRIG	Cocoa Research Institute of Ghana	UNDP	United Nations Development Program
CSIR	Council for Scientific and Industrial Research	URADEP	Upper Region Agricultural Development and Extension Project
FAO	Food and Agriculture Organization	VBRP	Volta Basin Research Project
FORIG	Forestry Research Institute of Ghana	VORADEP	Volta Region Agricultural Development and Extension Project
FPRI	Forest Products Research Institute	WACRI	West African Cocoa Research Institute
FRI	Food Research Institute	WAIFOR	West African Institute for Oilpalm Research
FTE	Full-Time Equivalent	WATBRU	West African Timber Borer Research Unit
GGDP	Ghana Grains Development Project	WRRI	Water Resources Research Institute
GLDB	Grains and Legumes Development Board	UCC	University of Cape Coast
IAB	Institute of Aquatic Biology	UOG	University of Ghana
IITA	International Institute for Tropical Agriculture	UST	University of Science and Technology
IRNR	Institute of Renewable Natural Resources	VSD	Veterinary Services Department
ISNAR	International Service for National Agricultural Research		
ISSER	Institute of Statistical, Social and Economic Research		
MOA	Ministry of Agriculture		
NAES	Nyankpala Agricultural Experiment Station		
NARS	National Agricultural Research System		

1. Introduction

The primary purpose of this brief is to provide statistical and institutional details on the development and current status of the public agricultural research system in Ghana. This information has been collected and presented in a systematic way in order to inform and thereby improve research policy formulation with regard to the Ghanaian NARS. Most importantly, these data are assembled and reported in a way that makes them directly comparable with the data presented in the other country briefs in this series. And because institutions take time to develop and there are often considerable lags in the agricultural research process, it is necessary for many analytical and policy purposes to have access to longer-run series of data.

NARSs vary markedly in their institutional structure and these institutional aspects can have a substantial and direct effect on their research performance. To provide a basis for analysis and cross-country, over-time comparisons, the various research agencies in a country have been grouped into five general categories; government, semi-public, private, academic, and supranational. A description of these categories is provided in table 1.

Table 1: *Institutional Categories*

Category	Description	Examples
Government	Agencies directly administered by government.	Research department within a ministry
Semi-public	Agencies not directly controlled by government and with no explicit profit making objective.	Research institute under a commodity board
Private	Agencies whose primary activity is the production of goods and services for profit.	Agricultural machinery or chemical company
Academic	Agencies that combine university-level education with research.	Faculty of agriculture
Supranational	Agencies whose mandate covers more than one country.	CGIAR institutes

Note: Adapted from OECD (1981).

The concept of a NARS used throughout this report includes only those institutes that can be classified as government, semi-public, and academic agencies. Where it is useful to do so, private and supranational research agencies have been discussed, but for reasons of comparability they are not included in the NARS data reported here. More detailed information on the definitions and concepts used in this brief is provided in appendix 2.

Section 2 provides a brief description of the institutional development and current structure of the NARS. Section 3 presents a statistical overview of the longer-run investment trends in agricultural research along with a more detailed look at contemporary investment orientations. The appendices provide further descriptive details and present the basic research personnel and expenditure data in disaggregated fashion. For general background information and statistics on Ghana we refer to appendix 1.

2. Agricultural Research Institutions

2.1 Historical Evolution¹

Ghana, previously known as Gold Coast, became a British colony in 1874. Protectorates over the Ashanti and northern territories were established in 1901. European exploration, however, began as early as the 15th century when Portuguese landed on the Gold Coast. Later in the century they established a settlement at Elmina as headquarters for the slave trade. The Portuguese were followed by traders from the Netherlands, England, Denmark, Sweden, and Prussia. By the middle of the 18th century the Gold Coast was controlled by numerous forts that were established along the coast by Dutch, British, and Danish merchants.

Agricultural research in Ghana began with the establishment of the Government Botanical Gardens at Aburi in 1890. The Aburi Gardens were formally linked to the Kew Gardens in England, whose staff largely directed the work at Aburi and provided plant materials, personnel, and scientific backstopping. In these early days, research focussed mainly on screening exotic plant material, such as oil palm, cocoa, and rubber, for economic uses in the colony. The Aburi Gardens also formed the basis for the development of the Department of Agriculture, which assumed a leadership role in agricultural research. Between 1900 and 1910 the department established agricultural experiment stations at Tarkwa, Kumasi, Asuansi, and Tamali. These stations, which often focussed on only one or two crops, supplemented the more generic crop introduction work at Aburi Gardens with research on specific crop production systems.

In addition to the research done by the Department of Agriculture of the colonial government, several regional research organizations were established throughout British West Africa in the late 1940s and early 1950s with support from the British government. When the member states gained political independence in the late 1950s and early 1960s, these regional organizations collapsed and their research facilities and activities were transferred to national governments. In this way, the Ghanaian government assumed the headquarters of the West African Cocoa Research Institute and some facilities of the West African Institute for Oil Palm Research and the West African Timber Borer Research Unit.

In 1957, when Ghana gained independence, most of the country's agricultural research was being carried out by the Specialist Branch of the Department of Agriculture with stations and trial sites located in all agroecological zones. At that time, research, extension, and advisory services were administratively and functionally integrated. The Research Act of 1958, however, sought to bring the administration of all research activities in Ghana, including agricultural research, under the newly established National Research Council (NRC). Before the act came into effect, the Specialist Branch was merged with the Soil and Land-Use Survey Department² in 1959 to form the Scientific Services Division (SSD) under the Ministry of Agriculture. The transfer of SSD to NRC took place in 1962. In 1963, NRC was succeeded by the Ghana Academy of Sciences and SSD was renamed the Agricultural Research Institute. In 1964, the Academy reorganized the Agricultural Research Institute into two separate institutes, namely the Crops Research Institute (CRI) and the Soil Research Institute (SRI).

1 The material presented in this section draws largely from FAO (1978), Nweke (1979), Korsah and Adotevi (1988), ISNAR (1989), and World Bank (1991).

2 This department originated from a soil research project initiated by WACRI in 1945. It was subsequently taken over by the Department of Agriculture in 1948.

In 1968, the Ghana Academy of Sciences was reconstituted as the Ghana Academy of Arts and Sciences (a learned society) and the Council for Scientific and Industrial Research (CSIR). The latter organization was made responsible for coordinating all scientific research in Ghana and presently oversees 10 research institutes. Seven of these institutes conduct agricultural research, namely the Animal Research Institute (ARI), the Crops Research Institute (CRI), the Soil Research Institute (SRI), the Oil Palm Research Institute (OPRI), the Institute of Aquatic Biology (IAB), the Food Research Institute (FRI), and the Water Resources Research Institute (WRI).

OPRI, which assumed its present form in 1988, was established in 1963/4 as the Oil Palm Research Centre of CRI. This center succeeded the local research activities of the West African Institute for Oil Palm Research, established in Nigeria in 1944. Another offspring of CRI is the Nyankpala Agricultural Experiment Station (NAES). Although formally still part of CRI, in 1990 it became a semi-autonomous operation with the support of the German Government. NAES began operating in 1948 as an experiment station of the Department of Agriculture, conducting research and extension on crops and animals that were relevant for the Guinea Savanna zone. In 1962 it was converted to a branch station of the newly established Agricultural Research Institute and two years later became part of CRI.

The Animal Research Institute (ARI) had its origins in the Parasitology Unit of the Zoology Department of Achimota College (today's University of Ghana). The unit was founded in 1957 and transferred to NRC in the early 1960s as the Entomological and Parasitological Research Unit. In 1964 this unit formed the basis for the establishment of ARI.

The Food Research Institute, the Institute of Aquatic Biology, and the Water Resources Research Institute were established in 1963, 1965, and 1966, respectively. WRI began operations as a unit and was only formally upgraded to an institute in 1982.

The Cocoa Research Institute of Ghana (CRIG) is one of the oldest research organizations in the country. The institute was founded in 1938 as the Central Cocoa Research Station of the Department of Agriculture. It took over the long-standing cocoa research at the Aburi Gardens. In April 1944 it became the headquarters of the West African Cocoa Research Institute (WACRI). In 1962 WACRI was nationalized, renamed the Cocoa Research Institute of Ghana (CRIG), and brought under the supervision of NRC and subsequently the Ghana Academy of Sciences and CSIR. In 1973, CRIG was separated from CSIR and transferred to the Cocoa Marketing Board, which was succeeded by the Ghana Cocoa Board (COCOBOD) in 1985. CRIG's responsibilities broadened over time to include research on coffee, cola, sheanut, and tallow. In 1987 World Bank funds were used to launch the Ghana Cocoa Rehabilitation Project, which included support for the strengthening of CRIG. This part of the project, sponsored by the British Government, has been executed by the Overseas Development Administration (ODA). The total cost of this five-year project was estimated to be 18 million dollars.

The Forest Products Research Institute (FPRI) was formed in 1962-3 by merging the research activities of the Forestry Department, established in 1908, and the former West African Timber Borer Research Unit. It was operated as a CSIR institute until 1980, when it was transferred to the newly formed Forestry Commission. A rehabilitation project for FPRI was launched in the late 1980s as part of the Ghana Forest Resources Project funded by the World Bank. Very recently, in 1993, FPRI was renamed Forestry Research Institute of Ghana (FORIG) and brought back under the aegis of CSIR.

Although the intention of the Research Act of 1958 was to consolidate all of the country's research under NRC, some research agencies remained part of or developed within the Ministry of Agriculture, such as the Research and Utilization Branch of the Fisheries Department (RUB/FD) and the veterinary laboratories of the Veterinary Services Department (VSD).

VSD has two principal veterinary laboratories, one at Accra and the other at Pong Tamale, which conduct some research. In addition, there are six regional veterinary laboratories that mainly have a service role. The laboratory at Pong Tamale is the oldest in the country and dates back to colonial times. It includes a Tsetse and Trypanosomiasis Unit. The Accra Veterinary Laboratory was established in 1966.

RUB/FD evolved out of a UNDP/FAO project which ran from 1962 to 1972. In 1977 the unit was given its present name. Between 1977 and 1990, substantial amounts of research were also executed through two regional development projects of the Ministry of Agriculture, namely the Upper Region Agricultural Development and Extension Project (URADEP) and the Volta Region Agricultural Development and Extension Project (VORADEP). Both projects, which were financed by the World Bank, included research activities that were largely done in isolation from the existing research institutes. Only a small part of the research activities initiated under these projects has been continued by CRI and SRI after the projects ended in 1985 (URADEP) and 1990 (VORADEP).

In addition to COCOBOD, several other commodity boards promote research and in some instances have developed their own research activities. The Cotton Development Board, for example, established a small cotton research unit in the early 1970s. In 1985 the unit ceased to exist as a result of a major reorientation of the Board's mandate and CRI assumed responsibility for cotton research. Other commodity boards that participate in research are: the Bast Fibre Development Board, the Timber Export Development Board, and the Grains and Legumes Development Board (GLDB). GLDB has collaborated closely with CRI, CIMMYT, IITA, and MOA through the Ghana Grains Development Project (GGDP) since 1979. This project, financially supported by the Canadian government, attempts to integrate research, extension, and input supply activities.

Ghana has a reasonably well-developed university system with three national universities as well as three faculties of agriculture. The oldest university, the University of Ghana, dates back to 1948 when a university college was established at Achimota. The college began an instructional program in the agricultural sciences in 1952. Soon thereafter, it also initiated a vigorous program of research, and established research stations at Legon (1953), Kpong (1954), Nungua (1956) and Kade (1957). Full-time research staff were permanently located at these stations. In 1961 the college, which was affiliated with the University of London, became the University of Ghana. In addition to the research undertaken by the Faculty of Agriculture, the Departments of Botany, Nutrition and Food Science, and Zoology within the Faculty of Science, as well as the Volta Basin Research Project (VBRP) and the Institute of Statistical, Social and Economic Research (ISSER), were also engaged in some agriculturally related research. The departments within the Faculty of Science have been doing research since the 1950s, while VBRP and ISSER began to do research in the 1960s.

The University of Science and Technology (UST) at Kumasi began operating as the Kumasi College of Technology in 1951. Courses in the agricultural sciences began in 1953. In 1961, the college was upgraded to a university and the agricultural department given faculty status. In

addition to the Faculty of Agriculture, the Biology Department of the Faculty of Science also does some agricultural research.

In the academic year 1974/75, a two-year postgraduate course leading to the MSc degree in Wood Technology was instituted and offered at FPRI on behalf of UST. The objective of the course was to train graduates for the timber industry in Ghana and other African countries. This program continued until 1982, when the responsibility for this postgraduate training was taken over by the newly constituted Institute of Renewable Natural Resources (IRNR). IRNR, although located within the campus of UST and institutionally integrated into the university, was formally part of the Forestry Commission until 1988. In that year it was transferred to UST. IRNR's curriculum includes not only forestry related disciplines but fisheries and wildlife disciplines as well.

The University of Cape Coast (UCC) began operating in 1962 as the University College of Science under the University of Ghana. In 1971, it became an independent university. UCC opened a School of Agriculture in 1974, which was only recently upgraded to faculty status. The Faculty of Science of UCC comprises a Department of Botany and a Department of Zoology, which both date back to the beginnings of the university. The Center for Development Studies, established in 1967, also does some agricultural research.

2.2 Present Structure

The current structure of the national agricultural research system in Ghana is presented in table 2. The Council for Scientific and Industrial Research (CSIR) comprises eight research institutes which, together with CRIG, form the nucleus of Ghana's agricultural research system. In addition, the Ministry of Agriculture oversees a fisheries research unit and some veterinary laboratories. Because of insufficient information some scattered research activities by commodity boards were not included in this overview. Also not included are the regional and international research organizations that conduct research in the country.

The academic component of the Ghanaian NARS comprises three universities, each with a faculty of agriculture and a faculty of science that includes departments of botany and zoology or biology. In addition, there are several institutes/projects attached to the universities that conduct research that is of direct relevance to agriculture, namely ISSER, VBRP, IRNR, and CDS.

The organigrams of most institutes are shown in appendix 3.

3. NARS Statistics

Questionnaire responses were received from ARI, CRI, IAB, NAES, OPRI, RUB/FD, and CRIG and combined with data and information from the sources cited at the conclusion of this brief. More detailed institutional data are provided in appendices 5 and 6. Because of insufficient data we have not included the research staff and expenditures of VSD, VORADEP, URADEP, and some commodity boards in these statistics.

The expenditure data presented in this brief are based as much as possible on the actual expenditures as reported by the various institutes. However, institutes underestimate the degree of donor support if they only have information about the donor support that is channeled through their accounting system. Most importantly they often underreport or fail to report the

Table 2: Overview of Present Structure of NARS, 1991/92

Institutional category	Executing agency		Research focus	Staffed research sites ^a	Number of researchers				
	Supervising agency	Name			Acronym	National	Expats	Total	
Government	Council for Scientific and Industrial Research	Animal Research Institute	ARI	animal production and health	4 (3)	15	1	16	16.0
		Crops Research Institute	CRI	crops	8 (3)	38	3	41	41.0
		Food Research Institute	FRI	food processing	1 (1)	35	0	35	35.0
		Forestry Research Institute of Ghana ^b	FORIG	forestry and wood processing	5 (1)	14	0	14	14.0
		Institute of Aquatic Biology	IAB	fisheries and water resources management	2 (2)	25	0	25	25.0
		Nyankpala Agricultural Research Station ^c	NAES	crops	4 (2)	23	6	29	29.0
		Oil Palm Research Institute	OPRI	oil palm, cocoa, and coconut	2 (2)	17	0	17	17.0
		Soil Research Institute	SRI	soil	7 (7)	18	0	18	18.0
		Water Resources Research Institute ^d	WRI	water resources	1 (1)	44	0	44	11.0
		Ministry of Agriculture	Research and Utilization Branch, Fisheries Dept.	RUB/FD	fisheries, water resources management	1 (1)	6	0	6
VSD	animal health			10 (2)	7	2	9	9.0	
Semi-public	Ghana Cocoa Board	Cocoa Research Institute of Ghana	CRIG	cocoa, coffee, sheanut, and kola	4 (3)	21	4	25	25.0

Table 2: Overview of Present Structure of NARS, 1991/92 (contd.)

Institutional category	Executing agency		Acronym	Research focus	Staffed research sites ^a	Number of researchers				
	Supervising agency	Name				National	Expats	Total	FTE	
Academic	University of Ghana	Faculty of Agriculture, Legon		crops, livestock, soils, extension, economics	4 (4)	na	na	70	22.3	
		Botany Department, Faculty of Sciences		botany	1 (1)	na	na	10	1.0	
		Nutrition and Food Science Department, Faculty of Science		post-harvest storage and processing	1 (1)	na	na	6	0.6	
		Zoology Department, Faculty of Sciences		zoology	1 (1)	na	na	12	1.2	
		Volta Basin Research Project	VBRP	biology	1 (1)	na	na	3	1.5	
	University of Science and Technology	Institute of Statistical Social and Economic Research	ISSER		socio-economics	1 (1)	na	na	19	1.9
			Faculty of Agriculture, Kumasi		crop, livestock, horticulture, agr. engineering, agr. economics, farm mgt.	1 (1)	na	na	47	4.7
		University of Cape Coast	Biology Department, Faculty of Science		biology	1 (1)	na	na	10	1.0
			Institute of renewable Natural Resources	IRNR	fisheries, forestry, wildlife	1 (1)	na	na	15	1.5
			Faculty of Agriculture		crops, livestock, soils, extension, agr. economics, agr. engineering	1 (1)	na	na	15	1.5
	Botany Department, Faculty of Science		botany	1 (1)	na	na	6	0.6		

Table 2: Overview of Present Structure of NARS, 1991/92 (contd.)

Institutional category	Executing agency		Research focus	Number of researchers					
	Supervising agency	Name		Acronym	Staffed research sites ^a	National	Expats	Total	FTE
	University of Cape Coast	Zoology Department, Faculty of Science	zoology		1 (1)	na	na	15	0.9
		Centre for Development Studies	socio-economics		1 (1)	na	na	5	1.3
TOTAL					44 (32)			516	286.9

Source: 0999, 1000.

^a Staffed with researchers and/or technicians. Bracketed sites are staffed with researchers.

^b This reflects the more recent situation. Until 1992 FORIG came under the Forestry Commission and was named FPRI.

^c Belongs formally to CRI but is managed financially as a separate unit since 1990.

^d It is rather difficult to estimate the share of WRRRI's research that can be classified as truly agricultural research. We assumed about 25%, since a great deal of the research activities focus on water and sanitation problems in urban areas. However, the indirect impact of WRRRI's research activities on agriculture could be considerably higher. ^e This total is slightly higher than that of the time-series dataset because incomplete historical data forced us to exclude VSD from the time-series data.

salaries and supplements paid directly to expatriate researchers. To correct for this problem in the Ghanaian data, we constructed an implicit cost series for expatriate researchers (see appendix 2) and where necessary added this to the expenditures reported by the various institutes.

Except for the experiment stations of the Faculty of Agriculture of the University of Ghana, no consistent research expenditure data were available for the academic institutes. In order to estimate these expenditures the number of FTE-researchers in each year have been multiplied by the average corresponding expenditure-per-researcher ratio of the CSIR institutes.

3.1 Long-term development

The Ghanaian NARS grew at a relatively modest rate over the past 30 years when compared with other African NARSs (table 3). Although both the number of researchers and expenditures grew steadily during the 1960s, early 1970s, and late 1980s, during the late 1970s and early 1980s the growth in research staff slowed and expenditures (corrected for inflation) declined substantially. These setbacks in the system's longer-run pattern of development were caused by a series of macroeconomic crises resulting from domestic policy distortions, economic mismanagement, and severe droughts, compounded by a worldwide recession. Only after Ghana adopted a structural adjustment program in 1984 and began to seriously implement some key aspects of this program during the second half of the 1980s, did the country resume a more positive trend in its overall economic development (Tabor, Papafio, and Haizel 1992).

Table 3: *NARS Researcher and Expenditure Series, 1961-91*

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991	annual growth rate ^a
								%
Researchers (FTEs)	78.4	127.9	156.3	186.6	193.7	235.7	277.9	4.2
Expenditures (million 1985 Cedis per year)	438.9	564.1	653.2	604.4	430.0	1059.2	1128.5	2.2
Expenditures (million 1985 PPP dollars per year) ^a	13.764	17.687	20.483	18.952	13.484	33.215	35.388	2.2
Expenditures per researcher (1985 PPP dollars per year) ^a	181,000	138,000	132,000	101,000	70,000	142,000	127,000	-1.8
Number of farmers (millions)	1.9	2.0	2.1	2.3	2.5	2.7	2.8	1.3
Researchers per million farmers	40.4	64.2	73.4	82.1	78.6	87.9	99.7	2.8
AgGDP (million 1985 PPP dollars) ^a	3033	4120	4951	4646	4735	5163	5494	1.8
Expenditures as a % of AgGDP	0.43	0.44	0.39	0.32	0.26	0.54	0.47	-0.3

Source: See appendices 5 and 6.

Note: Includes all relevant CSIR institutes, CRIG, FPRI, RUB/FD, and the universities.

^a For information about "PPP dollars" see appendix 2.

As can be seen in table 3, agricultural research expenditures were hit hard during the period of economic crisis in the decade following the mid-1970s but recovered quickly during the period of structural adjustment that followed. This latter development was due in part to an increase in donor funding, which declined substantially during the years of economic crisis. Consequently, the longer-run growth in real agricultural research expenditures during the past 30 years has

been a rather low 2.2% per annum, which is less than half the regional average. The 4.2% annual growth in research staff was also substantially below the 6.8% growth per annum for sub-Saharan Africa between 1961 and 1985 (Pardey, Roseboom, and Anderson 1991).

In the early 1960s Ghana had one of the higher per capita incomes in sub-Saharan Africa and supported a relatively well-developed agricultural research system. With 40 researchers per million farmers in 1961-65, Ghana had a substantially higher intensity of researchers than the regional average of 15. Agricultural research expenditures as a percentage of AgGDP were 0.43% in 1961-65, which was substantially above the prevailing regional average of 0.26%. Since the 1960s, however, Ghana slipped from being one of the more-developed countries in Africa. In terms of researchers per million farmers the country is still above the African average. But the amount of public spending on agricultural research relative to the size of the agricultural sector (as measured by AgGDP) dropped to a lowly 0.26% in 1981-85, compared with a weighted average of 0.49% for sub-Saharan Africa. In more recent years research expenditures grew substantially to a level of intensity that is now probably about average for the region.

3.2 Human Resources

Degree and Nationality Status of Researchers

Table 4 presents a fairly detailed, long-run overview of developments concerning the country's agricultural research staff. Unfortunately it was not possible to identify the expatriates working as faculty in the country's academic institutions so the breakdown by education level for these institutes includes both national and expatriate faculty. It is likely, however, that the nationalization of faculty has been roughly comparable with the pattern observed for researchers working in the government and semi-public agricultural research institutes.

The Ghanaian NARS shifted from expatriate to national researchers well ahead of most other African research systems. In 1961-65, the share of expatriate agricultural researchers working in Ghana was a modest 35% compared with 80% or more in most other African countries. Since the early 1970s the share of expatriate researchers remained less than 10%. There were only a few expatriate researchers working in the Ghanaian NARS during the late 1970s and early 1980s, but their numbers began to grow in the late 1980s in line with increased donor support.

The early and rapid nationalization of Ghanaian researchers is consistent with the relatively early establishment of the country's tertiary education system. Graduate training in the agricultural sciences began in Ghana in 1952. Moreover, four agricultural research stations were established by the University College during the 1950s, which suggests a willingness to support a strong research program within its Faculty of Agriculture (see section 2.1). Presently Ghana has a well-developed university system with three independent universities. Each of them has a faculty of agriculture as well as several other departments and institutes that provide instruction in the agricultural sciences.

The classification of national research staff by education level reveals a relatively high proportion of postgraduates in comparison with most other developing countries. By the early 1960s about half the national researchers in the government and semi-public institutes held a postgraduate degree. By the late 1970s this percentage had increased to about 75%, but dropped slightly to around 70% in more recent years. Most postgraduates in the government institutes hold an MSc degree, while at the semi-public institute (CRIG) the balance is in favor of those with a PhD degree.

Table 4: *Educational and Nationality Status of Researchers*

Institutional category	Researcher status	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991
		<i>(full-time equivalents)</i>						
Government	Nationals							
	PhD	4.5	16.2	20.5	29.2	28.1	30.7	43.7
	MSc	14.6	37.9	52.9	67.4	65.4	75.7	90.0
	BSc	18.9	25.3	30.9	32.1	38.3	54.9	67.3
	Subtotal	38.3	79.4	104.3	128.7	131.8	161.3	201.1
	Expatriates	12.6	9.1	3.1	1.6	6.2	11.0	10.9
	<i>Total</i>	<i>50.9</i>	<i>88.5</i>	<i>107.4</i>	<i>130.3</i>	<i>138.0</i>	<i>172.3</i>	<i>212.0</i>
Semi-public	Nationals							
	PhD	2.0	3.6	6.5	11.6	9.3	13.0	11.0
	MSc	1.5	3.8	9.1	8.4	8.8	4.8	4.0
	BSc	2.0	4.8	4.6	4.4	5.3	7.8	6.0
	Subtotal	5.5	12.2	20.2	24.4	24.8	25.6	21.0
	Expatriates	10.5	6.8	3.9	0.8	0.0	1.0	4.0
	<i>Total</i>	<i>16.0</i>	<i>19.0</i>	<i>24.1</i>	<i>25.2</i>	<i>24.8</i>	<i>26.6</i>	<i>25.0</i>
Academic ^a	PhD	3.4	6.8	8.9	10.7	11.0	14.2	19.0
	MSc	4.8	9.2	12.4	15.7	15.4	19.4	20.2
	BSc	3.5	4.4	3.6	4.8	4.6	3.2	1.7
	<i>Total</i>	<i>11.5</i>	<i>20.4</i>	<i>24.8</i>	<i>31.1</i>	<i>31.0</i>	<i>36.8</i>	<i>40.9</i>

Source: see appendix 6.

^a On the basis of the available data it was not possible to distinguish between national and expatriate faculty.

In the early 1960s about 70% of the faculty in the academic institutes were trained to postgraduate level. This percentage increased to 85% in the early 1970s, stagnated at that level in the following decade, but then continued to increase during the late 1980s to reach 96% by 1991.

Gender

In 1991 the research staff in the government as well as the semi-public institutes was about 9% female, while the three faculties of agriculture averaged about 16% females. The proportion of females working at the three faculties of agriculture grew steadily after 1985 when only 10% of the faculty were female. This shift toward a higher proportion of female researchers has been slower and more sporadic within the government and semi-public institutes. About 21% of the university student population in Ghana was female in 1990/91.

Staffing Composition

Table 5 provides a detailed breakdown of each institute's total permanent staff. There is a rather large variation in the staff composition among the different institutes. Particularly high support staff ratios can be found at the two "plantation crop" research institutes, OPRI and CRIG, which probably reflects the fact that their plantations are used for income generating purposes in addition to research. Support from qualified technical and administrative staff, however, is rather modest at these two institutes in comparison with the others. It is noteworthy that OPRI and CRIG have both reduced their "other support staff" by about 100 employees (i.e., 12% and 7%, respectively) over the past few years.

By contrast with the situation at OPRI and CRIG, CRI appears to have expanded its "other support staff" category substantially. The underlying annual data reveal a rather constant number of "other support staff" between 1985 and 1989, a considerable drop in 1990, followed by an extremely large increase in 1991.

Although support staff ratios differ markedly among institutes, the overall trend has been a decline in the number of support staff per researcher. In absolute terms the largest decline was in the ratio of other support staff per researcher, but the rate of decline in technical and administrative support staff per researcher is even more dramatic.

3.3 Financial Resources

Expenditures

Table 6 provides a breakdown of agricultural research expenditures by institutional category. The government institutes clearly gained in importance over time relative to CRIG, the only semi-public institute. In the early 1960s CRIG accounted for 37% of all public agricultural research expenditures. But over time CRIG's share declined, to about 22-23% in recent years, while its research mandate expanded to include crops such as coffee, sheanut, and kola, which together account for about 40% of the institute's current research. As a consequence of these changes, the share of cocoa research expenditures in the total public agricultural research expenditures is estimated to be around 14% in 1991.

Table 6: *Agricultural Research Expenditures*

Institutional category	1961-65	1971-75	1981-85	1986	1987	1988	1989	1990	1991
	<i>(millions 1985 PPP dollars per year)</i>								
Government	6.875	10.643	7.880	19.676	21.780	19.134	22.257	23.603	23.253
Semi-public	5.141	6.828	3.552	4.966	7.729	9.165	7.360	8.621	7.654
Academic	1.748	3.012	2.051	4.026	4.573	4.232	4.371	4.583	4.481
<i>Total</i>	<i>13.764</i>	<i>20.483</i>	<i>13.484</i>	<i>28.668</i>	<i>34.082</i>	<i>32.530</i>	<i>33.988</i>	<i>36.806</i>	<i>35.388</i>

Source: See appendix 6.

The academic institutes maintained a relatively constant share of total public agricultural research expenditures since the early 1960s. At around 12-16%, their share is higher than the corresponding figure for most other countries in the region.

Table 5: Staffing Structure, 1986-91

Staff category	ARI		CRI		IAB		NAES		OPRI		RUB/FD		CRIG		Total	
	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991
Research staff	17	16	35	41	17	25	22	29	14	17	8	6	27	25	139	159
Support staff																
Technical	11	15	93	71	19	22	78	90	4	2	30	26	36	40	270	266
Administrative	15	14	67	57	5	6	39	51	4	6	6	5	12	10	147	151
Other	286	266	459	783	68	80	361	409	831	732	61	56	1594	1482	3661	3808
Subtotal	312	295	619	911	92	110	477	550	838	740	97	87	1642	1532	4078	4222
Total	329	311	654	952	109	135	499	579	852	757	105	93	1669	1557	4217	4381
(number of personnel)																
Support staff per researcher:																
Technical	0.7	0.9	2.7	1.7	1.1	0.9	3.5	3.1	0.3	0.1	3.7	4.3	1.4	1.6	1.9	1.7
Administrative	0.9	0.9	1.9	1.4	0.3	0.3	1.7	1.8	0.3	0.4	0.7	0.8	0.5	0.4	1.1	0.9
Other	17.0	16.6	13.2	19.1	4.1	3.2	16.3	14.1	60.2	43.1	7.7	9.3	59.9	59.3	26.3	23.9
Total	18.4	18.4	17.7	22.2	5.4	4.4	21.7	19.0	59.9	43.5	12.1	14.5	60.8	61.3	29.3	26.6

Source: 0999.

Note: Not all the research institutes provided a detailed breakdown of their staff composition. The institutes included in this table jointly account for 60% of all agricultural researchers in Ghana.

Factor Mix

Table 7 identifies three broad cost categories: salaries, operating costs, and capital. The data reveal markedly different cost structures between institutes and also within institutes over time. This temporal instability is most likely a consequence of the unstable economic situation during the past decade. In the midst of Ghana's economic crisis, research institutes had to deal with unplanned and often seemingly ad hoc cuts in approved budgets, while the rate of inflation was more than 200% per annum at the peak of the crisis. Government salaries were only partially adjusted in line with inflation throughout much of the 1970s and the early 1980s. Over time this led to a significant erosion in real salaries and an exodus of qualified staff. In more recent years,

Table 7: *Cost Categories*

Cost category	ARI			CRI			FRI		
	1981-85	1986-90	1991	1981-85	1986-90	1991	1981-85	1986-90	1991
	<i>(percentages)</i>								
Salaries	72.1	55.5	60.3	63.6	62.6	na	58.5	68.5	na
Operating	23.2	19.6	13.7	27.2	34.0	na	41.5	22.6	na
Capital	4.6	24.8	26.0	9.2	3.4	na	0.0	9.0	na
Total	100	100	100	100	100	na	100	100	na
Cost category	IAB			NAES ^a			OPRI		
	1981-85	1986-90	1991	1981-85	1986-90	1991	1981-85	1986-90	1991
	<i>(percentages)</i>								
Salaries	42.5	50.3	35.3	64.3	26.3	24.0	66.5	29.0	43.5
Operating	46.0	22.0	26.4	12.6	7.5	4.6	22.8	23.5	38.6
Capital	11.5	27.7	38.3	23.1	66.2	71.4	10.7	47.5	17.9
Total	100	100	100	100	100	100	100	100	100
Cost category	SRI			WRRI			RUB/FD		
	1981-85	1986-90	1991	1981-85	1986-90	1991	1981-85	1986-90	1991
	<i>(percentages)</i>								
Salaries	54.2	66.9	na	30.5	34.3	32.0	35.6	41.3	30.9
Operating	24.4	11.9	na	18.6	21.8	8.9	64.4	53.3	24.7
Capital	21.4	21.2	na	51.0	43.9	59.0	0.0	5.4	44.4
Total	100	100	na	100	100	100	100	100	100
Cost category	FORIG			CRIG			Weighted Average		
	1981-85	1986-90	1991	1981-85	1986-90	1991	1981-85	1986-90	1991
	<i>(percentages)</i>								
Salaries	na	75.2	na	27.7	30.9	71.7	48.9	42.3	48.7
Operating	na	17.9	na	51.8	35.3	15.9	35.5	24.1	16.5
Capital	na	6.8	na	20.5	33.7	12.4	15.6	33.6	34.8
Total	na	100	na	100	100	100	100	100	100

Source: 0017, 0086, 0999.

^a The high share of capital expenditures for the years 1986-90 and 1991 may in part reflect biased capital expenditure estimates because these cost estimates may include some operating expenditures paid by GTZ. After deducting the salary costs of the relevant expatriate researchers, the remaining donor support coming from GTZ was charged to capital items when constructing the NAES figures.

however, government salaries have increased markedly, in particular for qualified staff. According to Tabor, Papafio, and Haizel (1992) salaries of senior researchers increased more than eight-fold in real terms between 1983 and 1991. In several cases these salary gains appear to have been at the expense of maintaining a viable amount of operational expenditures.

Overall, the most significant change in the cost structure is with respect to capital expenditures. Their share in total expenditures has grown markedly since the early 1980s. This no doubt reflects the improved financial situation and, in part, increased donor support for agricultural research, especially during the latter half of the 1980s.

Source of Funds

Although not all institutes provided information about their source of funds, data are provided for quite a number of them (table 8). Most institutes are funded mainly by the Ghanaian government and donors. Only OPRI reported sales of products as being a substantial although declining source of income. For all other institutes the revenues derived from product sales were negligible.

Overall, the share of donor-sourced funds has fluctuated around 30% since 1985 and peaked at 40% in 1990. NAES is largely funded by Germany and to some extent also by France. It is the institute most heavily dependent on donor funding. Another major donor is Canada, which, since the late 1970s, has supported the Ghana Grains Legumes Project at CRI. More recently, CRIG and FORIG received donor support through the Cocoa Rehabilitation Project and the Forest Resource Management Project, respectively. Both projects are led by the World Bank. Donor support is expected to increase even further in coming years as the World Bank launched a National Agricultural Research Project in late 1992. This project intends to rehabilitate ARI, CRI, OPRI, FRI, and IAB and is budgeted at 29.5 million dollars for five years.

3.4 Research Focus

An overview of the research focus of the Ghanaian NARS is provided in table 9. A large proportion of the researchers focus on non- or cross-commodity research. All researchers employed by SRI, WRRI, and FRI were classified in the non- or cross-commodity research categories. CRI, NAES, IAB, and the universities report that a substantial number of their researchers also engage in non-commodity or cross-commodity research such as farming systems, integrated pest management, socio-economics, and natural resources.

Crop production engages about three times as many researchers as livestock production. Of the crop researchers, excluding university researchers, 21% focus on cocoa, 13.1% on oil palm, 12.6% on maize, 10.9% on food legumes, 8.4% on rice, 7.2% on coffee, and 7.1% on roots and tubers. Minor research crops are: sorghum & millet, coconut, kola, cotton, plantain & bananas, vegetables, sheanut, and fruits. Natural resources (soil and water) research is concentrated in SRI, WRRI, and IAB, while post-harvest research is done mainly by FRI.

Table 8: *Source of Funding, 1985-91*

		1985	1986	1987	1988	1989	1990	1991
		<i>(percentages)</i>						
ARI	Government	80.1	90.3	89.9	89.0	89.6	88.8	82.7
	Sales	0.8	0.1	0.6	0.6	1.3	1.7	4.7
	Donor	19.1	9.6	9.5	10.4	9.1	9.5	12.6
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
CRI	Government	69.4	69.8	72.8	85.7	87.8	76.3	82.0
	Donor	30.6	30.2	27.2	14.3	12.2	23.7	18.0
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
IAB	Government	69.4	83.7	93.6	91.9	89.9	77.0	76.8
	Donor	30.6	16.3	6.4	8.1	10.1	23.0	23.2
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
NAES	Government	22.5	14.2	15.3	16.9	23.4	19.9	17.4
	Sales	1.0	0.8	0.6	1.3	0.8	0.6	0.2
	Donor	76.5	84.9	84.1	81.8	75.9	79.5	82.4
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
OPRI	Government	48.2	52.6	55.0	42.6	40.5	26.6	71.7
	Sales	46.3	47.4	13.9	12.3	10.0	5.9	15.5
	Donor	5.5	0.0	31.1	45.1	49.6	67.5	12.9
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
RUB/FD	Government	100.0	100.0	65.7	75.1	75.6	84.9	94.1
	Donor	0.0	0.0	34.3	24.9	24.4	15.1	5.9
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
CRIG	Government	98.7	98.9	99.0	99.6	98.8	78.0	69.1
	Sales	1.3	1.1	1.0	0.4	0.8	0.5	0.7
	Donor	0.0	0.0	0.0	0.0	0.4	21.5	30.1
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
WRRRI	Government	89.8	95.2	98.8	77.4	88.8	90.4	88.2
	Sales	10.2	4.8	0.8	22.6	11.2	5.6	11.8
	Donor	0	0	0.4	0	0	4.0	0
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
TOTAL	Government	64.3	59.3	65.8	70.3	70.3	58.4	62.1
	Sales	6.8	5.4	2.7	2.6	2.4	1.6	2.0
	Donor	28.9	35.3	31.5	27.1	27.2	40.0	35.9
	<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>

Source: 0999.

Table 9: *Research Focus, 1991*

Institute	Research orientation							Total
	Crops	Livestock	Forestry	Fisheries	Natural resources	Post-harvest	Other	
	<i>(full-time equivalents)</i>							
ARI		16.0						16.0
CRI	28.1						12.9	41.0
FORIG			14.0					
FRI						35.0		35.0
IAB				11.0	6.0		8.0	25.0
NAES	16.2				1.2		11.6	29.0
OPRI	17.0							17.0
SRI					18.0			18.0
WRI					11.0			11.0
RUB/FD				6.0				6.0
VL/VSD		9.0						9.0
CRIG	25.0							25.0
Universities	16.5	11.4	0.9	0.3	1.0	0.6	10.2	40.9
Total (FTEs)	102.8	36.4	14.9	17.3	37.2	35.6	42.7	286.9
<i>Total (%)</i>	<i>35.8%</i>	<i>12.7%</i>	<i>5.2%</i>	<i>6.0%</i>	<i>13.0%</i>	<i>12.4%</i>	<i>14.9%</i>	<i>100%</i>

Note: The “natural resources,” “post-harvest,” and “other” categories include research that could not otherwise be allocated to a specific commodity or commodity group. The natural resource category refers to unallocatable soils, land use, and water research.

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This bibliography comprises three different sets of references. The “references” section relates to references cited in the text, the “data sources” to references from which data have been extracted to construct the time series (see appendices 5 and 6), and “other references” to references that have been consulted in the process of data collection but not used.

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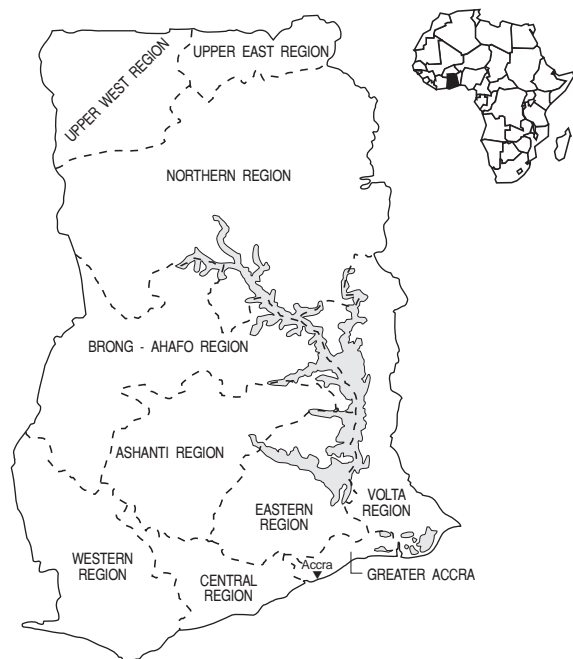
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Appendix 1: Country background information



Geography

Area: 23.9 million ha

Location: facing the Gulf of Guinea of the Atlantic Ocean on the South, Ghana is bordered by the Ivory Coast on the west, Burkina Faso on the northwest and north, and Togo in the east.

Agroecological features: the forest zone covers one third of the country and is inhabited by two-thirds of the population. A bi-modal rainfall brings annually 1,300-2,125 mm to this region, which is cultivated with the main cash crops. Cattle are generally not kept in the forest zone because the area is tsetse fly zone. The savannah zone is found south and north of the forests. To the south the coastal savannah (7% of the land area) receives 625-1,000 mm rainfall annually in a bi-modal pattern. This area is mostly covered with grassland/shrub vegetation and has poor soils on the whole. To the north, the northern savannah zone covers 57% of the country. Over 70% of the country's livestock is raised in this area. Rainfall ranges from 800-1,200 mm, decreasing to the north, with a very long dry season a short wet season. Soils have a low organic content and nutrient status.

Population

Total (1991): 15.3 million.

Annual growth rate (1981-90)^a: 3.4%

Literacy (1990): 60.3%

Life expectancy (1991): 55 years

Economy (values reported in 1985 PPP dollars)

Gross Domestic Product (1991): 14,162 million dollars

Per capita GDP (1991): 924 dollars

Agricultural GDP (1991): 5,494 million dollars

Share of agriculture in GDP (1991): 38.8%

Annual growth rates (1981-90)^a

GDP: 3.8%

GDP per capita: 0.3%

AgGDP: 1.5%

Trade (values reported in current dollars)

Net surplus total trade (1991): -337 million dollars

Net surplus agricultural trade (1991): 197 million dollars

Percentage of agricultural imports in total imports: 18.7%

Percentage of agricultural exports in total exports: 44.8%

Major agricultural import commodities (1991)^b: refined sugar (17%), fishery products (15%), rice (14%), wheat (12%) and beef & veal (12%)

Major agricultural export commodities (1991)^b: cocoa beans (64%), forestry products (18%) and fishery products (8%)

Agriculture

Agricultural land (1990): 7.7 million ha

Annual growth rate (1981-90)^a: -0.03%

Percentage arable: 14.8%

Percentage permanent crop: 20.5%

Percentage permanent pastures: 64.8%

Percentage irrigated arable and permanent cropland: 0.3%

Economically active agricultural population (1991): 2.8 million

Annual growth rate (1981-90)^a: 1.7%

Percentage in total economically active population: 49.3%

Fertilizer use per ha arable land (year): 4.8 kg

Annual growth rate (1981-90)^a: -10.1%

Major crops (in order of importance): cocoa beans, cassava, yams, plantains and taro.

Sources: Europa Publications (1992), FAO (1993), and World Bank (1992).

^a Least squares growth rate.

^b Bracketed percentages represent value share of the respective total.

Appendix 2: Definitions and concepts

NARS

The construction of quantitative and internationally comparable expenditure, personnel, and related measures of a national agricultural research system (NARS) requires a precise idea of what, in fact, is being measured. Since the term NARS is subject to a variety of interpretations, it is necessary to define rather precisely the NARS concept used here. Our approach adheres, wherever possible and appropriate, to the internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1981 and UNESCO 1984). For statistical purposes a NARS is defined in terms of the following characteristics:

(a) *National*. The concept of a “national” system used in this report refers to domestically targeted research activities funded and/or executed by the public sector of a particular country. A relatively broad concept of the public sector is taken to include government, semi-public and academic research institutes. However, private, for-profit research as well as the research activities of supranational research agencies that are not executed through national institutes are excluded. Also excluded is research undertaken by short-term development projects.

(b) *Agricultural*. Agricultural research, as defined here, includes crop, livestock, forestry, and fisheries research, as well as research on agricultural inputs, the natural resource base, and socio-economic aspects of primary agricultural production. It excludes, where possible, research concerning the off-farm storage and processing of agricultural products, commonly referred to as post-harvest research and food-processing research. This delineation corresponds with the national accounts definition of the agricultural sector.

(c) *Research*. Research is often performed in conjunction with other activities such as extension, education, and production. To the extent possible, research activities (in terms of expenditures and staff) are differentiated from these other activities. However, if non-research activities were an integral part of an institute’s research activities, and accounted for less than 20% of the resources of the institute, it was expedient to classify all the activities of the institute as being research-related.

Full-Time Equivalent (FTE)

A full-time equivalent researcher year is taken to be a person who holds a full-time position as a researcher during the whole year. Adjustments to full-time equivalents have only been made when: (a) a research position was part-time; (b) a research position was not

filled for the whole year; or (c) if the position explicitly involved tasks other than agricultural research. In the latter case an estimate was made of the time spent on agricultural research. No adjustments were made, however, for vacation or sick leave nor for time spent on administration, meetings, travel or other activities that form part of the normal duties required to support a research endeavor. Following this line of reasoning, professional staff in management positions were classified as researchers.

The degree status of researchers is determined on the following basis: 3-4 years full-time university education (BSc), 5-6 years (MSc), and more than 6 years plus doctorate thesis (PhD).

Expatriate Researcher Costs

Many expatriate researchers working on donor-supported projects in NARSs are paid their salaries and living expenses directly by the donor agency. All (or some substantial fraction) of these costs do not get included in the financial reports of the agricultural research organizations. To calculate these *implicit* costs we took the average cost per researcher in 1985 to be 120,000 “1985 PPP dollars” and backcast this figure using the rate of change in real personnel costs per FTE researcher in the US state agricultural experiment station system. This extrapolation procedure makes the assumption that the personnel-cost trend for US researchers is a reasonable proxy of the trend in real costs of internationally recruited staff working in NARSs. Unless otherwise stated, FTE expatriate researchers were costed at \$80,000 “1985 PPP dollars” per researcher for the 1961-65 period, \$85,000 per researcher for 1966-70, \$90,000 per researcher for 1971-75, \$110,000 per researcher for 1976-80, and \$120,000 per researcher for 1981-91.

Deflators and Exchange Rates

All expenditure figures were first compiled in current local currency units (appendix 5). In order to facilitate comparisons over time and across countries these figures are deflated with a local GDP deflator to base year 1985, and then converted to a common currency (US dollars) using the 1985 purchasing power parity (PPP) over GDP. PPPs are synthetic exchange rates that attempt to reflect the purchasing power of a country’s currency. The PPPs used here are derived from the Penn World Table (Mark 5) which is based on the benchmark studies of the International Comparison Project (Summers and Heston 1991). For additional information on currency conversion methods in this context see Pardey, Roseboom, and Craig (1992).

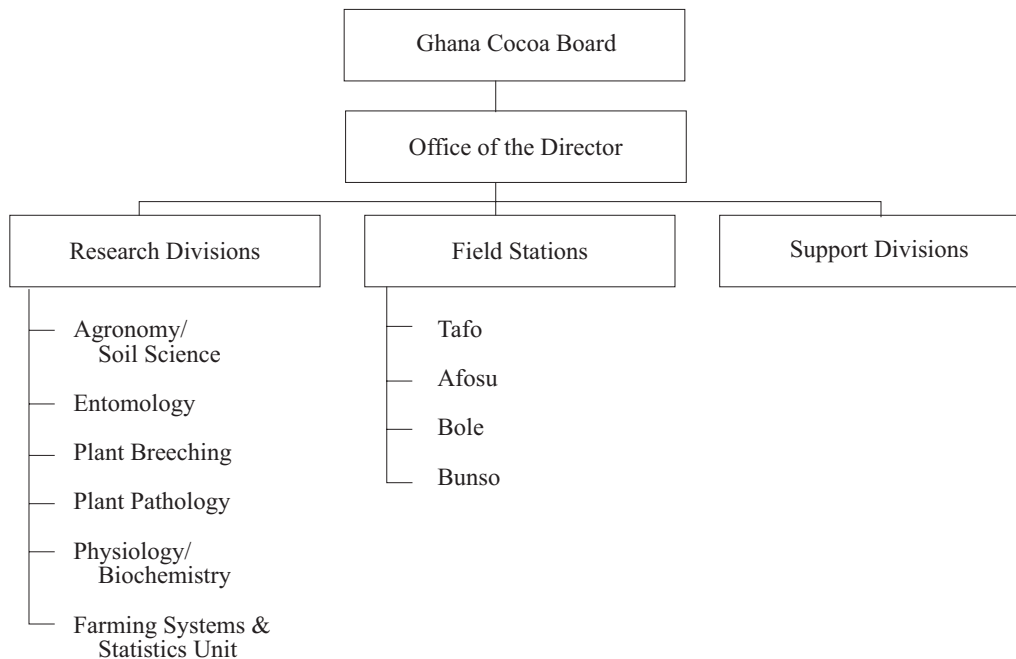
Nomenclature for tables in text

A zero indicates an actual observation of zero, a dash indicates that an observation is not relevant (due to institutional mergers, closures and so on), while “na” indicates an observation that is not available.

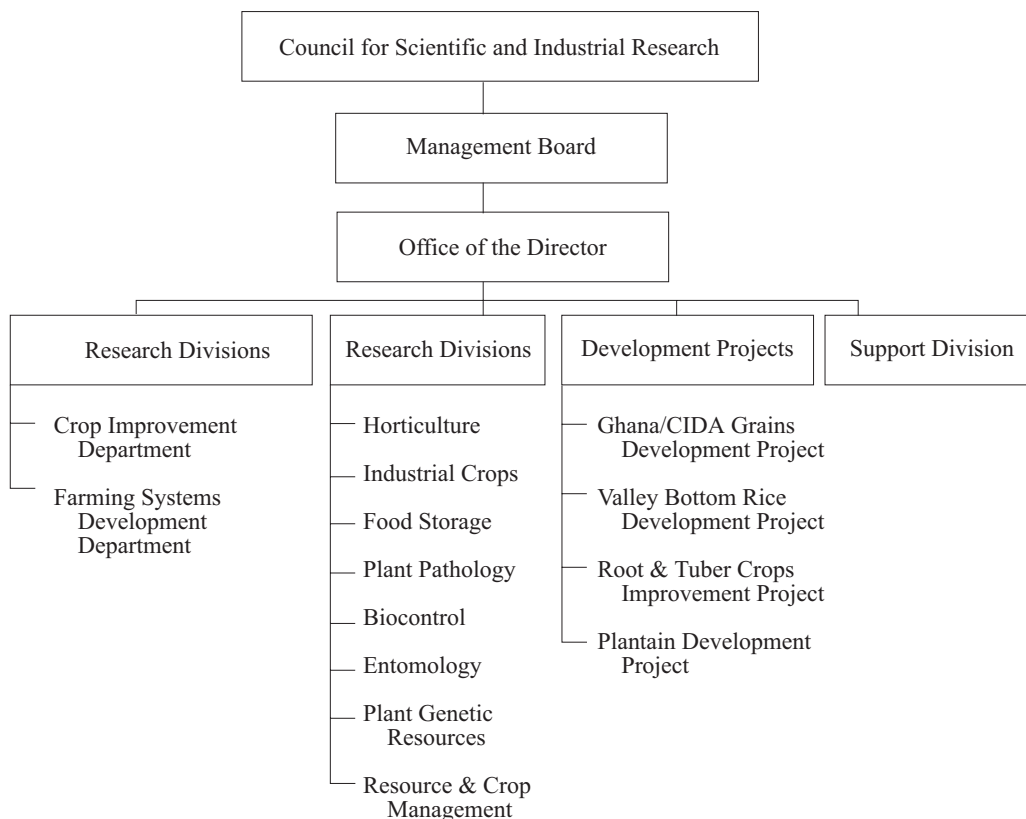
In the text we note any marked deviations from these data compilation norms and include points of clarification if warranted.

Appendix 3: Organizational charts of the agricultural research institutes

Animal Research Institute (1991/92)

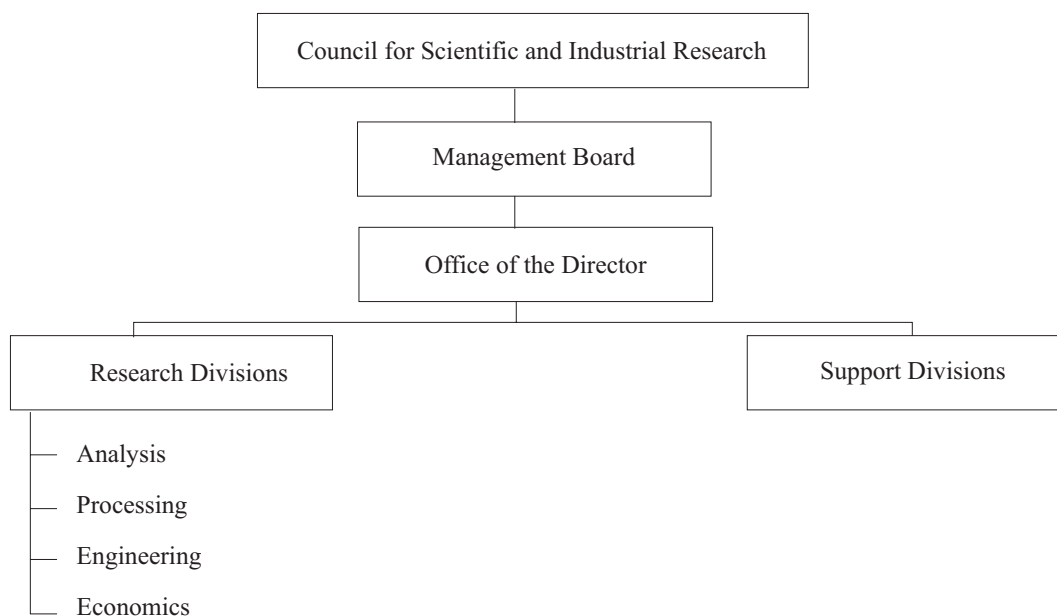


Crop Research Institute (1991/92)

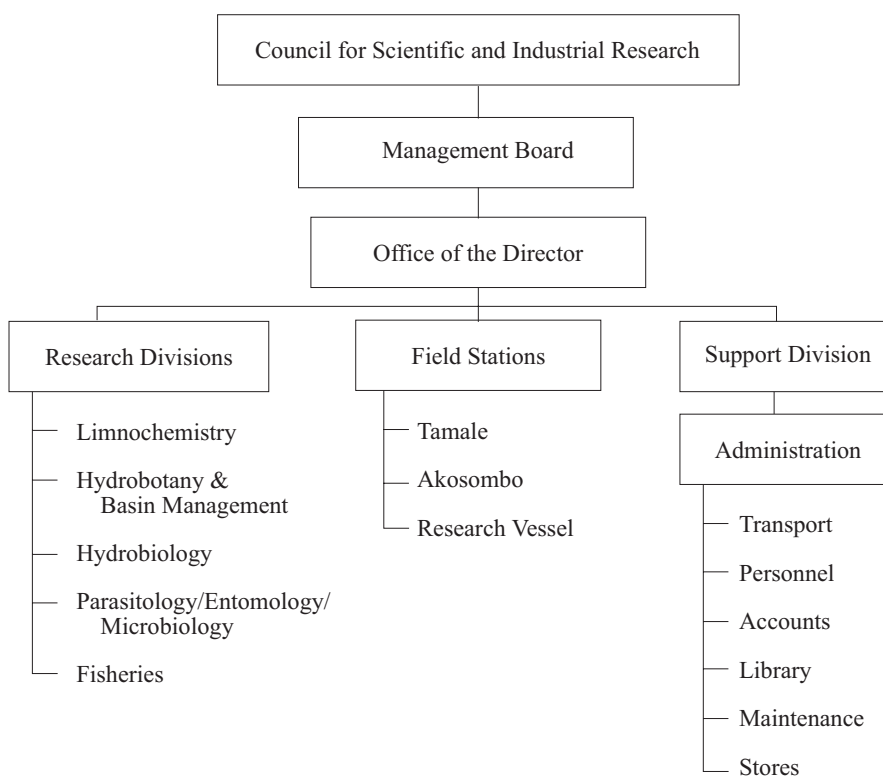


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Food Research Institute (1991/92)

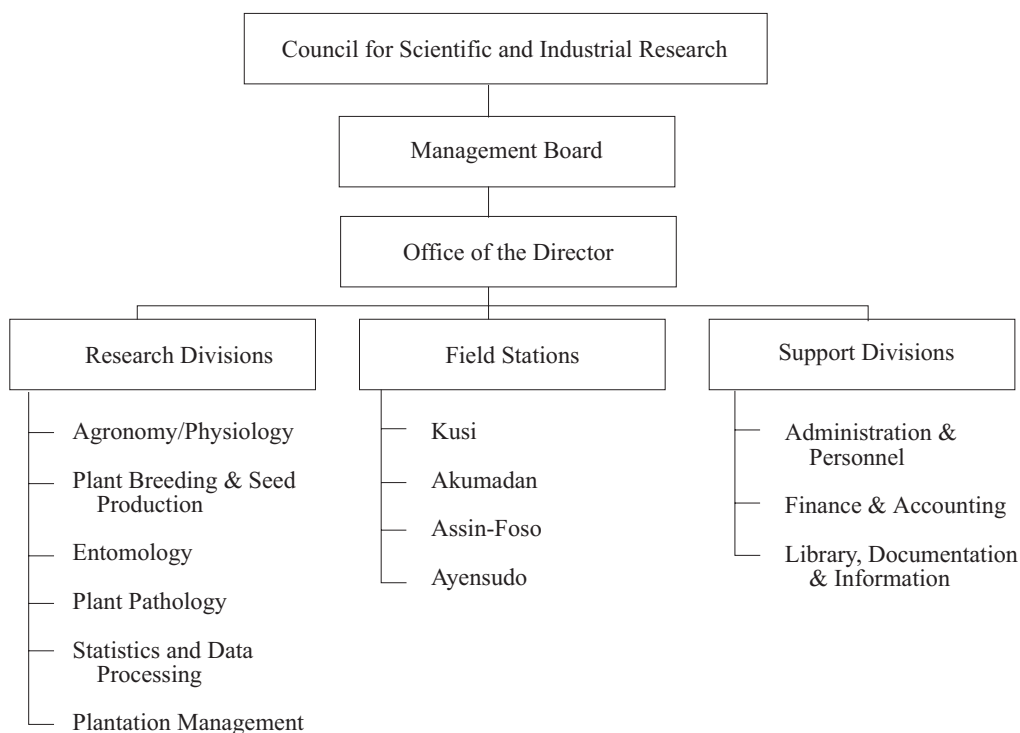


Institute of Aquatic Biology (1991/92)

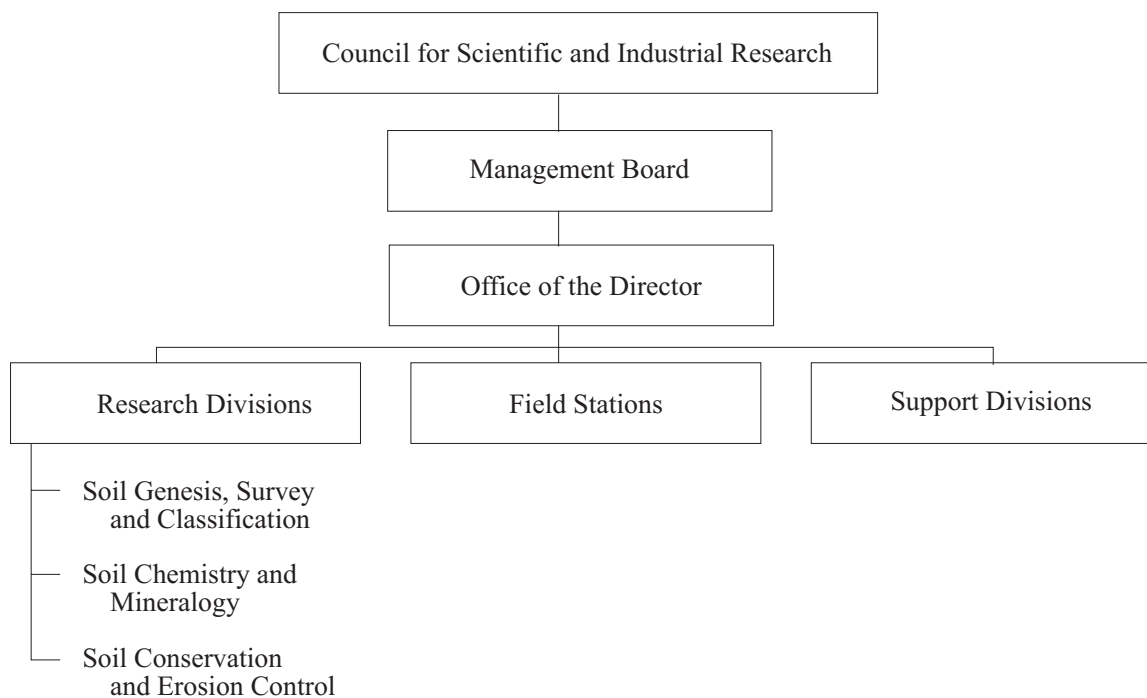


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Oil Palm Research Institute (1991/92)

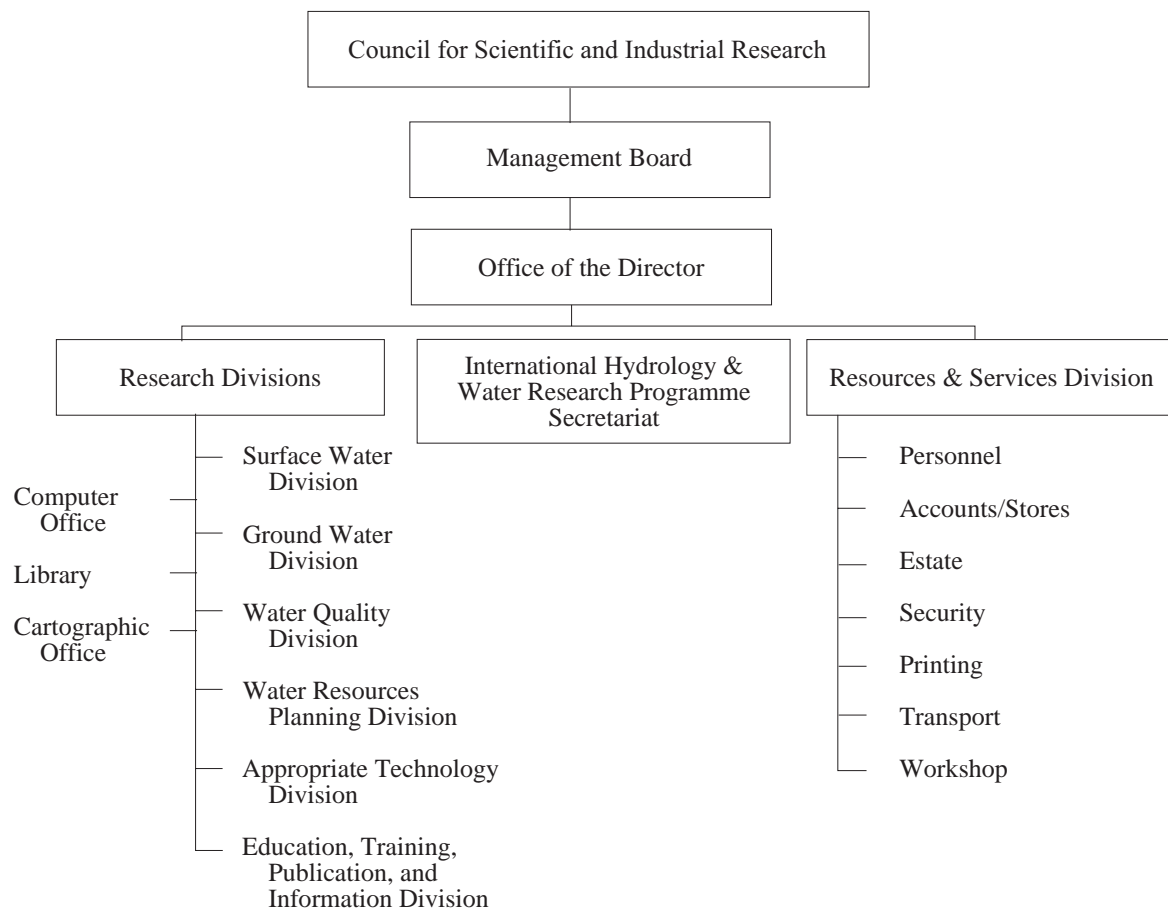


Soil Research Institute (1991/92)

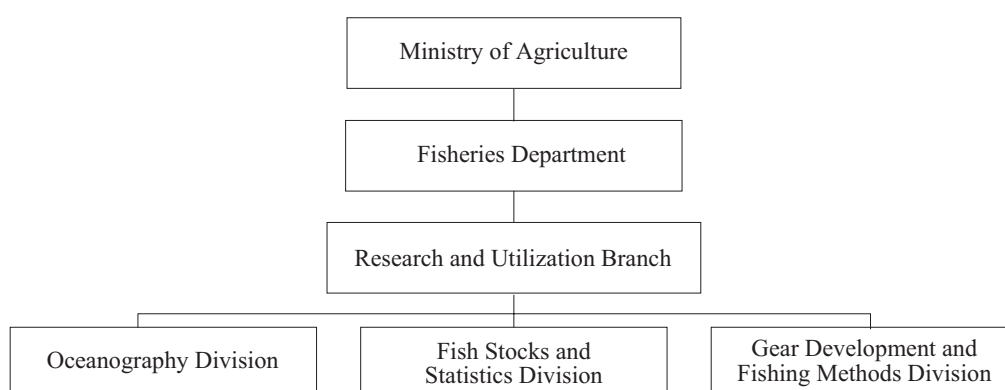


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Water Resources Research Institute (1991/92)

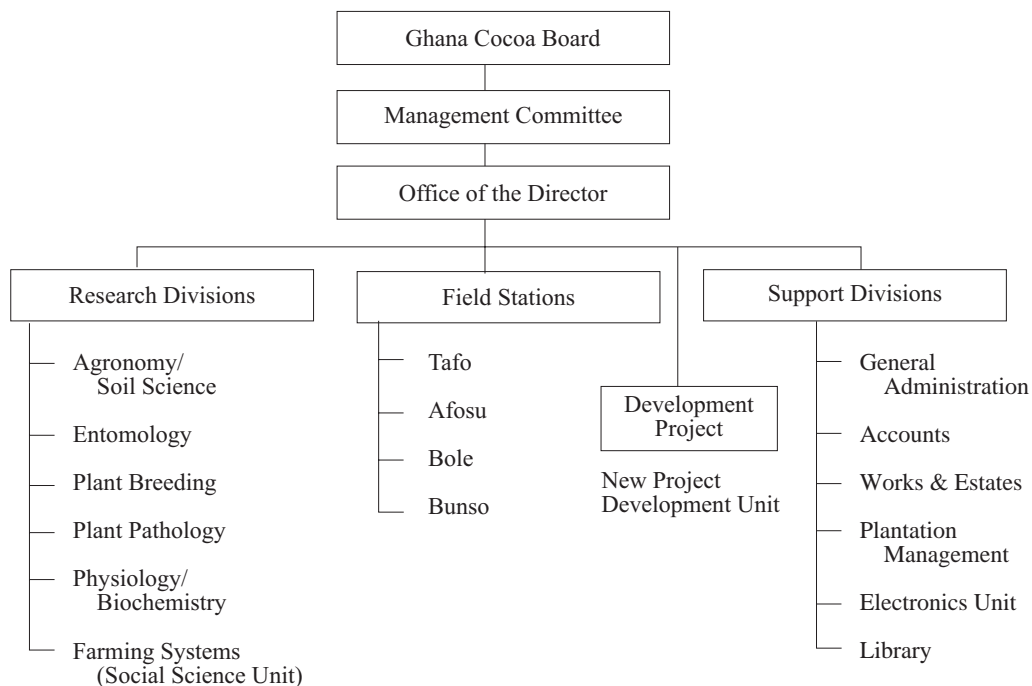


Research and Utilization Branch, Fisheries Department (1991/92)

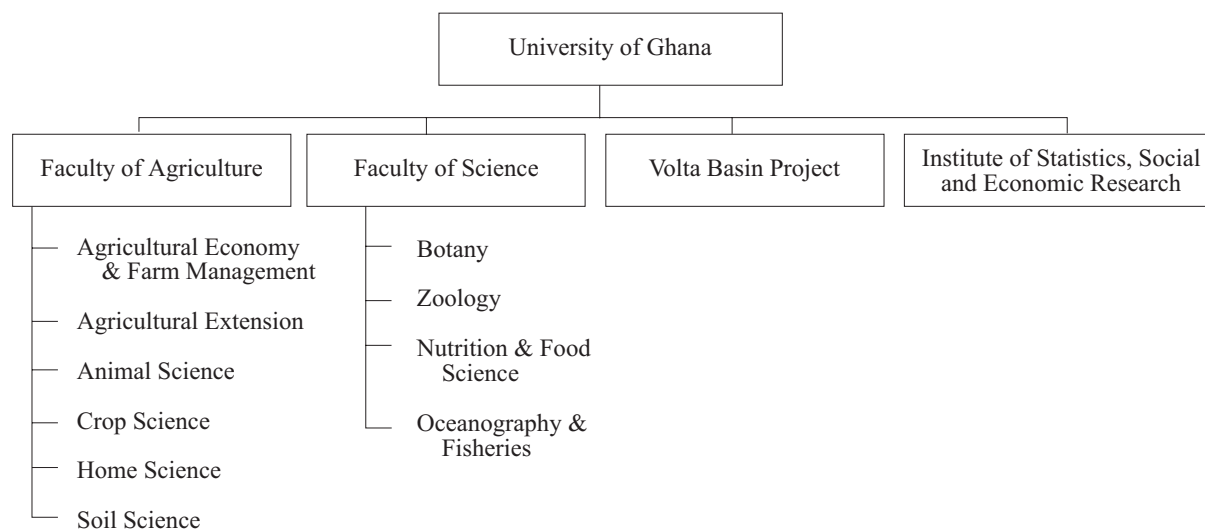


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Cocoa Research Institute of Ghana (1991/92)

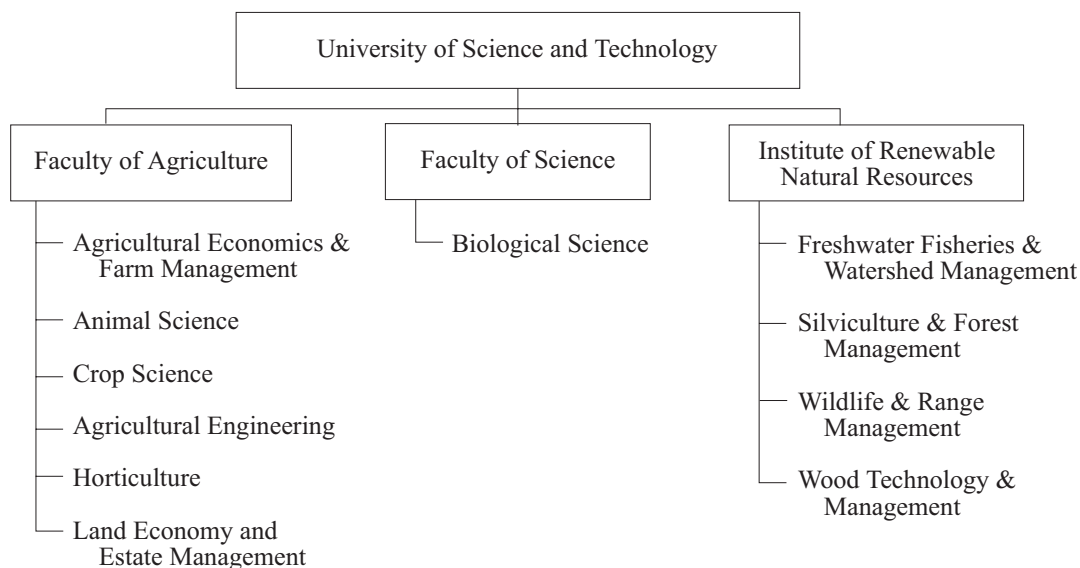


University of Ghana (1991/92)

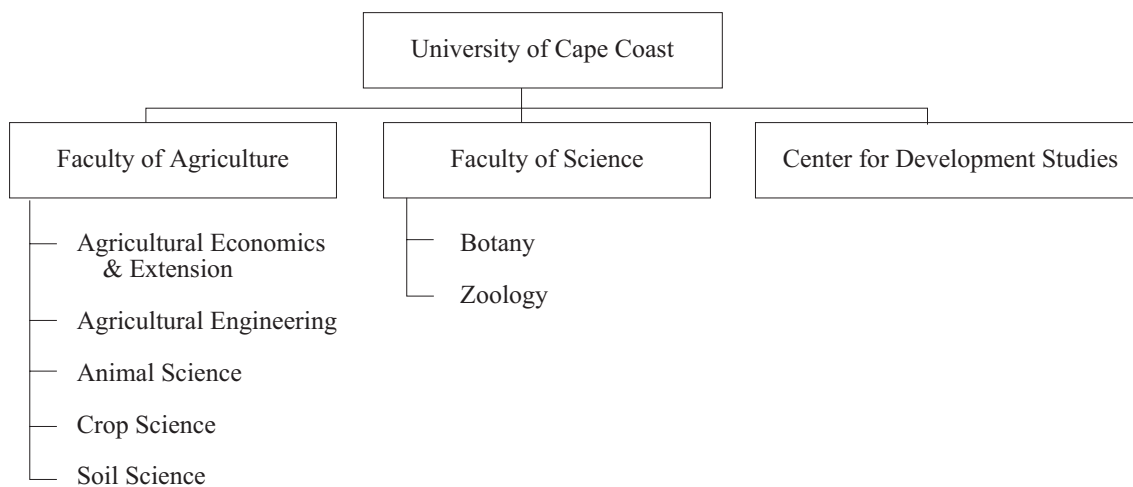


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

University of Science and Technology (1991/92)



University of Cape Coast (1991/92)



Appendix 4: Addresses of the agricultural research institutes

Director General CSIR P.O. Box M 32 ACCRA	Ghana Cotton Co. Ltd P.O. Box 371 TAMALE
Director Animal Research Institute P.O. Box 20 ACHIMOTA	Grains and Legumes Development Board P.O. Box 4000 KUMASI
Director Crops Research Institute P.O. Box 3785 KUMASI	Timber Export and Development Board P.O. Box 515 TAKORADI
Director Food Research Institute P.O. Box M 20 ACCRA	University of Ghana P.O. Box 25 LEGON
Director Institute of Aquatic Biology P.O. Box 38 Achimota ACCRA	University of Science & Technology University Post Office KUMASI
Director Oil Palm Research Institute P.O. Box 74 KADE	Dean Faculty of Agriculture University of Cape Coast University Post Office CAPE COAST
Soil Research Institute Private Mail Bag Academy Post Office Kwadaso KUMASI	Director Centre for Development Studies University of Cape Coast University Post Office CAPE COAST
Director Water Resources Research Institute P.O. Box M 32 ACCRA	Veterinary Services Department Ministry of Agriculture Ministry Branch Post Office P.O. Box M. 161 ACCRA
Executive Director Cocoa Research Institute of Ghana P.O. Box 8 TAFO	
Director Forestry Research Institute of Ghana University P.O. Box 63 KUMASI	
Director Bast Fibres Development Board P.O. Box 1992 KUMASI	

Appendix 5a: Research totals, 1961-91

Total Number of FTE Researchers		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
Category	Name institute																	
Government	CSIR/ARI	5.0	8.8	12.5	16.2	20	17.7	15.3	13	14.5	16	7	10	10.5	11	12	16	
	CSIR/CRI	13.0	14.0	15.0	16.0	17	18.0	19.0	20	23.0	26.0	29	31	29.5	28	30	31	
	CSIR/FRI					9	11.3	13.7	16	15.5	15	10	12.3	14.7	17	19	19	
	CSIR/IAB					5.0	6.0	7.0	8.0	9.0	10	10.2	10.5	10.8	11	13	13	
	CSIR/NAES																	
	CSIR/OPRI																	6
	CSIR/SRI	7.0	7.5	8.0	8.5	9	9.7	10.3	11	9.5	8	8	8	16	16.5	17	18	17
	CSIR/WRI							0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.1	1.2	1.5	1.8
	CSIR/FORIG	8.0	10.0	12.0	14.0	16	15.0	14.0	13	15.5	18	20	20	19.7	19.3	19	21	22
	MOA/Fisheries			1.0	1.0	1	2.0	3.0	4	5.5	7	6	6	6	6	6	6	6
MOA/Veterinary			na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
Subtotal government		33.0	40.2	48.5	55.8	77.0	79.7	83.1	85.8	93.2	100.8	91.1	106.5	108.4	110.2	120.5	131.8	
Semi-public	CRIG	16.0	16.0	16.0	16.0	16	17	18.0	19	20.0	21	20	20	25.5	31	24	28	
Academic	UOG/FA	1.4	1.2	1.5	1.8	2.2	2.4	2.5	2.8	3.1	2.8	3.1	3.2	3.4	3.8	3.7	3.8	
	UOG/EXPST	3.3	4.0	4.0	4.0	5.0	5.5	6.0	6.5	7.0	9.0	6.0	7.0	8.0	8.0	11.0	9.5	
	UOG/BOT	0.6	0.6	0.6	0.7	0.7	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8	
	UOG/FOOD	0.1	0.1	0.2	0.3	1.2	1.2	1.1	1.1	1.0	0.8	0.7	0.8	0.8	0.8	0.5	0.7	0.8
	UOG/ZOO	0.7	0.6	0.9	1.2	1.1	1.2	1.2	1.2	0.8	1.1	1.0	1.0	0.8	0.5	0.7	0.9	0.8
	UOG/ISSER				0.4	0.4	0.6	0.9	1.0	1.0	1.0	1.9	2.1	2.0	1.8	2.0	2.1	2.0
	UOG/VBRP				2.5	3.5	2.5	1.5	1.8	1.8	2.0	2.5	1.0	3.0	2.2	2.5	2.8	
	UCC/FA																	
	UCC/BOT			0.2	0.4	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.9	0.8	0.8	0.7	1.4	1.2
	UCC/ZOO			0.2	0.4	0.9	0.7	0.5	0.5	0.6	0.7	0.8	0.9	0.9	0.9	0.5	0.7	0.6
	UCC/CDS									0.8	0.8	0.6	0.5	0.9	1.2	1.2	2.5	2.2
	UST/FA	1.1	1.1	1.4	1.6	1.3	1.6	2.0	2.0	2.9	2.3	2.7	2.9	3.1	3.3	3.5	3.3	3.3
	UST/IRNR																	
	UST/BIOL	0.4	0.6	0.8	1.0	0.8	0.7	0.6	0.6	0.8	0.9	0.8	0.7	0.6	0.6	0.8	1.2	1.2
	Subtotal		7.6	8.2	9.8	14.3	17.8	17.8	17.8	20.3	21.3	24.6	20.6	23.8	24.1	24.8	31.0	29.3
TOTAL		56.6	64.4	74.3	86.0	110.8	114.5	118.9	125.1	134.6	146.4	131.7	150.3	157.9	166.0	175.5	189.0	
Source			1000		1000	286	589	1000	285	1000	532	279	431	1000	244	164	95	
					1000	1000					1191				1178	1000	164	
																1191	1192	

Appendix 5a: Research totals, 1961-91 (contd.)

Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
Government	CSIR/ARI	18	15.7	13.3	11	12.0	13.0	14	16	15	18	18	18	17	13	16		
	CSIR/CRI	27	26.3	25.7	25	28	30.0	32	31.0	30	26	26	37	43	42	41		
	CSIR/FRI	19	19.3	19.7	20	20.3	20.7	21	22.5	24	24	25	28.0	31	33.0	35		
	CSIR/IAB	15	13.7	12.3	11	12.7	14.3	16	18	18	17	15	18	17	17	25		
	CSIR/NAES																	
	CSIR/OPRI	5	4.7	4.3	4	6	7.0	8	8.0	8	8	11	12	12	15	19	17	
	CSIR/SRI	17	17.7	18.3	19	15.3	11.7	8	6	6	8	10	10	12	11	14.5	18	
	CSIR/WFRI	2.0	2.2	2.5	2.8	3.0	3.2	3.5	3.8	4.2	4.2	5.0	5.0	5.5	6.0	8.5	11.0	
	CSIR/FORIG	27	26.0	25.0	24	22.6	21.2	19.8	18.4	17	15.7	15.7	14.4	13	14	14.0	14.0	
	MOA/Fisheries	6	6.3	6.7	7	5	5.2	5.5	5.8	6	6	6	7	9	9	9	6	
	MOA/Veterinary	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
	Subtotal government		136.0	131.9	127.8	123.8	124.9	126.4	141.8	146.4	150.2	151.7	150.4	171.5	189.0	199.0	212.0	
	Semi-public	CRIG	27	25.3	23.7	22	23.3	24.7	26	30	20	27	22	26	28	30	25	
	Academic	UOG/FA	4.0	4.0	4.0	4.2	4.5	4.0	3.4	3.6	3.8	4.1	4.3	4.6	4.2	4.8	5.3	
		UOG/EXPST	8.0	10.5	13.0	12.0	11.0	12.0	13.0	13.0	13.0	13.7	14.3	15.0	17.0	17.0	17.0	
UOG/BOT		0.8	0.7	0.6	0.5	0.4	0.6	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.0	
UOG/FOOD		0.8	0.8	0.8	0.6	0.7	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.6	0.6	0.6	0.6	
UOG/ZOO		0.7	0.8	0.8	0.8	0.7	0.5	0.3	0.5	0.5	0.7	0.9	0.9	1.2	1.1	1.2	1.2	
UOG/ISSER		1.9	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.7	1.5	1.5	1.6	1.6	1.4	1.6	1.9	
UOG/VBRP		3.0	3.5	4.0	3.5	3.0	2.5	2.5	2.0	1.8	1.5	1.8	2.2	2.5	2.0	1.8	1.5	
UCC/FA		0.4	0.6	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.8	1.0	1.1	1.3	1.8	2.4	
UCC/BOT		0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6	0.4	0.3	0.4	0.5	0.6	0.5	0.6	0.6	
UCC/ZOO		0.6	0.7	0.8	0.8	0.6	0.4	0.2	0.4	0.2	0.3	0.4	0.6	0.7	0.5	0.7	0.9	
UCC/CDS		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.2	1.8	1.5	1.2	
UST/FA		3.3	3.8	4.1	4.3	4.6	4.3	4.3	4.0	3.9	3.8	4.1	4.3	4.6	4.7	4.7	4.7	
UST/IRNR							0.4	0.4	0.4	0.5	0.6	0.9	1.2	1.5	1.4	1.4	1.5	
UST/BIOL		1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	
Subtotal			27.6	31.1	34.5	33.2	31.8	31.5	30.9	30.5	30.1	32.7	35.3	38.1	38.4	39.6	40.8	
TOTAL		190.6	188.4	186.0	178.9	180.1	182.6	198.7	206.9	200.4	211.4	207.8	235.6	255.4	268.6	277.8		
Source		243		1000	242	68		17	86	999	925	999	925	999	999	999		
		1000			1199	1000		1000		1000	999	1208	999	1000		1000		
						1193				1179	1182	1210	1000	1191		1194		
										1183		1211	1209			1313		

Note: Italicized figures represent data that are either constructed or interpolated.

Appendix 5b: Expenditure totals, 1961-91

Total Research Expenditures		Currency: million Cedis															
Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Government	CSIR/ARI	0.127	0.196	0.280	0.378	0.526	0.499	0.412	0.388	0.479	0.541	0.260	0.503	0.548	0.595	0.680	0.873
	CSIR/CRI	0.278	0.290	0.317	0.347	0.410	0.464	0.463	0.541	0.663	0.744	0.848	1.043	1.190	1.390	1.948	2.850
	CSIR/FRI					0.125	0.159	0.173	0.217	0.218	0.200	0.135	0.179	0.244	0.338	0.400	0.510
	CSIR/IAB					0.041	0.053	0.059	0.076	0.095	0.109	0.117	0.139	0.172	0.218	0.357	0.378
	CSIR/NAES																
	CSIR/OPRI																0.500
	CSIR/SRI	0.132	0.133	0.140	0.154	0.183	0.212	0.218	0.262	0.252	0.218	0.228	0.530	0.613	0.722	0.916	1.005
	CSIR/WRRI							0.009	0.011	0.012	0.012	0.015	0.020	0.027	0.037	0.058	0.087
	CSIR/FORIG	0.071	0.091	0.117	0.147	0.195	0.197	0.177	0.186	0.247	0.298	0.353	0.399	0.469	0.566	0.818	0.750
	MOA/Fisheries			0.017	0.018	0.021	0.045	0.067	0.105	0.167	0.226	0.192	0.223	0.269	0.334	0.405	0.479
	MOA/Veterinary Labs.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Government subtotal		0.607	0.710	0.871	1.044	1.500	1.628	1.578	1.786	2.133	2.347	2.148	3.035	3.533	4.199	5.583	7.432
Semi-public	CRIG	0.680	0.662	0.669	0.677	0.736	0.787	0.831	1.011	1.209	1.334	1.377	1.562	2.333	3.415	3.286	4.786
Academic	UOG/FA	0.029	0.025	0.031	0.039	0.047	0.052	0.050	0.061	0.074	0.067	0.076	0.097	0.114	0.147	0.173	0.230
	UOG/EXPST	0.059	0.073	0.078	0.084	0.122	0.145	0.152	0.186	0.222	0.294	0.205	0.353	0.447	0.505	0.818	0.805
	UOG/BOT	0.013	0.012	0.014	0.015	0.015	0.018	0.018	0.020	0.021	0.022	0.020	0.022	0.024	0.031	0.037	0.048
	UOG/FOOD	0.002	0.002	0.004	0.006	0.026	0.025	0.022	0.021	0.019	0.018	0.017	0.022	0.027	0.019	0.033	0.045
	UOG/ZOO	0.016	0.012	0.019	0.026	0.024	0.025	0.024	0.017	0.026	0.024	0.025	0.022	0.017	0.027	0.042	0.048
	UOG/ISSER			0.009	0.009	0.009	0.014	0.018	0.021	0.024	0.046	0.052	0.058	0.061	0.075	0.098	0.120
	UOG/VBRP				0.054	0.075	0.055	0.030	0.038	0.048	0.060	0.025	0.090	0.067	0.087	0.117	0.164
	UCC/FA															0.009	0.018
	UCC/BOT			0.004	0.009	0.015	0.014	0.012	0.015	0.019	0.020	0.022	0.025	0.027	0.027	0.065	0.069
	UCC/ZOO			0.004	0.009	0.019	0.015	0.010	0.013	0.017	0.019	0.022	0.027	0.030	0.019	0.033	0.039
	UCC/CDS								0.016	0.018	0.015	0.012	0.026	0.042	0.048	0.117	0.135
	UST/FA	0.024	0.023	0.028	0.035	0.028	0.036	0.040	0.063	0.055	0.065	0.071	0.093	0.111	0.135	0.154	0.197
	UST/IRNR																
	UST/BIOL	0.009	0.012	0.017	0.022	0.017	0.015	0.012	0.016	0.021	0.019	0.017	0.019	0.020	0.031	0.056	0.072
Academic subtotal		0.151	0.159	0.198	0.306	0.396	0.417	0.390	0.487	0.564	0.670	0.565	0.855	0.987	1.153	1.751	1.989
Total (current Cedis)		1.438	1.531	1.738	2.027	2.633	2.832	2.799	3.284	3.905	4.350	4.090	5.452	6.853	8.767	10.620	14.207
GDP Deflator		0.37	0.38	0.41	0.44	0.51	0.55	0.53	0.60	0.66	0.68	0.72	0.83	1.00	1.25	1.63	2.09
Total (constant 1985 Cedis)		387.521	402.035	426.315	461.895	516.901	515.383	529.318	549.701	588.020	637.828	571.317	656.212	682.503	704.127	651.853	681.273
Total (constant 1985 PPP dollars)		12.152	12.607	13.368	14.484	16.209	16.161	16.598	17.237	18.439	20.001	17.915	20.577	21.401	22.080	20.440	21.363
Expat costs included in the total (constant 1985 PPP dollars)		na	na	na	na	na	2.990	2.765	2.495	2.080	1.708	1.358	1.139	0.929	0.725	0.519	0.682
Source		1256	1256				589					589	431			164	95

Appendix 5b: Expenditure totals, 1961-91 (contd.)

Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992		
Government	CSIR/ARI	1.981	2.723	2.543	2.057	4.328	6.195	3.904	9.068	19.890	48.155	144.377	90.841	150.091	211.568	184.415			
	CSIR/CR1	3.359	7.237	8.205	9.948	17.791	17.859	27.439	34.443	121.014	221.304	258.801	343.626	515.708	685.440	970.468			
	CSIR/FR1	0.978	1.720	1.992	2.443	3.245	2.785	3.105	3.600	8.040	32.110	37.540	65.357	106.076	165.496	230.000			
	CSIR/IAB	0.579	0.996	1.467	1.698	2.699	2.876	4.870	3.100	9.800	25.300	46.900	85.400	142.100	204.000	238.200			
	CSIR/NAES							16.262	28.244	117.154	306.551	383.029	426.213	511.240	666.730	1061.15			
	CSIR/OPRI	1.039	2.166	2.336	2.677	5.499	5.917	9.341	18.000	51.656	98.535	253.411	311.332	601.819	876.355	511.1.23			
	CSIR/SRI	1.528	2.433	3.049	4.138	6.562	7.065	11.875	14.948	31.770	59.050	99.910	151.846	169.124	241.339	319.803			
	CSIR/WRRI	0.168	0.323	0.444	0.446	0.971	0.933	0.894	1.349	5.587	13.891	20.841	16.959	49.651	53.198	77.208			
	CSIR/FORIG	2.262	3.729	4.903	7.107	11.686	13.955	29.037	36.474	35.960	74.700	100.900	82.080	113.568	148.138	174.879			
	MOA/Fisheries	0.737	1.211	1.569	2.211	2.413	2.765	5.377	7.599	9.000	10.220	27.430	37.100	47.900	77.700	105.500			
	MOA/Veterinary Labs.																		
	Government subtotal		12.631	22.538	26.508	32.726	55.194	60.350	112.103	156.824	409.871	889.815	1373.14	1610.75	2407.28	3329.96	3872.75		
	Semi-public	CRIG	7.431	11.415	12.535	14.700	23.158	25.693	47.488	131.700	129.622	224.561	487.286	771.553	796.103	1216.24	1274.85		
	Academic	UOG/FA	0.374	0.707	0.833	1.073	1.900	1.725	2.267	3.320	10.897	25.179	41.815	45.895	56.822	85.476	102.917		
UOG/EXPST		1.439	1.587	2.725	3.851	6.248	8.794	21.507	29.454	36.001	63.924	85.890	126.277	183.872	239.843	283.137			
UOG/BOT		0.075	0.124	0.125	0.126	0.169	0.240	0.467	0.600	1.721	4.128	7.076	7.982	12.176	17.095	19.418			
UOG/FOOD		0.075	0.141	0.167	0.151	0.296	0.284	0.400	0.461	1.147	2.889	5.146	5.986	8.117	10.797	11.651			
UOG/ZOO		0.065	0.133	0.167	0.189	0.296	0.218	0.200	0.461	2.007	5.366	9.114	11.973	14.882	20.694	23.302			
UOG/ISSER		0.178	0.345	0.417	0.492	0.802	0.830	1.267	1.568	4.302	9.494	15.118	15.963	18.941	29.692	36.895			
UOG/VBRP		0.281	0.619	0.833	0.883	1.267	1.092	1.334	1.614	4.302	11.351	20.908	24.943	27.058	31.491	29.127			
UCC/FA		0.037	0.106	0.156	0.227	0.380	0.393	0.600	0.738	2.007	5.160	9.328	10.975	17.588	33.291	46.604			
UCC/BOT		0.084	0.159	0.167	0.177	0.253	0.262	0.400	0.415	0.860	2.477	4.825	5.986	6.764	9.897	11.651			
UCC/ZOO		0.056	0.124	0.156	0.202	0.253	0.175	0.133	0.231	0.860	2.683	5.468	6.984	6.764	12.596	17.476			
UCC/CDS		0.187	0.353	0.417	0.505	0.844	0.873	1.334	1.845	5.735	12.899	20.908	22.448	23.676	26.992	24.273			
UST/FA		0.309	0.672	0.847	1.094	1.942	1.878	2.667	3.597	10.897	25.179	41.815	45.895	63.586	84.576	91.266			
UST/IRNR								0.175	0.267	0.461	1.721	5.572	11.580	14.966	18.941	26.093	29.127		
UST/BIOL		0.112	0.159	0.188	0.227	0.380	0.393	0.600	0.830	2.581	5.779	9.328	9.977	13.529	17.995	19.418			
Academic subtotal		3.272	5.227	7.197	9.197	15.030	17.331	33.444	45.595	85.038	182.079	288.319	356.248	472.715	646.528	746.261			
Total (current Cedis)		23.334	39.180	46.241	56.623	93.382	103.374	193.035	334.119	624.531	1296.46	2148.74	2738.56	3676.09	5192.73	5893.86			
GDP Deflator		3.50	6.00	8.20	12.38	21.62	27.52	61.31	82.88	100.00	141.81	197.69	263.98	339.16	442.40	522.26			
Total (constant 1985 Cedis)		666.081	653.426	563.899	457.310	431.930	375.613	314.829	403.147	624.531	914.223	1086.90	1037.41	1083.88	1173.76	1128.53			
Total (constant 1985 PPP dollars)		20.887	20.490	17.682	14.340	13.544	11.778	9.872	12.642	19.584	28.668	34.082	32.530	33.988	36.806	35.388			
Expat costs included in the total																			
(constant 1985 PPP dollars)		0.640	0.508	0.391	0.263	1.049	0.817	1.742	2.084	2.778	2.792	2.772	3.124	3.160	3.561	3.285			
Source:		310	310	999	68	68	999	17	68	999	999	999	999	999	999	999			
					999	999	999	999	86	1191	1191	1191	999	999	999	1194			

Note: Italicized figures represent data that are either constructed or interpolated.

Appendix 6: Research staff development by institute

Animal Research Institute (ARI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0.0	0.0	0.0	0.0	0	0.7	1.3	2	2.2	2.5	1	2.0	2.5	3	2.0	2.0
MSc	0.0	1.0	3.0	4.0	6	7.0	8.0	9	10.1	11.2	5	7.0	7.0	7	8.0	9.0
BSc	1.0	4.0	6.0	8.0	11	7.7	4.3	1	1.1	1.2	0	0.0	0.0	0	1.0	4.0
Subtotal	1.0	5.0	9.0	13.0	17	15.3	13.7	12	13.5	15.0	6	9.0	9.5	10	11.0	15.0
Expatriates	4.0	3.8	3.5	3.2	3	2.3	1.7	1	1.0	1.0	1	1.0	1.0	1	1.0	1.0
Total	5.0	8.8	12.5	16.2	20	17.7	15.3	13	14.5	16	7	10	10.5	11	12	16
Source					286			285		532	279	431		244	164	95
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	2	2.3	2.7	3	2.7	2.3	2	4	3	3	3	3	3	2	5	
MSc	10	8.7	7.3	6	7.3	8.7	10	11	8	11	11	11	10	9	9	
BSc	6	4.7	3.3	2	2.0	2.0	2	1	3	3	3	3	3	1	1	
Subtotal	18	15.7	13.3	11	12.0	13.0	14	16	14	17	17	17	16	12	15	
Expatriates	0	0.0	0.0	0	0.0	0.0	0	0	1	1	1	1	1	1	1	
Total	18	15.7	13.3	11	12.0	13.0	14	16	15	18	18	18	17	13	16	
Source	243			242			17	86	999	999	999	999	999	999	999	

Crops Research Institute (CRI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0.0	1.2	2.5	3.8	5	5.7	6.3	7	7.0	7.0	7	7.6	8.3	8	9.4	10.6
MSc	0.0	1.2	2.5	3.8	5	6.3	7.7	9	11.0	13.0	15	16.2	14.6	14	14.8	15.1
BSc	4.0	3.5	3.0	2.5	2	1.3	0.7	0	2.0	4.0	6	6.5	6.2	6	5.8	5.3
Subtotal	4.0	6.0	8.0	10.0	12	13.3	14.7	16	20.0	24.0	28	30.3	29.2	28	30.0	31.0
Expatriates	9.0	8.0	7.0	6.0	5	4.7	4.3	4	3.0	2.0	1	0.7	0.3	0	0.0	0.0
Total	13.0	14.0	15.0	16.0	17	18.0	19.0	20	23.0	26.0	29	31	29.5	28	30	31
Source					286			285			279	431		244	164	95
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	10	9.3	8.7	8	8	6.0	4	6.0	8	7	7	9	9	9	10	
MSc	13	13.0	13.0	13	9	10.0	11	11.5	12	9	8	14	20	22	18	
BSc	4	4.0	4.0	4	8	11.5	15	11.5	8	8	9	11	11	8	10	
Subtotal	27	26.3	25.7	25	25	27.5	30	29.0	28	24	24	34	40	39	38	
Expatriates	0	0.0	0.0	0	3	2.5	2	2.0	2	2	2	3	3	3	3	
Total	27	26.3	25.7	25	28	30.0	32	31.0	30	26	26	37	43	42	41	
Source	243			242	1193		17		999	999	999	999	999	999	999	

Food Research Institute (FRI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD					0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	2.0
MSc					0	2.0	4.0	6	6.0	7.0	6	8.0	10.0	12	13.4	13.0
BSc					5	5.3	5.7	6	6.5	6.0	3	3.7	4.3	5	5.6	4.0
Subtotal					5	7.3	9.7	12	12.5	13.0	9	11.7	14.3	17	19	19
Expatriates					4	4.0	4.0	4	3.0	2.0	1	0.7	0.3	0	0	0
Total					9	11.3	13.7	16	15.5	15	10	12.3	14.7	17	19	19
Source					286			285		1191	279			1178	1191	164
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	2	2.0	2.0	2	2.7	3.3	4	4.0	4	5	5	5.6	6.2	6.6	7.0	
MSc	13	12.7	12.3	12	12.0	12.0	12	10.5	9	8	11	12.3	13.6	14.5	15.4	
BSc	4	4.7	5.3	6	5.7	5.3	5	8.0	11	11	9	10.1	11.2	11.9	12.6	
Subtotal	19	19.3	19.7	20	20.3	20.7	21	22.5	24	24	25	28.0	31.0	33.0	35.0	
Expatriates	0	0.0	0.0	0	0.0	0.0	0	0.0	0	0	0	0.0	0.0	0.0	0.0	
Total	19	19.3	19.7	20	20.3	20.7	21	22.5	24	24	25	28.0	31	33.0	35	
Source	243			242			17		1179	925	2111		1191		1194	

Appendix 6: Research staff development by institute (contd.)

Institute of Aquatic Biology (IAB), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD					0.0	0.4	0.8	1.2	1.6	2.0	2.2	2.5	2.8	3	3.0	3.0
MSc					1.0	1.4	1.8	2.2	2.6	3.0	2.8	2.5	2.2	2	4.0	6.0
BSc					4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.5	5.8	6	5.7	3.3
Subtotal					5.0	6.0	7.0	8.0	9.0	10.0	10.2	10.5	10.8	11	12.7	12.3
Expatriates					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.3	0.7
Total					5.0	6.0	7.0	8.0	9.0	10	10.2	10.5	10.8	11	13	13
Source										532				1178	164	164
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	3	3.0	3.0	3	3.3	3.7	4	4	4	2	2	2	4	4	4	
MSc	8	7.7	7.3	7	7.0	7.0	7	8	8	8	8	10	8	9	11	
BSc	2	1.3	0.7	0	1.7	3.3	5	6	6	7	5	6	5	4	10	
Subtotal	13	12.0	11.0	10	12.0	14.0	16	18	18	17	15	18	17	17	25	
Expatriates	2	1.7	1.3	1	0.7	0.3	0	0	0	0	0	0	0	0	0	
Total	15	13.7	12.3	11	12.7	14.3	16	18	18	17	15	18	17	17	25	
Source	243			242			17	86	999	999	999	999	999	999	999	

Nyankpala Agricultural Experiment Station (NAES), CRI, CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD																
MSc																
BSc																
Subtotal																
Expatriates																
Total																
Source																
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD							0	0.0	0	0	0	2	3	4	6	
MSc							6	6.0	6	7	8	7	10	12	10	
BSc							4	5.5	7	5	3	3	6	6	7	
Subtotal							10	11.5	13	12	11	12	19	22	23	
Expatriates							4	5.5	7	7	7	7	7	7	6	
Total							14	17.0	20	19	18	19	26	29	29	
Source							17		999	999	999	999	999	999	999	

Oil Palm Research Institute (OPRI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD																2.0
MSc																2.0
BSc																2.0
Subtotal																6.0
Expatriates																0.0
Total																6
Source																95
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	1	1.3	1.7	2	2	2.0	2	2.0	2	2	2	3	3	3	3	
MSc	2	2.0	2.0	2	2	2.0	2	2.0	2	2	2	2	3	4	4	
BSc	2	1.3	0.7	0	2	3.0	4	4.0	4	7	8	7	9	12	10	
Subtotal	5	4.7	4.3	4	6	7.0	8	8.0	8	11	12	12	15	19	17	
Expatriates	0	0.0	0.0	0	0	0.0	0	0.0	0	0	0	0	0	0	0	
Total	5	4.7	4.3	4	6	7.0	8	8.0	8	11	12	12	15	19	17	
Source	243			242	1193		17		999	999	999	999	999	999	999	

Appendix 6: Research staff development by institute (contd.)

Soil Research Institute (SRI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0.0	0.5	1.1	1.5	2	2.7	3.3	4	4.5	5	5	6.0	6.0	6	6	5
MSc	2.0	3.1	4.3	5.2	6	5.7	5.3	5	3.0	1	1	6.0	6.0	6	6	6
BSc	2.0	1.8	1.6	1.3	1	1.3	1.7	2	2.0	2	2	4.0	4.5	5	6	6
Subtotal	4.0	5.5	7.0	8.0	9	9.7	10.3	11	9.5	8	8	16.0	16.5	17	18	17
Expatriates	3.0	2.0	1.0	0.5	0	0.0	0.0	0	0.0	0	0	0.0	0.0	0	0	0
Total	7.0	7.5	8.0	8.5	9	9.7	10.3	11	9.5	8	8	16	16.5	17	18	17
Source					286			285		532	279	431		244	164	1192
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	4	4.0	4.0	4	3.0	2.0	1	0	0	0	0	0	0	0.5	1	1
MSc	4	6.0	8.0	10	8.7	7.3	6	3	4	4	5	6	6	7.5	9	13
BSc	9	7.7	6.3	5	3.7	2.3	1	3	4	6	5	6	5	6.5	8	13
Subtotal	17	17.7	18.3	19	15.3	11.7	8	6	8	10	10	12	11	14.5	18	27
Expatriates	0	0.0	0.0	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
Total	17	17.7	18.3	19	15.3	11.7	8	6	8	10	10	12	11	14.5	18	27
Source	243			242			17	86	1179	1182	1208	1209	1191		1313	1313

Institute: Water Resources Research Institute (WRI), CSIR

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD														0		
MSc														2		
BSc														3		
Subtotal														5	6.0	7.0
Expatriates														0	0.0	0.0
Total							3.0	3.0	3.0	3	3.5	4.0	4.5	5	6.0	7.0
FTE							0.8	0.8	0.8	0.8	0.9	1.0	1.1	1.2	1.5	1.8
Source										1191				1178		
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD									1	1	2	2.8	3.6			
MSc									5	5	7	10.1	13.2			
BSc									11	14	11	9.1	7.2			
Subtotal	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	17	20	20	22.0	24	34.0	44	
Expatriates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.0	0	0.0	0	
Total	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	17	20	20	22.0	24	34.0	44	
FTE	2.0	2.2	2.5	2.8	3.0	3.2	3.5	3.8	4.2	5.0	5.0	5.5	6.0	8.5	11.0	
Source									1179	1182	1210		1191		1194	

Note: We have assumed that WRI staff spend roughly 25% of their time on agriculturally related research.

Forestry Research Institute of Ghana (FORIG)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0.0	0.5	1.0	1.5	2	2.0	2.0	2	2.0	1.0	1	1.3	1.7	2	2.0	3.0
MSc	3.0	4.0	5.0	6.0	7	7.0	7.0	7	7.0	8.0	9	10.7	12.3	14	14.0	15.0
BSc	5.0	5.5	6.0	6.5	7	6.0	5.0	4	5.5	7.0	7	5.7	4.3	3	5.0	4.0
Subtotal	8.0	10.0	12.0	14.0	16	15.0	14.0	13	14.5	16.0	17	17.7	18.3	19	21.0	22.0
Expatriates	0.0	0.0	0.0	0.0	0	0.0	0.0	0	1.0	2.0	3	2.0	1.0	0	0.0	0.0
Total	8.0	10.0	12.0	14.0	16	15.0	14.0	13	15.5	18	20	19.7	19.3	19	21	22
Source					286			285		532	279			244	164	164
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	4	6.0	8.0	10	9.2	8.4	7.6	6.8	6	6.0	6.0	6	5	5.0	5.0	
MSc	16	15.0	14.0	13	12.6	12.2	11.8	11.4	11	9.7	8.4	7	6	6.0	6.0	
BSc	7	5.0	3.0	1	0.8	0.6	0.4	0.2	0	0.0	0.0	0	3	3.0	3.0	
Subtotal	27	26.0	25.0	24	22.6	21.2	19.8	18.4	17	15.7	14.4	13	14	14.0	14.0	
Expatriates	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0.0	0.0	
Total	27	26.0	25.0	24	22.6	21.2	19.8	18.4	17	15.7	14.4	13	14	14.0	14.0	
Source	243			242					1183			925	1191			

Appendix 6: Research staff development by institute (contd.)

Research and Utilization Branch, Fisheries Department, MOA																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD			0.0	0.0	0	0.3	0.7	1	1.0	1.0	0	0.0	0.0	0	0.0	0.0
MSc			0.0	0.0	0	0.3	0.7	1	1.0	1.0	1	1.0	1.0	1	1.0	1.0
BSc			1.0	1.0	1	1.3	1.7	2	3.5	5.0	5	5.0	5.0	5	5.0	5.0
Subtotal			1.0	1.0	1	2.0	3.0	4	5.5	7.0	6	6.0	6.0	6	6.0	6.0
Expatriates			0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Total			1.0	1.0	1	2.0	3.0	4	5.5	7	6	6.0	6.0	6	6.0	6.0
Source					286			285		532	279			244		
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0
MSc	1	1.3	1.7	2.0	1.7	2.0	2.3	2.6	3	3	3	3	3	3	3	3
BSc	5	5.0	5.0	5.0	3.3	3.3	3.2	3.1	3	3	4	6	6	6	6	3
Subtotal	6	6.3	6.7	7	5	5.2	5.5	5.8	6	6	7	9	9	9	6	6
Expatriates	0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0	0	0	0	0	0
Total	6	6.3	6.7	7	5	5.2	5.5	5.8	6	6	7	9	9	9	6	6
Source	243			1199	68				999	999	999	999	999	999	999	999

Cocoa Research Institute of Ghana (CRIG)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0.0	1.0	2.0	3.0	4	3.0	3.0	3	4.0	5.0	5	5	6.5	8	8.0	12.0
MSc	1.0	1.2	1.5	1.8	2	2.0	2.0	2	5.0	8.0	9	9	9.5	10	8.0	8.0
BSc	0.0	1.0	2.0	3.0	4	4.0	5.0	7	5.0	3.0	2	2	5.0	8	6.0	6.0
Subtotal	1.0	3.2	5.5	7.8	10	9.0	10.0	12	14.0	16.0	16	16	21.0	26	22.0	26.0
Expatriates	15.0	12.8	10.5	8.2	6	8.0	8.0	7	6.0	5.0	4	4	4.5	5	2.0	2.0
Total	16.0	16.0	16.0	16.0	16	17	18.0	19	20.0	21	20	20	25.5	31	24	28
Source					286	589		285		532	279	431		244	164	164
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	12	11.7	11.3	11	9.7	8.3	7	9.5	12	15	13	13	13	11	11	11
MSc	8	8.3	8.7	9	9.7	10.3	11	8.0	5	6	4	5	5	4	4	4
BSc	6	4.7	3.3	2	4.0	6.0	8	5.5	3	6	5	8	9	11	6	6
Subtotal	26	24.7	23.3	22	23.3	24.7	26	30	20	27	22	26	27	26	21	21
Expatriates	1	0.7	0.3	0	0.0	0.0	0	0	0	0	0	0	1	4	4	4
Total	27	25.3	23.7	22	23.3	24.7	26	30	20	27	22	26	28	30	25	25
Source	243			242			17	68	999	999	999	999	999	999	999	999

Faculty of Agriculture, University of Ghana																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	2.0	2	2.5	3	3	5.5	8	8	12	12	13	14.5	16	15	16	17.5
MSc	5.7	5	7.0	9	13	12.5	12	16	13	14	15	15.5	16	22	19	19.0
BSc	6.0	5	5.5	6	6	5.5	5	4	6	2	3	2.5	2	1	2	2.0
Total	13.7	12	15.0	18	22	23.5	25	28	31	28	31	32.5	34	38	37	38.5
FTF	1.4	1.2	1.5	1.8	2.2	2.4	2.5	2.8	3.1	2.8	3.1	3.2	3.4	3.8	3.7	3.8
Source		1000		1000	1000		1000	285	1000	279	1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	19	21.5	24	25.5	27	21.0	15	16.0	17	18.0	19.0	20	19	23.5	28	28
MSc	19	17.0	15	16.0	17	17.0	17	18.5	20	22.0	24.0	26	23	24.0	25	25
BSc	2	1.5	1	1.0	1	1.5	2	1.5	1	0.7	0.3	0	0	0.0	0	0
Total	40	40.0	40	42.5	45	39.5	34	36.0	38	40.7	43.3	46	42	47.5	53	53
FTE	4.0	4.0	4.0	4.2	4.5	4.0	3.4	3.6	3.8	4.1	4.3	4.6	4.2	4.8	5.3	5.3
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Experiment Stations at Legon, Kabe, and Kpong, Faculty of Agriculture, University of Ghana																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	0.0	0	0.0	0	2	1.5	1	1.0	1	2.0	2	2.0	2	1	2	1.5
MSc	2.3	3	3.0	3	2	3.0	4	4.5	5	5.0	2	3.0	4	7	6	5.5
BSc	1.0	1	1.0	1	1	1.0	1	1.0	1	2.0	2	2.0	2	0	3	2.5
Total	3.3	4	4.0	4	5	5.5	6	6.5	7	9	6	7.0	8	8	11	9.5
FTE	3.3	4.0	4.0	4.0	5.0	5.5	6.0	6.5	7.0	9.0	6.0	7.0	8.0	8.0	11.0	9.5
Source		1000		1000	1000		1000		1000	532	1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	1	1.5	2	2.5	3	3.0	3	3.0	3	3.0	3.0	3	5	6.0	7	7
MSc	5	6.5	8	7.0	6	7.0	8	8.0	8	9.0	10.0	11	12	10.5	9	9
BSc	2	2.5	3	2.5	2	2.0	2	2.0	2	1.7	1.3	1	0	0.5	1	1
Total	8	10.5	13	12.0	11	12.0	13	13.0	13	13.7	14.3	15	17	17.0	17	17
FTE	8.0	10.5	13.0	12.0	11.0	12.0	13.0	13.0	13.0	13.7	14.3	15.0	17.0	17.0	17.0	17.0
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Appendix 6: Research staff development by institute (contd.)

Department of Botany, Faculty of Science, University of Ghana

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	6.0	6	6.0	6	6	5.5	5	5	6	5	5	5.0	5	6	6	6.0
MSc	0.0	0	0.5	1	1	2.0	3	1	2	1	1	0.5	0	1	1	1.0
BSc	0.0	0	0.0	0	0	0.5	1	3	1	3	2	2.0	2	1	1	1.0
Total	6.0	6	6.5	7	7	8.0	9	9	9	9	8	7.5	7	8	8	8.0
FTE	0.6	0.6	0.6	0.7	0.7	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8
Source		1000		1000	1000		1000	285	1000	279	1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	6	5.0	4	4.0	4	4.5	5	4.5	4	4.3	4.7	5	5	5.5	6	
MSc	1	1.0	1	0.5	0	1.0	2	2.0	2	2.3	2.7	3	3	3.5	4	
BSc	1	1.0	1	0.5	0	0.0	0	0.0	0	0.0	0.0	0	1	0.5	0	
Total	8	7.0	6	5.0	4	5.5	7	6.5	6	6.7	7.3	8	9	9.5	10	
FTE	0.8	0.7	0.6	0.5	0.4	0.6	0.7	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.0	
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Department of Zoology, Faculty of Science, University of Ghana

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	4.3	3	5.0	7	5	5.5	6	5	6	7	6	5.0	4	5	5	5.0
MSc	1.3	1	2.0	3	4	3.5	3	2	3	2	2	1.0	0	0	1	0.5
BSc	2.3	2	2.0	2	2	2.5	3	1	2	1	2	1.5	1	2	3	2.5
Total	7.3	6	9.0	12	11	11.5	12	8	11	10	10	7.5	5	7	9	8.0
FTE	0.7	0.6	0.9	1.2	1.1	1.2	1.2	0.8	1.1	1.0	1.0	0.8	0.5	0.7	0.9	0.8
Source		1000		1000	1000		1000	285	1000	279	1000		1000	242	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	5	5.0	5	3.5	2	1.5	1	1.5	2	3.3	4.2	6	6	7.0	8	
MSc	0	1.0	2	2.5	3	2.0	1	2.5	4	4.7	4.8	6	5	4.5	4	
BSc	2	1.5	1	1.5	2	1.5	1	1.0	1	0.7	0.4	0	0	0.0	0	
Total	7	7.5	8	7.5	7	5.0	3	5.0	7	8.7	9.4	12	11	11.5	12	
FTE	0.7	0.8	0.8	0.8	0.7	0.5	0.3	0.5	0.7	0.9	0.9	1.2	1.1	1.2	1.2	
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Department of Nutrition and Food Science, Faculty of Science, University of Ghana

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	0.0	0	1.5	3	6	6.0	6	5.5	5	5.0	5	6.0	7	4	6	6.0
MSc	0.0	0	0.0	0	2	3.0	4	3.5	3	2.0	1	1.0	1	1	1	1.0
BSc	1.0	1	2.0	3	4	2.5	1	0.5	0	0.5	1	0.5	0	0	0	0.5
Total	1.0	1	2.0	3	12	11.5	11	9.5	8	7.5	7	7.5	8	5	7	7.5
FTE	0.1	0.1	0.2	0.3	1.2	1.2	1.1	1.0	0.8	0.8	0.7	0.8	0.8	0.5	0.7	0.8
Source		1000		1000	1000		1000		1000		1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	6	6.0	6	5	5	4.5	4	4.0	4	4.0	4.0	4	4	4.0	4	
MSc	1	1.0	1	1	1	1.0	1	0.5	0	0.3	0.7	1	2	2.0	2	
BSc	1	1.0	1	0	1	1.0	1	0.5	0	0.3	0.7	1	0	0.0	0	
Total	8	8.0	8	6	7	6.5	6	5.0	4	4.7	5.3	6	6	6.0	6	
FTE	0.8	0.8	0.8	0.6	0.7	0.6	0.6	0.5	0.4	0.5	0.5	0.6	0.6	0.6	0.6	
Source	1000		1000	242	1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Institute of Statistical, Social and Economic Research (ISSER), University of Ghana

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD				3	2	2.0	2	2.5	3	8.0	9	7.5	6	5.5	5	5.5
MSc				1	1	3.5	6	6.0	6	9.0	10	10.5	11	12.5	14	13.0
BSc				0	1	1.0	1	1.0	1	2.0	2	1.5	1	1.5	2	1.5
Total				4	4	6.5	9	9.5	10	19	21	19.5	18	19.5	21	20.0
FTE				0.4	0.4	0.6	0.9	1.0	1.0	1.9	2.1	2.0	1.8	2.0	2.1	2.0
Source				1000	1000		1000		1000	532	1000		1000		1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	6	7.0	8	8.5	9	9.0	9	7.5	6	6.0	6.0	6	8	9.0	10	
MSc	12	11.5	11	10.0	9	7.5	6	6.5	7	7.3	7.7	8	6	7.5	9	
BSc	1	1.0	1	1.0	1	2.5	4	3.0	2	2.0	2.0	2	0	0.0	0	
Total	19	19.5	20	19.5	19	19.0	19	17.0	15	15.3	15.7	16	14	16.5	19	
FTE	1.9	2.0	2.0	2.0	1.9	1.9	1.9	1.7	1.5	1.5	1.6	1.6	1.4	1.6	1.9	
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Appendix 6: Research staff development by institute (contd.)

Volta Basin Research Project, University of Ghana

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD				3	4	2.5	1	1.0	1	2	2	3.0	1	1.0	1	1.5
MSc				1	1	0.5	0	0.0	0	0	0	3.0	3	3.5	4	4.0
BSc				1	2	2.0	2	2.5	3	3	0	0.0	0	0.0	0	0.0
Total				5	7	5.0	3	3.5	4	5	2	6	4	4.5	5	5.5
FTE				2.5	3.5	2.5	1.5	1.8	2.0	2.5	1.0	3.0	2.0	2.2	2.5	2.8
Source				1000	1000		1000		1000	532	1000	431	1000		1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	2	2.0	2	1.5	1	0.5	0	0.5	1	1.3	1.7	2	2	1.5	1	
MSc	4	4.5	5	4.5	4	3.5	3	2.0	1	1.3	1.7	2	2	2.0	2	
BSc	0	0.5	1	1.0	1	1.0	1	1.0	1	1.0	1.0	1	0	0.0	0	
Total	6	7.0	8	7.0	6	5.0	4	3.5	3	3.7	4.3	5	4	3.5	3	
FTE	3.0	3.5	4.0	3.5	3.0	2.5	2.0	1.8	1.5	1.8	2.2	2.5	2.0	1.8	1.5	
Source	1000		1000		1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 50%.

Faculty of Agriculture, University of Science and Technology

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	3.0	3	4.0	5	4	4.5	5	8	5	6	8	8.5	9	10	12	12.0
MSc	3.0	3	4.5	6	7	9.0	11	16	15	18	16	17.0	18	20	15	15.5
BSc	5.0	5	5.0	5	2	3.0	4	5	3	3	5	5.5	6	5	6	5.5
Total	11.0	11	13.5	16	13	16.5	20	29	23	27	29	31.0	33	35	33	33.0
FTE	1.1	1.1	1.4	1.6	1.3	1.6	2.0	2.9	2.3	2.7	2.9	3.1	3.3	3.5	3.3	3.3
Source		1000		1000	1000		1000	285	1000	279	1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	12	12	12.3	12.7	13	15.0	17	16.5	16	17.7	19.3	21	22	24.5	27	
MSc	16	19	20.3	21.7	23	18.0	13	12.5	12	13.0	14.0	15	20	17.5	15	
BSc	5	7	8.0	9.0	10	10.0	10	10.0	10	10.0	10.0	10	5	5.0	5	
Total	33	38	40.7	43.3	46	43.0	40	39.0	38	40.7	43.3	46	47	47.0	47	
FTE	3.3	3.8	4.1	4.3	4.6	4.3	4.0	3.9	3.8	4.1	4.3	4.6	4.7	4.7	4.7	
Source	1000	1000			1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Department of Biological Sciences, Faculty of Science, University of Science and Technology

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD	0.4	0.6	0.8	1	1	1.5	2	3.0	4	4.0	4	3.5	3	5	3	3.5
MSc	1.6	2.4	3.2	4	3	3.0	3	3.0	3	3.0	3	3.0	3	3	7	6.5
BSc	2.0	3.0	4.0	5	5	3.0	1	1.5	2	1.0	0	0.0	0	0	2	2.0
Total	4.0	6.0	8.0	10	8	7.0	6	7.5	9	8.0	7	6.5	6	8	12	12.0
FTE	0.4	0.6	0.8	1.0	0.8	0.7	0.6	0.8	0.9	0.8	0.7	0.6	0.6	0.8	1.2	1.2
Source				1000	1000		1000		1000		1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	4	3	3.0	3.0	3	4.5	6	5.0	4	4.3	4.7	5	5	5.0	5	
MSc	6	4	4.3	4.7	5	3.5	2	3.0	4	4.0	4.0	4	4	4.5	5	
BSc	2	2	1.7	1.3	1	1.0	1	1.0	1	1.0	1.0	1	1	0.5	0	
Total	12	9	9.0	9.0	9	9.0	9	9.0	9	9.3	9.7	10	10	10.0	10	
FTE	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	
Source	1000	1000			1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Institute of Renewable Natural Resources (IRNR), University of Science and Technology

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD																
MSc																
BSc																
Total																
FTE																
Source																
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD						1.0	1	1.0	1	3.0	5.0	7	4	4.5	5	
MSc						2.0	2	1.5	1	1.3	1.7	2	4	6.5	9	
BSc						1.0	1	2.5	4	4.7	5.3	6	6	3.5	1	
Total						4.0	4	5.0	6	9.0	12.0	15	14	14.5	15	
FTE						0.4	0.4	0.5	0.6	0.9	1.2	1.5	1.4	1.4	1.5	
Source							1000		1000			1000	1000		1000	

Note: Established in 1982. FTE estimated at 10%.

Appendix 6: Research staff development by institute (contd.)

Faculty of Agriculture, University of Cape Coast

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD															2	2.5
MSc															0	0.5
BSc															0	0.0
Total															2	3.0
FTE															0.2	0.3
Source															1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	3	3	3.0	3	2	2.5	3	2.5	2	3.0	4.0	5	4	5.5	7	
MSc	1	2	3.0	4	5	5.0	5	5.0	5	5.3	5.7	6	9	12.5	16	
BSc	0	1	1.5	2	2	1.5	1	0.5	0	0.0	0.0	0	0	0.5	1	
Total	4	6	7.5	9	9	9.0	9	8.0	7	8.3	9.7	11	13	18.5	24	
FTE	0.4	0.6	0.8	0.9	0.9	0.9	0.9	0.8	0.7	0.8	1.0	1.1	1.3	1.8	2.4	
Source	1000	1000		242	1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Department of Botany, Faculty of Science, University of Cape Coast

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD			1.0	2	4	4.0	4	4.5	5	5.0	5	4.0	3	5	7	5.5
MSc			0.0	0	0	0.0	0	0.5	1	1.5	2	2.0	2	1	3	3.0
BSc			1.0	2	3	2.5	2	2.0	2	2.0	2	2.5	3	1	4	3.0
Total			2.0	4	7	6.5	6	7.0	8	8.5	9	8.5	8	7	14	11.5
FTE			0.2	0.4	0.7	0.6	0.6	0.7	0.8	0.8	0.9	0.8	0.8	0.7	1.4	1.2
Source				1000	1000		1000		1000		1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	4	6	6.0	6.0	6	6.0	6	4.0	2	3.0	4.0	5	5	4.5	4	
MSc	3	2	1.3	0.7	0	0.0	0	0.5	1	1.0	1.0	1	0	1.0	2	
BSc	2	1	0.7	0.3	0	0.0	0	0.0	0	0.0	0.0	0	0	0.0	0	
Total	9	9	8.0	7.0	6	6.0	6	4.5	3	4.0	5.0	6	5	5.5	6	
FTE	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.4	0.3	0.4	0.5	0.6	0.5	0.6	0.6	
Source	1000	1000			1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Department of Zoology, Faculty of Science, University of Cape Coast

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD			0.0	0	4	3.5	3	4.0	5	5.5	6	6.5	7	4	5	4.5
MSc			0.0	0	0	0.0	0	1.0	2	2.0	2	1.5	1	0	0	0.0
BSc			2.0	4	5	3.5	2	1.0	0	0.5	1	1.0	1	1	2	2.0
Total			2.0	4	9	7.0	5	6.0	7	8.0	9	9.0	9	5	7	6.5
FTE			0.2	0.4	0.9	0.7	0.5	0.6	0.7	0.8	0.9	0.9	0.9	0.5	0.7	0.6
Source				1000	1000		1000		1000		1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	4	5	5.0	5.0	4	3.0	2	2.5	3	4.0	5.0	6	5	5.5	6	
MSc	0	1	1.5	2.0	1	0.5	0	0.0	0	0.3	0.7	1	0	1.5	3	
BSc	2	1	1.0	1.0	1	0.5	0	0.0	0	0.0	0.0	0	0	0.0	0	
Total	6	7	7.5	8.0	6	4.0	2	2.5	3	4.3	5.7	7	5	7.0	9	
FTE	0.6	0.7	0.8	0.8	0.6	0.4	0.2	0.2	0.3	0.4	0.6	0.7	0.5	0.7	0.9	
Source	1000	1000		242	1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 10%.

Centre for Development Studies (CDS), University of Cape Coast

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
PhD								1.0	1	0.5	0	0.0	0	1	2	3.0
MSc								2.0	2	2.0	2	3.5	5	4	7	5.0
BSc								0.0	0	0.0	0	0.0	0	0	1	1.0
Total								3.0	3	2.5	2	3.5	5	5	10	9.0
FTE								0.8	0.8	0.6	0.5	0.9	1.2	1.2	2.5	2.2
Source									1000		1000		1000	244	1000	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PhD	4	3	3.0	3.0	3	3.0	3	3.5	4	4.0	4.0	4	2	2.0	2	
MSc	3	4	4.3	4.7	5	5.0	5	4.0	3	3.0	3.0	3	3	3.0	3	
BSc	1	1	0.7	0.3	0	0.0	0	0.5	1	1.3	1.7	2	2	1.0	0	
Total	8	8	8.0	8.0	8	8.0	8	8.0	8	8.3	8.7	9	7	6.0	5	
FTE	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.2	1.8	1.5	1.2	
Source	1000	1000			1000		1000		1000			1000	1000		1000	

Note: FTE estimated at 25%.

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