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Statistical Brief on the National Agricultural Research System

of

ZAMBIA

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Philip G. Pardey

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

| | | | |
|---------|---|-------|---|
| APT | Adaptive Research Planning Team | MENR | Ministry of Environment and Natural Resources |
| CFRI | Central Fisheries Research Institute | MHEST | Ministry of Higher Education and Science and Technology |
| CGIAR | Consultative Group on International Agricultural Research | NARS | National Agricultural Research System |
| CRT | Crop Research Team | NCSR | National Council for Scientific Research |
| CVRI | Central Veterinary Research Institute | OECD | Organization of Economic Coordination and Development |
| DAE | Department of Agricultural Engineering | PPP | Purchasing Power Parity |
| DFR | Division of Forestry Research | RB | Research Branch |
| DFPRD | Division of Forest Products Research and Development | RDSB | Rural Development Studies Bureau |
| FAO | Food and Agriculture Organization | SAS | School of Agricultural Sciences |
| FINNIDA | Finnish International Development Agency | SRT | Specialist Research Team |
| FTE | Full-Time Equivalent | SVM | School of Veterinary Medicine |
| FTRU | Food Technology Research Unit | TIRC | Tree Improvement Research Centre |
| ISNAR | International Service for National Agricultural Research | UNZA | University of Zambia |
| LPRC | Livestock and Pest Research Centre | WRRU | Water Resources Research Unit |
| MAFF | Ministry of Agriculture, Food and Fisheries | | |

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 Zambia. 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 Zambian 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 Zambia we refer to appendix 1.

2. Agricultural Research Institutions

2.1 Historical Evolution ¹

Agricultural research in Zambia began in 1922 at the Experimental Gardens in Chilanga. Work at the Gardens emphasized cash crops such as cotton and tobacco, although various other crops were also introduced and evaluated for yield potential as well as for pest and disease susceptibility. In 1937 the first formal evaluation of yields of local maize varieties was made.

By 1940 several other research sites had been opened up for crop research, including sites at Chipata, Mazabuka, and Mbala. Entomological and plant pathology research continued to be important and locust and army worm outbreaks were investigated. Although during the war years only a skeletal staff was maintained, in 1944 Lusaka Agricultural Station was opened at Chalimbana and work was initiated on wheat, with emphasis on surveying disease problems and assessing varietal performance.

In 1953 the research activities of the Department of Agriculture were separated from the other activities of the department and concentrated in a separately administered Research Branch. At the same time a Central Research Station was built at Mount Makulu as well as three substations supported by the Colonial Development and Welfare Act. In 1959 livestock research was transferred from the Veterinary Department to the Research Branch. Several other regional research stations were established during the 1960s to improve the geographical coverage of research throughout the country.

Agricultural research during the colonial period focused mainly on the commercial production of crops by European farmers. Particular emphasis was given to maize (a principal source of food for the copper mine workers), although export crops such as coffee and tobacco and also various foodstuffs aimed at the European consumer such as fruits and vegetables were also quite heavily researched. Only a small number of trials were conducted on crops grown by the majority of African farmers, including sorghum, millet, groundnuts, and beans. However, some attention was given to replacing or revamping the shifting cultivation system as part of an effort to conserve the natural resource base.

Beginning with a situation in which research focused almost exclusively on the commercial agricultural sector, the research emphasis of the Research Branch has, since independence, shifted only very gradually towards the production problems of the small-scale and subsistence farmers. Since commercial, large-scale farmers account for a substantial share of the local supply of food for the country's (relatively large) urban population, the government refrained from making radical changes in research priorities. In addition, the continued reliance on a significant input from expatriate researchers, who tend to be more acquainted with modern rather than traditional agriculture, may also have contributed to these research priorities. In this respect, it is noteworthy that the first African national researcher within the Research Branch was appointed in 1967 and a decade later only 18 of the 74 researchers at the Research Branch were nationals, most of them employed in relatively junior positions.

1 The information presented in this section draws largely from Chungu (1984), Kean and Singogo (1988), Royal Tropical Institute and Euroconsult (1988), Burley, et al. (1989), and Eylands and Patel (1990).

Until the late 1970s, the Research Branch was organized predominantly by discipline. Most experiments were conducted at the research stations under input intensive production systems that were more representative of large-scale, commercial farmers than the majority of Zambia's small-scale, subsistence farmers. In an effort to reorient the research activities of the Research Branch more towards the needs of small-scale and subsistence farmers, the Branch was reorganized in the early 1980s. The new structure consisted of nine Commodity Research Teams (CRTs) and seven Specialist Research Teams (SRTs), each established on a multidisciplinary basis to conduct on-station, component research. In addition, Adaptive Research Planning Teams (ARPTs) were established. They operate in each of Zambia's nine provinces and conduct farming-systems research, including on-farm trials under farmers' conditions. By way of these organizational changes, it was hoped that more attention would be given to the problems of the small-scale and subsistence farmers.

For more than 50 years the Research Branch of the Department of Agriculture has been the principal agricultural research organization in the country. However, over the years several other agricultural research agencies have emerged alongside the Research Branch.

Veterinary research facilities were established at Mazabuka in 1928 by the Veterinary Department. For more than half a century the Central Veterinary Research Station was located at Mazabuka. In 1979, however, the station was relocated to new facilities at Balmoral and renamed the Central Veterinary Research Institute.

Forestry research under the Forest Department dates back to the early 1930s when numerous exotic hardwoods and pines were established as species trials in the Northern, Central, and Southern plateaux, as well as the Lake Basin and the Zambezi Valley. At about the same time fundamental studies of indigenous tree species were initiated. These included woodland classification, timber quality investigations, and comparative studies on growth rates, productivity, and silvicultural systems. These early studies were further consolidated in the 1960s, particularly after independence, by increasing the number of professional and technical staff working in the Forestry Research Division as well as the number of research sites. During the 1970s and 1980s the Forestry Research Division received major support from FINNIDA in the form of technical assistance, oversees training, and financial contributions to research projects and capital investments. After 1985 this support seems to have ceased or at least been significantly reduced.

In 1963, when the first plantation-grown timber was marketed in Zambia, the Division of Forest Products Research and Development was formed within the Forest Department. The division conducts research on the use and processing of wood and was first developed with assistance from FAO and more recently from FINNIDA.

Fisheries research in Zambia began with the establishment of a Research Division (also named the Central Fisheries Research Institute (CFRI)) within the Department of Fisheries in 1951. In addition to its headquarters at Chilanga, CFRI operates several research stations located at the major fisheries, i.e., Lake Kariba, Lake Bangweulu, Lake Mweru, Lake Tanganyika, Lake Mweru-Wa-Ntipa, Kafue flood plain, and the Itezhi-tezhi reservoir.

In 1961 the Agricultural Research Council of Central Africa was established by the Federation of Rhodesia and Nyasaland (today's Malawi, Zimbabwe, and Zambia) after the model of the Agricultural Research Council of East Africa. The council quite rapidly established its own research activities and facilities in each of the member countries. With the dissolution of the

federation in 1963, however, the council fell apart. In Zambia, the research activities of the regional council were taken over by a newly established national Agricultural Research Council, that in due course was taken over by the National Council for Scientific Research (NCSR) which was established in 1967. The main functions of NCSR are to advise the Government on national research policy and to coordinate and promote scientific research in ways that address national development objectives. In addition, NCSR directly manages research conducted at the following facilities: the Livestock Pests and Disease Control Centre, the Tree Improvement Centre, the Food Technology Research Unit, and the Water Resources Research Unit. The apparent duplication of effort in some research areas such as forestry and veterinary research may stem from the pre-independence situation where more basic and fundamental research was done by the regional council and applied research by the national ministries. But it is unclear whether that division of labor is still the case or, indeed, whether there is in fact an unwarranted duplication of effort.

The University of Zambia was established in 1966 and includes several schools, among which are the School of Agricultural Sciences established in 1971 and the School of Veterinary Medicine established in 1983. Other schools that may conduct some research of relevance for agriculture are the School of Natural Sciences, the School of Engineering (agricultural engineering), and the Rural Development Studies Bureau. The Bureau was established in 1972 to undertake policy-oriented research on the rural development problems facing the country.

2.2 Present Structure

The Research Branch of the Department of Agriculture is by far the most important agricultural research agency in Zambia. In 1992, it accounted for about 60% of the country's research capacity in terms of full-time equivalent researchers (table 2). Its research mandate includes a wide array of topics related to crop and livestock production. The Research Branch currently consists of nine commodity research teams (cereals, oilseeds, fibres, roots and tubers, vegetables, grain legumes, tobacco, tree and plantation crops, and livestock, forage and pastures), seven specialist research teams (plant protection, farm machinery and soil tillage, soil productivity, cropping systems, irrigation, food storage and conservation, and weed control), nine agricultural research planning teams (one in each province), and three service units (crop and soil advisory, library, and seed control). These teams and units execute their research activities at Mount Makulu Central Agricultural Research Station and at ten regional and specialized research stations (Mazabuka, Mochipapa, Magoye, Misamfu, Mansa, Msekera, Copperbelt, Mongu, Mutanda, and Kabwe). In addition, the branch has some 11 substations and an unspecified number of trial sites.

In addition to the commodity coverage of the nine commodity teams identified above, research on estate tea production is conducted at the Kawambwa Tea Estate and entirely financed by the tea industry. Although the research at Kawambwe is done quite independently from that undertaken by the Research Branch, it is formally managed by the Branch. The tobacco industry also provides partial funding for the tobacco research conducted by the Research Branch.

The Department of Forestry, the Department of Fisheries, and the Department of Veterinary and Tsetse Control have their own research divisions. In addition, NCSR supervises several research agencies of which four are of relevance to agriculture, namely FTRU (food technology), LPRC (animal diseases), TIRC (forestry), and WRRU (water resources).

Table 2: Overview of Present Structure of NARS, 1992

| Institutional category | Executing agency | | | | Staffed research sites ^a | Number of researchers | | | |
|------------------------|--|---|---------|--------------------------|-------------------------------------|-----------------------|--------|-------|-------|
| | Supervising agency | Name | Acronym | Research focus | | National | Expats | Total | FTE |
| Government | MAFF - Department of Agriculture | Research Branch | RB | crops and livestock | 16 (13) | 138 | 26 | 164 | 164.5 |
| | MAFF - Department of Fisheries | Central Fisheries Research Institute | CFRI | freshwater fisheries | 13 (13) | 22 | 5 | 27 | 27.0 |
| | MAFF - Department of Veterinary and Tsetse Control | Central Veterinary Research Institute | CVRI | veterinary medicine | 6 (2) | 10 | 1 | 11 | 11.0 |
| | MENR - Forestry Department | Division of Forestry Research | DFR | forestry | 9 (1) | 5 | 0 | 5 | 5.0 |
| | | Division of Forest Products Research and Development | DFPRD | forest products | 1 (1) | 4 | 0 | 4 | 4.0 |
| | MHEST - National Council for Scientific Research | Tree Improvement Research Centre | TIRC | forestry | 1 (1) | 5 | 1 | 6 | 6.0 |
| | | Food Technology Research Unit | FTRU | processing of food | 1 (1) | 5 | 0 | 5 | 5.0 |
| Academic | University of Zambia | Livestock and Pest Research Centre | LPRC | veterinary medicine | 1 (1) | 11 | 0 | 11 | 11.0 |
| | | Water Resources Research Unit | WRRU | water resources | 1 (1) | 5 | 0 | 5 | 5.0 |
| | | School of Agricultural Sciences | SAS | crops and livestock | 1 (1) | 26 | 6 | 32 | 8.0 |
| Academic | University of Zambia | School of Veterinary Medicine | SVM | veterinary medicine | 1 (1) | 21 | 20 | 41 | 16.4 |
| | | Department of Agricultural Engineering, School of Engineering | DAE | agricultural engineering | 1 (1) | 5 | 1 | 6 | 0.6 |
| | | Rural Development Studies Bureau | RDSB | socio-economics | 1 (1) | 4 | 0 | 4 | 4.0 |
| <i>Total</i> | | | | | 53 (38) | 261 | 60 | 321 | 267.5 |

Source: 0999.

Note: Data in square brackets are inferred or constructed by authors.

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

The academic component of the NARS comprises the School of Agricultural Sciences, the School of Veterinary Medicine, the Department of Agricultural Engineering of the School of Engineering, and the Rural Development Studies Bureau, which all fall under the aegis of the University of Zambia. Not included in this overview, because of lack of detailed information, are the School of Natural Sciences and the School of Environmental Sciences. Both may be involved in research that has some relevance to agriculture.

The present organizational structures of most institutes are provided in diagrammatic form in appendix 3.

3. NARS Statistics

Questionnaire responses were received from CFRI, CVRI, DFR, WRRU, FTRU, TIRC, LPRC, SAS, SVM, and DAE/SE and combined with data and information from numerous other sources cited at the conclusion of this brief. Some of the (historical) annual data was, by necessity, constructed by means of interpolation or extrapolation. The constructed data have been identified as such in appendices 5 and 6.

The expenditure data presented here are based as much as possible on the actual expenditures as reported by the various institutes. However, institutes most likely underestimate the degree of donor support if they only have information about the donor funds that are channeled through their accounting system. Most importantly they often underreport or fail to report the salaries and supplements paid directly to expatriate researchers. To correct for this problem in the Zambian data, we constructed an implicit cost series for expatriate researchers and, where necessary, added this to the expenditures reported by the various institutes (appendix 2).

To construct reliable expenditure estimates for the Zambian NARS requires that a distinction be made between: (a) expatriate researchers on a local salary under direct contract with the Government of Zambia, (b) expatriate researchers on a local salary under direct contract with the Government of Zambia but receiving supplementary support from a donor organization, and (c) expatriate researchers under contract to a donor organization and paid in full by the donor. Unfortunately the data available to us meant that we were unable to fully reconcile these distinctions to our satisfaction. However, for the Research Branch we obtained specific information on the contract status of the expatriate researchers for the period 1965-89 from Dr. Stuart Kean. This helped us to estimate more precisely donor expenditures on expatriate salaries and to avoid double counting.

During the initial 10 to 15 years after independence the first two categories of expatriate researchers were rather common as local research salaries were, at that time, quite competitive internationally. During this period, for example, Zambia attracted quite a number of Indian nationals as researchers. However, with the decline of the Zambian economy after 1975 as a result of falling copper prices,² the (inflation-adjusted) salaries of researchers working under local contract markedly declined. As a result, the increasingly common practice has been to pay expatriate researchers directly from donor funds.

2 In the late 1960s, high copper prices financed a fourfold expansion of total government spending in a six-year period. However, in a nine-month period in 1974-75 the price of copper halved and since then has fallen to about one-quarter of its real value in 1970. Copper accounts for about 90% of Zambia's exports.

3.1 Long-term development

Zambia's agricultural research capacity in terms of researchers per million economically active agricultural population has increased quite rapidly since the early 1960s and has been well above the corresponding regional average throughout the whole period (table 3). Since 1961 the number of researchers grew at a rapid rate, averaging 7.7% per annum. Most of this growth, however, took place in the 1961-85 period. During the more recent years the number of researchers has changed little.

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

| | '61-65 | '66-70 | '71-75 | '76-80 | '81-85 | '86-90 | 1991 | 1992 | growth rate ^a |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------------|
| Researchers (FTEs) | 34.0 | 68.9 | 120.3 | 149.4 | 216.9 | 254.4 | 267.1 | 267.5 | 7.7 |
| Expenditures (million 1985 Zambian Kwachas) | 7.556 | 15.019 | 21.985 | 25.437 | 31.244 | 26.310 | 33.229 | 20.801 | 4.5 |
| Expenditures (million 1985 PPP dollars) | 5.461 | 10.854 | 15.888 | 18.382 | 22.579 | 19.013 | 24.013 | 15.032 | 4.5 |
| Expenditures per re-searcher (thousand 1985 PPP dollars) | 162 | 157 | 134 | 123 | 106 | 75 | 90 | 56 | -3.0 |
| Number of econ. active agr. population (millions) | 0.97 | 1.08 | 1.20 | 1.31 | 1.51 | 1.77 | 1.93 | 1.98 | 2.4 |
| Researchers per million econ. active agr. popul. | 34.9 | 63.8 | 100.4 | 114.3 | 143.5 | 143.9 | 138.6 | 134.9 | 5.1 |
| AgGDP (million 1985 PPP dollars) ^c | 379 | 485 | 548 | 618 | 626 | 773 | 791 | 530 | 2.3 |
| Expenditures as a % of AgGDP | 1.16 | 2.32 | 2.74 | 2.42 | 3.09 | 2.39 | 2.77 | 1.31 | 1.8 |

Source: See annexes 5 and 6.

Note: Includes all institutes listed in table 2.

^a Least squares annual growth rate for the 1961-92 period.

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

^c Deflated with an AgGDP specific deflator.

The longer-run (i.e., 1961-92) average annual rate of growth in agricultural research expenditures was a solid 4.5%. But again much of this growth occurred in the period prior to 1985; it was negative and highly fluctuative in real terms for the six years that followed. Since 1961 the number of researchers has grown substantially faster than expenditures, hence the dramatic decline in expenditures per researcher. Until recently, the Zambian NARS has been heavily staffed with expatriate researchers. As a consequence, expenditures per researcher have been rather high throughout most of the period reported here, particularly because the salaries of many expatriate researchers were included at international costs. Expatriate salaries alone constitute about 40%-50% of total expenditures during the pre-1985 years. After 1985 the number of expatriate researchers declined rapidly as did the corresponding expenditures.

Zambia has invested substantially more in agricultural research than most other African countries. In 1991, Zambia's agricultural research expenditures amounted to 2.8% of its AgGDP. However, because of extreme inflation (prices more or less doubled every year between 1989 and 1993) and a drop in donor support (after a relatively high peak in 1991), the intensity ratio dropped to 1.3% in 1992. In comparison, the corresponding research expenditure ratio for 24 African countries averaged about 0.7%. It is noteworthy, however, that the Zambian NARS has relied more heavily on donor support than many other African research systems. In

terms of researchers per million farmers, Zambia is also comparatively high. In 1991, Zambia had 138 FTE researchers per million farmers compared with an African average of 70. Neighboring countries like Malawi and Zimbabwe had 62 and 108 researchers per million farmers, respectively.

Despite the historically high amounts of investment in agricultural research, the Zambian NARS has experienced severe financial difficulties in recent years. High rates of inflation coupled with a slowdown in support for agricultural research has resulted in a dramatic decline in the real support to research in recent years. Most of the research activities that are on-going are heavily reliant on donor funding.

3.2 Human Resources

Degree and Nationality Status of Researchers

One of the more striking aspects of Zambia's agricultural research staff development during the past three decades is the relatively late and, initially, rather slow rate of nationalization of its research cadre. In most African countries, very few African nationals occupied professional research positions within their respective research agencies at the time of political independence. Zambia was no exception in this regard. But it took until 1967 before the first African national was appointed to a research position at the Research Branch. Ten years later the number of nationals working as professional staff within the Research Branch was still only 18 out of a total of 74.

It took until the late 1970s, before priority was given to nationalizing the research staff. With the financial support of various donors, the number of Zambians sent overseas for postgraduate training in the agricultural sciences increased markedly during the late 1970s and early 1980s. As a result, many of the country's research agencies considerably increased their employment of national researchers during the 1980s, while the number of expatriate researchers declined, particularly after 1985 (table 4). Within a decade the role of expatriate researchers was significantly reduced. This change in the composition of the country's research personnel took place in the context of a stagnant and, for some agencies, declining number of research positions.

In the late 1970s, nearly all national researchers at the Research Branch held only a BSc degree. During the 1980s this situation gradually improved.

The pattern of change in the research personnel at NCSR and the academic institutes differs from the other government research agencies. They began recruiting national researchers somewhat earlier and generally employ higher qualified staff.

Table 4: *Educational and Nationality Status of Researchers*

| Institute | Degree | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991 | 1992 |
|-------------------|-----------------|--------------------------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| | | <i>(full-time equivalents)</i> | | | | | | | |
| Research Branch | PhD (nationals) | 0.0 | 0.0 | 0.0 | 0.6 | 1.2 | na | na | na |
| | MSc (nationals) | 0.0 | 0.8 | 1.7 | 5.7 | 10.6 | na | na | na |
| | BSc (nationals) | 0.0 | 0.2 | 5.1 | 19.3 | 42.8 | na | na | na |
| | Subtotal | 0.0 | 1.0 | 6.8 | 25.6 | 54.6 | 98.1 | 128.0 | 138.5 |
| | Expatriates | 21.3 | 39.8 | 57.8 | 48.6 | 53.6 | 54.4 | 35.0 | 26.0 |
| | <i>Total</i> | <i>21.3</i> | <i>40.8</i> | <i>64.6</i> | <i>74.2</i> | <i>108.2</i> | <i>152.5</i> | <i>163.0</i> | <i>164.5</i> |
| CVRI | PhD (nationals) | 0.0 | 0.0 | na | na | 0.8 | 0.0 | 0.0 | 1.0 |
| | MSc (nationals) | 0.0 | 0.0 | na | na | 2.4 | 4.8 | 6.0 | 6.0 |
| | BSc (nationals) | 0.0 | 1.0 | na | na | 3.2 | 5.2 | 4.0 | 3.0 |
| | Subtotal | 0.0 | 1.0 | 3.0 | 5.0 | 6.4 | 10.0 | 10.0 | 10.0 |
| | Expatriates | 4.0 | 5.4 | 4.9 | 6.3 | 12.6 | 2.8 | 1.0 | 1.0 |
| | <i>Total</i> | <i>4.0</i> | <i>6.4</i> | <i>7.9</i> | <i>11.3</i> | <i>19.0</i> | <i>12.8</i> | <i>11.0</i> | <i>11.0</i> |
| CFRI | PhD (nationals) | na | na | na | na | 0.0 | 1.0 | 1.0 | 1.0 |
| | MSc (nationals) | na | na | na | na | 1.0 | 3.8 | 8.0 | 9.0 |
| | BSc (nationals) | na | na | na | na | 5.3 | 9.0 | 11.0 | 12.0 |
| | Subtotal | 0.0 | 0.0 | 0.0 | 1.2 | 6.3 | 13.8 | 20.0 | 22.0 |
| | Expatriates | 3.2 | 4.2 | 4.2 | 3.6 | 4.3 | 4.6 | 5.0 | 5.0 |
| | <i>Total</i> | <i>3.2</i> | <i>4.2</i> | <i>4.2</i> | <i>4.8</i> | <i>10.6</i> | <i>18.4</i> | <i>25.0</i> | <i>27.0</i> |
| DFR and DFPDR | PhD (nationals) | 0.0 | 0.0 | na | na | 0.0 | 0.0 | 0.0 | 0.0 |
| | MSc (nationals) | 0.0 | 0.0 | na | na | 3.4 | 2.4 | 2.0 | 4.0 |
| | BSc (nationals) | 0.0 | 0.0 | na | na | 7.1 | 6.2 | 7.0 | 5.0 |
| | Subtotal | 0.0 | 0.0 | 2.3 | 8.0 | 10.5 | 8.6 | 9.0 | 9.0 |
| | Expatriates | 6.3 | 10.3 | 8.7 | 5.2 | 5.5 | 1.4 | 0.0 | 0.0 |
| | <i>Total</i> | <i>6.3</i> | <i>10.3</i> | <i>11.0</i> | <i>13.2</i> | <i>16.0</i> | <i>10.0</i> | <i>9.0</i> | <i>9.0</i> |
| NCSR ^a | PhD (nationals) | — | na | na | na | na | 6.6 | 4.0 | 5.0 |
| | MSc (nationals) | — | na | na | na | na | 16.8 | 17.0 | 16.0 |
| | BSc (nationals) | — | na | na | na | na | 11.6 | 10.0 | 5.0 |
| | Subtotal | — | 2.0 | 17.0 | 30.9 | 40.8 | 35.0 | 31.0 | 26.0 |
| | Expatriates | — | 5.1 | 9.2 | 7.7 | 6.8 | 5.4 | 1.0 | 1.0 |
| | <i>Total</i> | — | <i>7.1</i> | <i>26.2</i> | <i>38.6</i> | <i>47.6</i> | <i>40.4</i> | <i>32.0</i> | <i>27.0</i> |
| Academic | Nationals | — | — | na | na | na | 12.2 | 19.5 | 19.4 |
| | Expatriates | — | — | na | na | na | 8.2 | 9.6 | 9.6 |
| | <i>Total</i> | — | — | <i>6.2</i> | <i>7.3</i> | <i>14.3</i> | <i>20.4</i> | <i>29.1</i> | <i>29.0</i> |

Source: see annex 6.

Note: Unfortunately information on the degree level of national staff was not provided for the Research Branch for the most recent years. Staff projections made in 1986/87 indicate a target of 40 PhDs, 40 MScs, and 100 BScs for the year 2000 (source 1421).

^a Covers FTRU, LPRC, TIRC, and WRRU.

Gender

About 10% of the national researchers during the period 1986-92 were women. At CVRI and FTRU the share of women in research positions was 25% and 18%, respectively. However, several research agencies (i.e., CFRI, TIRC, DAE/SE, and RDSB) employed no female researchers.

Although the percentage of female researchers is relatively low compared with other African countries, it is more-or-less in line with the share of women in the student population of the School of Agricultural Sciences (about 10% in 1982).

Staff Composition

The staffing structures of the various agricultural research agencies differ considerably (table 5). A major difficulty in compiling these data is that some sources classified certificate and diploma holders as technicians, while other sources report only diploma holders. Taking this information at face value causes large, and largely implausible, variations in the estimated number of technicians, particularly for CVRI, CFRI, and DFR.

The number of overall support staff at the Research Branch grew slightly slower than the total number of researchers. As a consequence, the number of support staff per researcher decreased from 5.4 per researcher in 1983 to 4.4 in 1992. The number of technicians, however, increased at a faster rate than the number of researchers, resulting in a slight increase in the number of technicians per researcher.

The number of researchers working for NCSR agencies decreased substantially during the period 1985-92, while during the same period the number of support staff only marginally decreased. As a consequence, support staff ratios significantly increased.

3.3 Financial Resources

Expenditures

Agricultural research has largely been implemented by government agencies. It is only since the early 1970s that academic institutions were established and began doing agricultural research. The share of agricultural research expenditures going to the academic sector increased gradually from 5% in 1971-75 to 11% in 1992 (table 6). No semi-public agricultural research agencies (e.g., research institutes managed and financed by commodity boards) operate in Zambia. In the past the Tobacco Research Board and the Tea Research Foundation of Central Africa, located in Zimbabwe and Malawi, respectively, also served Zambia. But with the disintegration of the old colonial structures these entities ceased operating with a regional mandate.

Table 5: Staffing Structure

| Staff category | Research Branch | | | | CVRI | | | |
|----------------|--------------------------|----------------------|-------------|--------------|--------------------------|--------------|--------------|--------------|
| | 1981-85 ^a | 1986-90 ^b | 1991 | 1992 | 1981-85 ^a | 1986-90 | 1991 | 1992 |
| | <i>(number of staff)</i> | | | | <i>(number of staff)</i> | | | |
| Researchers | 107.0 | 145.0 | 163.0 | 166.0 | 25.0 | 12.8 | 11.0 | 11.0 |
| Technicians | 134.0 | 270.0 | | 231.0 | 40.0 | 23.2 | 24.0 | 25.0 |
| Administrative | | | | 113.0 | | 4.0 | 3.0 | 3.0 |
| Other | 442.0 | | | 383.0 | 100.0 | 122.2 | 125.0 | 123.0 |
| <i>Total</i> | <i>692.0</i> | | | <i>893.8</i> | <i>165.0</i> | <i>162.2</i> | <i>163.0</i> | <i>162.0</i> |
| | CFRI | | | | DFR | | | |
| | 1981-85 ^a | 1986-90 | 1991 | 1992 | 1981-85 ^a | 1986-90 | 1991 | 1992 |
| | <i>(number of staff)</i> | | | | <i>(number of staff)</i> | | | |
| Researchers | 11.0 | 18.4 | 25.0 | 27.0 | 10.0 | 6.2 | 5.0 | 5.0 |
| Technicians | 8.0 | 16.0 | 16.0 | 16.0 | 32.0 | 3.4 | 3.0 | 3.0 |
| Administrative | | 5.0 | 5.0 | 5.0 | | 2.0 | 2.0 | 2.0 |
| Other | 100.0 | | | | 83.0 | 1.6 | 1.0 | 1.0 |
| <i>Total</i> | <i>119.0</i> | | | | <i>125.0</i> | <i>13.2</i> | <i>11.0</i> | <i>11.0</i> |
| | FTRU | | | | LPRC | | | |
| | 1981-85 | 1986-90 | 1991 | 1992 | 1981-85 ^c | 1986-90 | 1991 | 1992 |
| | <i>(number of staff)</i> | | | | <i>(number of staff)</i> | | | |
| Researchers | na | 9.6 | 6.0 | 5.0 | 25.0 | 13.8 | 12.0 | 11.0 |
| Technicians | na | 7.8 | 8.0 | 8.0 | 34.0 | 46.6 | 42.0 | 40.0 |
| Administrative | na | 1.0 | 1.0 | 1.0 | 3.0 | 9.6 | 9.0 | 9.0 |
| Other | na | 2.0 | 2.0 | 2.0 | 61.0 | 35.2 | 34.0 | 34.0 |
| <i>Total</i> | <i>na</i> | <i>20.4</i> | <i>17.0</i> | <i>16.0</i> | <i>123.0</i> | <i>105.2</i> | <i>97.0</i> | <i>94.0</i> |
| | TIRC | | | | WRRU | | | |
| | 1981-85 | 1986-90 | 1991 | 1992 | 1981-85 | 1986-90 | 1991 | 1992 |
| | <i>(number of staff)</i> | | | | <i>(number of staff)</i> | | | |
| Researchers | na | 8.2 | 5.0 | 5.0 | na | 8.8 | 9.0 | 6.0 |
| Technicians | na | 16.2 | 12.0 | 13.0 | na | 17.2 | 15.0 | 15.0 |
| Administrative | na | 4.0 | 4.0 | 4.0 | na | 1.0 | 1.0 | 1.0 |
| Other | na | 17.8 | 18.0 | 18.0 | na | 3.8 | 1.0 | 2.0 |
| <i>Total</i> | <i>na</i> | <i>46.2</i> | <i>39.0</i> | <i>40.0</i> | <i>na</i> | <i>30.8</i> | <i>26.0</i> | <i>24.0</i> |

Source: 0002, 0017, and 0999.

^a This five year average is based on 1983 data only.

^b This five year average is based on 1987 data only.

^c This five year average is based on 1984 data only.

Table 6: *Agricultural Research Expenditures*

| Institutional category | '61-65 | '71-75 | '81-85 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|-----------------------------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <i>(million 1985 Kwachas)</i> | | | | | | | | | | |
| Government | 7.556 | 20.874 | 29.228 | 23.825 | 22.952 | 26.168 | 26.550 | 21.540 | 29.614 | 18.546 |
| Academic | 0.000 | 1.111 | 2.016 | 2.037 | 1.771 | 2.419 | 2.375 | 1.911 | 3.615 | 2.255 |
| <i>Total</i> | <i>7.566</i> | <i>21.985</i> | <i>31.244</i> | <i>25.863</i> | <i>24.723</i> | <i>28.587</i> | <i>28.926</i> | <i>23.452</i> | <i>33.229</i> | <i>20.801</i> |
| <i>(million 1985 PPP dollars)</i> | | | | | | | | | | |
| <i>Total</i> | <i>5.461</i> | <i>15.888</i> | <i>22.579</i> | <i>18.690</i> | <i>17.866</i> | <i>20.658</i> | <i>20.903</i> | <i>16.947</i> | <i>24.013</i> | <i>15.032</i> |

Source: see appendix 6.

Agricultural research expenditures fluctuated quite dramatically in real terms during the past decade. For the past several decades the country has been in a persistent state of economic crisis. There was a dramatic decline in world copper prices in the mid-1970s followed by a prolonged (and continuing) period of (hyper-) inflation. National budgets for agricultural research failed to keep pace with these price hikes. As a consequence, the country has become especially dependent on donor funds to support its agricultural research. Tables 7 and 8 describe the financial situation of the Research Branch during the period 1986-92 in some detail.

Factor Mix

A straightforward breakdown of expenditures by the Research Branch into various cost categories could not be obtained. Unfortunately donor-funded research projects are reported in the government expenditure yearbooks as capital expenditures without further details of how the budget has actually been used. Over time the share of expenditures reported in this fashion increased quite dramatically from 43% in 1981, to 55% in 1986, and 91% in 1992 (table 7). The amount of financial resources under the direct control of the director of the Research Branch has been marginalized in recent years (e.g., the salary budget declined quite dramatically from 3.1 million "1985 PPP dollars" in 1983 to less than a tenth of that amount in 1992). Donor funds denominated in foreign currencies are less severely affected by the bouts of hyper-inflation that have occurred over the past several decades. The substantial year-to-year variation in "capital expenditures" evident in table 7 is largely an artifact of the way the variable pattern of expenditures from donor-supported projects are classified as capital costs in the government accounts. Largely independent from these developments are the donor funds used to pay the salaries of expatriate researchers. Although the number of expatriate researchers has declined substantially in recent years, the salaries paid directly to these expatriates from donor sources still represents a substantial share of total costs.

The overall picture that emerges from these expenditure data is one wherein the core budget for the Research Branch has rapidly deteriorated to the point that the agency's research program now consists of a collection of research projects that are heavily reliant on donor support.

Table 7: *Cost Categories: Research Branch*

| Cost category | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---------------------|------------------------------------|---------------|---------------|---------------|---------------|---------------|--------------|
| | <i>(millions 1985 PPP dollars)</i> | | | | | | |
| Salaries | 1.759 | 1.199 | 1.261 | 1.646 | 0.868 | 0.485 | 0.276 |
| Operating | 0.497 | 0.346 | 0.580 | 0.355 | 0.587 | 0.192 | 0.205 |
| Capital | 2.932 | 3.925 | 4.306 | 6.546 | 4.066 | 11.394 | 4.698 |
| Subtotal | 5.187 | 5.470 | 6.146 | 8.546 | 5.521 | 12.072 | 5.180 |
| Expatriate salaries | 6.460 | 6.180 | 7.450 | 6.140 | 5.280 | 4.200 | 3.120 |
| <i>Total</i> | <i>11.647</i> | <i>11.650</i> | <i>13.596</i> | <i>14.686</i> | <i>10.801</i> | <i>16.272</i> | <i>8.300</i> |

Source: 388, 1441 and 1450.

Source of Funds

Table 8 provides an overview of the different sources of funding for the Research Branch during the period 1986-92. On average, only 21% of the funding came from the national government. The other 79% was provided by donors, either in the form of a loan, a grant, or as technical assistance. As mentioned above, support in the form of technical assistance has declined significantly in recent years as national professionals have assumed the positions formerly held by expatriate researchers. The loan monies identified in table 8 were provided by the World Bank (IDA) and the African Development Bank as part of the National Agricultural Research Project. Major donors providing bilateral grants included Norway, Sweden, The Netherlands, Belgium, Canada, USA, and UNDP.

Table 8: *Source of Funds: Research Branch*

| Source of funding | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | share '86-92 |
|-----------------------|-----------------------------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------------|
| | <i>(million 1985 PPP dollars)</i> | | | | | | | % |
| Government | 2.503 | 2.012 | 4.182 | 2.718 | 2.378 | 3.436 | 1.785 | 21.1 |
| Donor: loan money | 0.000 | 1.723 | 0.371 | 1.001 | 0.490 | 2.515 | 0.000 | 6.8 |
| Donor: grants | 2.496 | 3.330 | 3.496 | 4.828 | 2.653 | 6.121 | 3.395 | 29.2 |
| Donor: expat salaries | 6.460 | 6.180 | 7.450 | 6.140 | 5.280 | 4.200 | 3.120 | 43.0 |
| <i>Total</i> | <i>11.459</i> | <i>13.245</i> | <i>15.499</i> | <i>14.687</i> | <i>10.801</i> | <i>16.272</i> | <i>8.300</i> | <i>100</i> |

Source: 388, 1441 and 1450.

3.4 Research Focus

Of the estimated 276.5 full-time equivalent researchers in Zambia in 1992, about 33.5% focus on crops, 20.8% on livestock, 6.5% on forestry, 10.1% on fisheries, 13.7% on natural resources, and 15.5% on other issues (table 9). Crops that receive major attention are cereals (maize), food legumes, vegetables, and root and tubers. The large majority of the livestock researchers focus on animal health. Natural resource research consists mainly of soil and water research, while the "other" category consist mainly of socio-economic research and postharvest research (DFPRD and FTRU).

Table 9: *Research Focus (1992)*

| Institute | Crops | Livestock | Forestry | Fisheries | Natural Resources | Other | Total |
|------------------|-------------------------------|-------------|-------------|-------------|-------------------|-------------|--------------|
| | <i>(full-time equivalent)</i> | | | | | | |
| Research Branch | 87.0 | 15.7 | 6.3 | | 29.3 | 26.2 | 164.5 |
| CFRI | | | | 27.0 | | | 27.0 |
| CVRI | | 11.0 | | | | | 11.0 |
| DFR | | | 5.0 | | | | 5.0 |
| DFPRD | | | | | | 4.0 | 4.0 |
| FTRU | | | | | | 5.0 | 5.0 |
| LPRC | | 11.0 | | | | | 11.0 |
| TIRC | | | 6.0 | | | | 6.0 |
| WRRU | | | | | 5.0 | | 5.0 |
| SAS | 2.6 | 1.6 | | | 2.2 | 1.6 | 8.0 |
| SVM | | 16.4 | | | | | 16.4 |
| SE/DAE | | | | | | 0.6 | 0.6 |
| RDSB | | | | | | 4.0 | 4.0 |
| <i>Total</i> | <i>89.5</i> | <i>55.7</i> | <i>17.3</i> | <i>27.0</i> | <i>36.6</i> | <i>41.4</i> | <i>267.5</i> |
| <i>Share (%)</i> | <i>33.5</i> | <i>20.8</i> | <i>6.5</i> | <i>10.1</i> | <i>13.7</i> | <i>15.5</i> | <i>100</i> |

Source: 0999

Note: The “natural resources” 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 annex 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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Annex 1: Country background information



Geography

Area: 75.3 million ha

Location: land-locked country in southern Africa. Bordered to the west by Angola, to the northwest by Zaire, to the northeast by Tanzania, to the east by Malawi, to the southeast by Mozambique, to the south by Zimbabwe and Botswana and to the southwest by Namibia.

Agroecological features: The country largely occupies a plateau with an almost uniform surface and broken occasionally by widely dispersed hills and ranges. Zambia has a subequatorial climate with three seasons: hot and dry between August and October, warm and wet between November and April and dry and cool between May and July. The average rainfall ranges from 600-800 mm annually in the southern river valleys to 1000-1300 mm in the northeastern highlands. Wooded savannah of tall perennial grasses and small leguminous trees covers most of the country. The southwest consists of valuable forests. The grasslands support domestic livestock, like beef and dairy cattle.

Population

Total (1991): 8.3 million

Annual growth rate (1981-90)^a: 3.6%

Literacy (1990): 72.8%

Life expectancy (1991): 49 years

Economy (values reported in 1985 PPP dollars)

Gross Domestic Product (1989): 5,407 million dollars

Per capita GDP (1989): 650 dollars

Agricultural GDP (1989): 791 million dollars

Share of agriculture in GDP (1989): 14.6%

Annual growth rates (1981-90)^a

GDP: 0.9%

GDP per capita: -2.7%

AgGDP: 3.8%

Trade (values reported in current dollars)

Net surplus total trade (1991): 175 million dollars

Net surplus agricultural trade (1991): -23 million dollars

Percentage of agricultural imports in total imports: 4.7%

Percentage of agricultural exports in total exports: 1.9%

Major agricultural import commodities (1991)^b: maize (40%), soybean oil (23%), forestry products (17%), and dry milk (5%)

Major agricultural export commodities (1991)^b: cotton lint (30%), tobacco (25%), cottonseed (16%), raw sugar (12%), and coffee (10%)

Agriculture

Agricultural land (1990): 35.3 million ha

Annual growth rate (1981-90)^a: 0.04%

Percentage arable: 14.9%

Percentage permanent crop: 0.0%

Percentage permanent pastures: 85.1%

Percentage irrigated arable and permanent cropland: 0.6%

Economically active agricultural population (1991):

1.9 million

Annual growth rate (1981-90)^a: 3.3%

Percentage in total economically active population: 68.5%

Fertilizer use per ha arable land (1990): 11.3 kg

Annual growth rate (1981-90)^a: -0.4%

Major crops (in decreasing order of value of production): maize, sugar cane, cassava, cotton lint, and groundnuts

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).

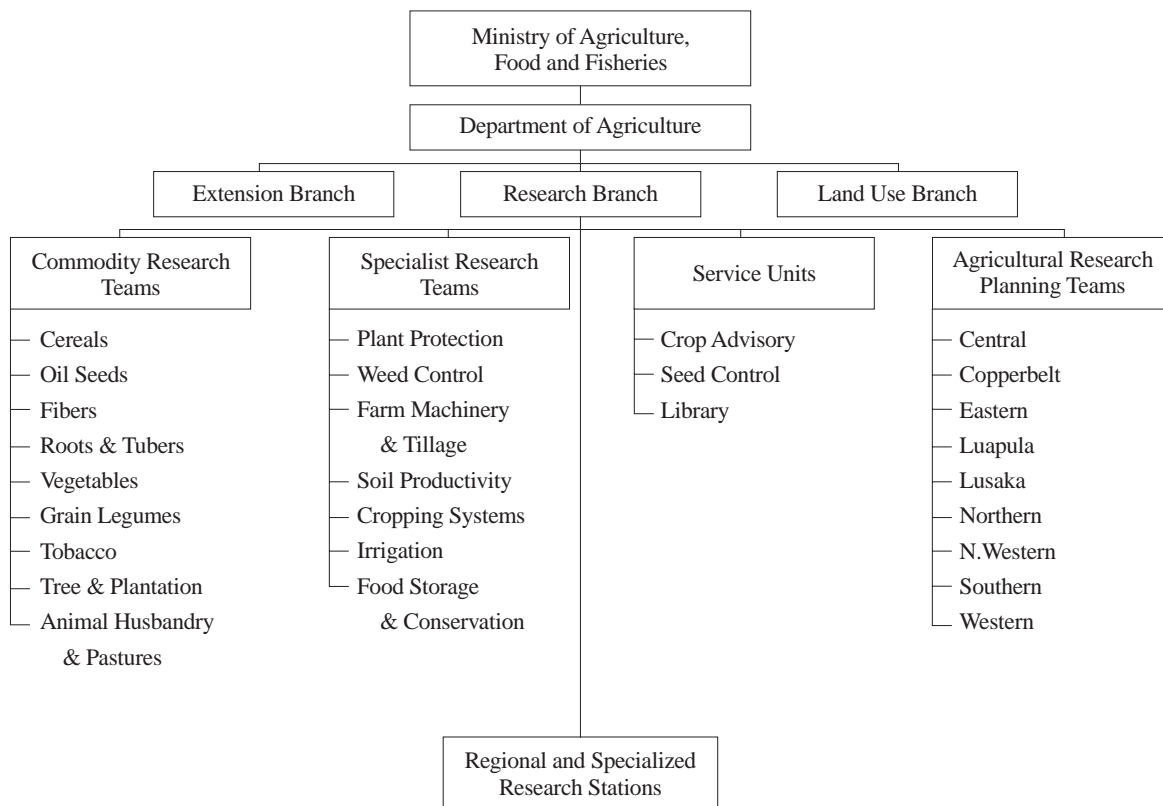
Nomenclature for tables in text

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.

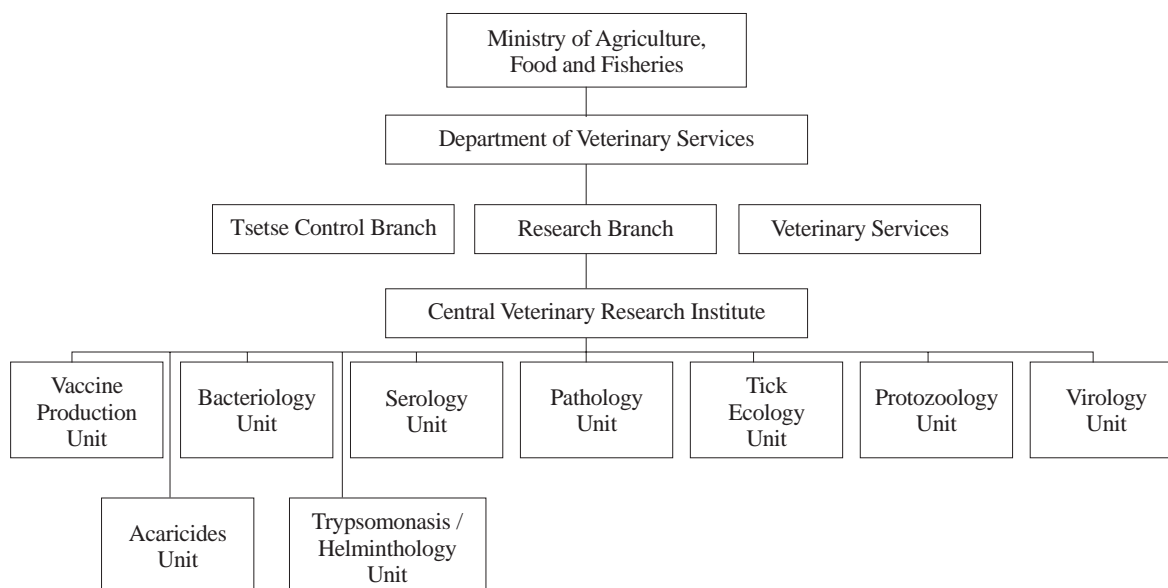
In the text we note any marked deviations from these data compilation norms and include points of clarification if warranted.

Appendix 3: Organizational charts of the agricultural research institutes

Research Branch, Department of Agriculture

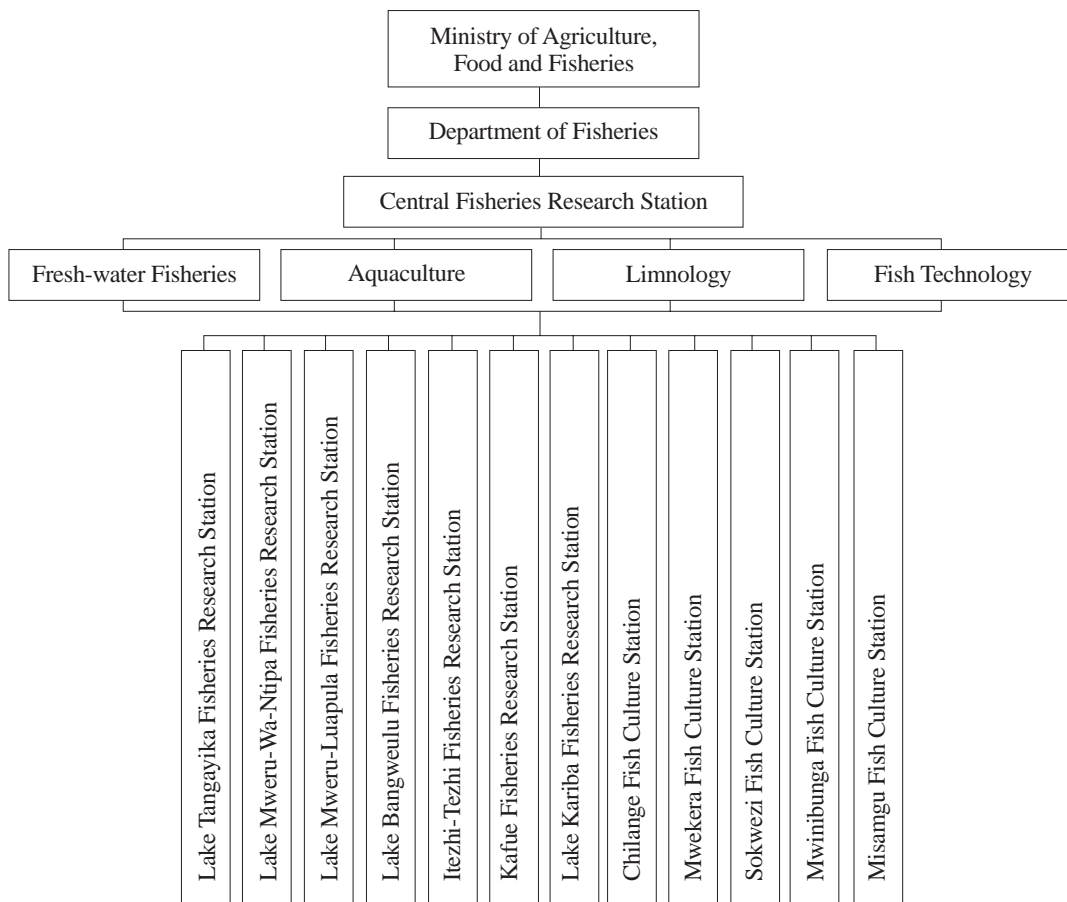


Central Veterinary Research Institute, Department of Veterinary Services

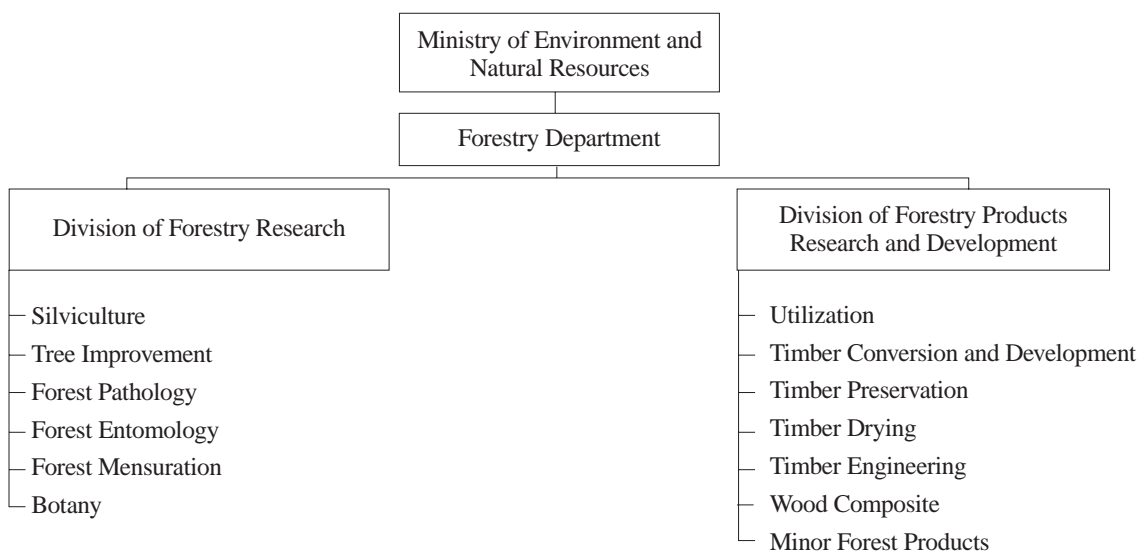


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Central Fisheries Research Institute, Department of Fisheries

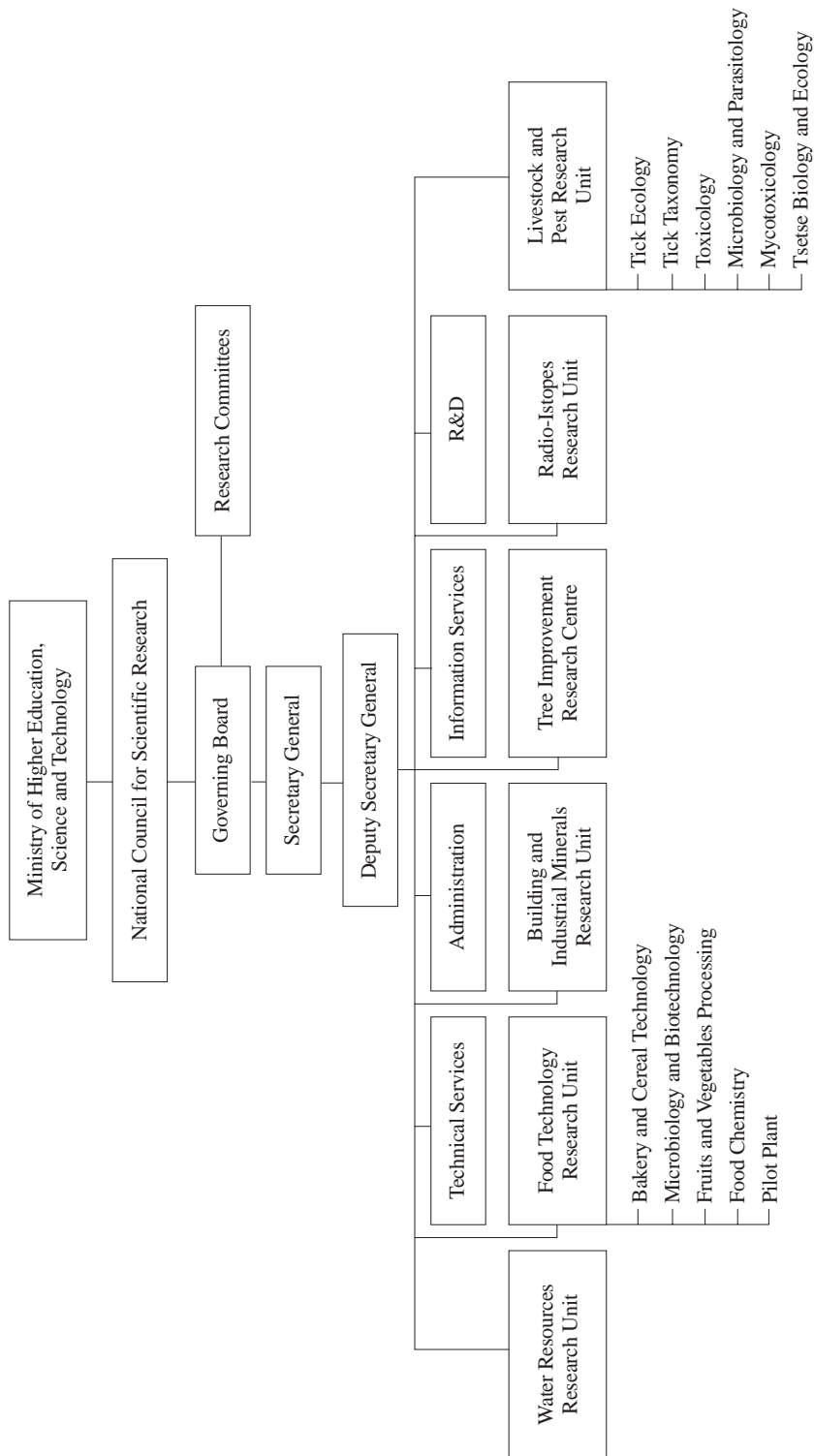


Division of Forestry Research and Division of Forestry Products R&D, Forestry Department



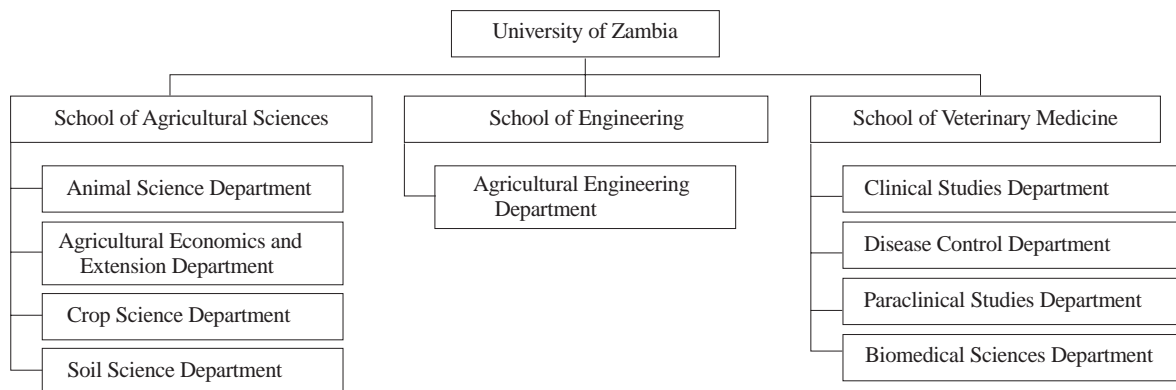
Appendix 3: Organizational charts of the agricultural research institutes (contd.)

National Council for Scientific Research (NCSR)



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

University of Zambia



Appendix 4: Addresses of the agricultural research institutes

Research Branch
Department of Agriculture
Ministry of Agriculture, Food and Fisheries
P.O. Box 50291
LUSAKA

Food Technology Research Unit
National Council for Scientific Research
P.O. Box 310158
Chelston
LUSAKA

Mount Makulu Central Agricultural Station
Research Branch
Department of Agriculture
Ministry of Agriculture, Food and Fisheries
Private Bag 7
Chilanga
LUSAKA

Water Resources Research Unit
National Council for Scientific Research
P.O. Box 310158
15302 Chelston
LUSAKA

Central Veterinary Research Institute
Department of Veterinary Medicine and Tsetse Control
Services
Ministry of Agriculture, Food and Fisheries
P.O. Box 33980
LUSAKA

Tree Improvement Research Centre
National Council for Scientific Research
P.O. Box 21210
KITWE

Central Fisheries Research Institute
Fisheries Research Division
Department of Fisheries
Ministry of Agriculture, Food and Fisheries
P.O. Box 350100
CHILANGA

Livestock and Pest Research Centre
National Council for Scientific Research
P.O. Box 350049
Chilanga
LUSAKA

Chief Forestry Research Officer
Division of Forest Research
Forestry Department
Ministry of Environment and Natural Resources
P.O. Box 22099
KITWE

Dean
School of Agricultural Sciences
University of Zambia
P.O. Box 32379
10101 LUSAKA

Chief Forest Products Research Officer
Division of Forest Products Research and Development
Forestry Department
Ministry of Environment and Natural Resources
P.O. Box 20388
KITWE

Dean
School of Veterinary Medicine
University of Zambia
P.O. Box 32379
LUSAKA

National Council for Scientific Research
P.O. Box 310158
Chelston
LUSAKA

Dean
School of Engineering
University of Zambia
P.O. Box 32379
LUSAKA

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 | 1977 |
|---------------------------------|-----------------|---------|----------|---------|----------|----------|-----------|-------|----------|-------|-------|---------|-------|----------|----------|----------|---------|-----------|
| Category | Name Institute | 15.0 | 18.5 | 22 | 20 | 31 | 36 | 43 | 40 | 42 | 43 | 56 | 69 | 65 | 61 | 72 | 75 | 74 |
| Government | Research Branch | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 4 |
| | CFRI | 4.0 | 4.0 | 4.3 | 4.7 | 4 | 5.0 | 6.0 | 7.2 | 7.2 | 7.4 | 7.7 | 7.9 | 8.1 | 8.3 | 8.6 | 8.8 | 9 |
| | CVRI | 3.7 | 4.0 | 4.0 | 4.7 | 5 | 6.3 | 7.7 | 9 | 7.5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 |
| | FRD | — | — | 1.0 | 2.0 | 3 | 3.0 | 3.0 | 3 | 3.0 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 6 |
| | FPRDD | 0 | 0 | 0 | — | 0 | 0 | 0 | 2.0 | 2.0 | 2.0 | 2 | 4.0 | 6.0 | 8 | 8.0 | 8.0 | 8.0 |
| | FTRU/NCSSR | — | — | — | — | — | — | — | — | — | 8.0 | 10 | 11.3 | 12.7 | 14 | 15.1 | 16.2 | 17.3 |
| | LPRC/NCSSR | — | — | — | — | — | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | 2.3 | 2.7 | 3 | 3.2 | 3.4 | 3.7 |
| | TIRC/NCSSR | — | — | — | — | — | 1.0 | 1.6 | 2.3 | 2.3 | 4.1 | 4.1 | 4.8 | 5.4 | 6 | 6.6 | 7.1 | 7.7 |
| | WRRU/NCSSR | — | — | — | — | — | 33.7 | 67.3 | 69.3 | 70.6 | 79.9 | 96.6 | 115.3 | 113.8 | 115.3 | 129.4 | 135.6 | 136.7 |
| Government subtotal | | 25.7 | 29.5 | 34.3 | 33.7 | 47.0 | 57.3 | 67.3 | 69.3 | 70.6 | 79.9 | 96.6 | 115.3 | 113.8 | 115.3 | 129.4 | 135.6 | 136.7 |
| Academic | SAS | — | — | — | — | — | — | — | — | — | — | 2.0 | 2.8 | 3.5 | 3.3 | 3.0 | 3.0 | 3.0 |
| | SVM | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| | SE/DAE | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| | RDSB | — | — | — | — | — | — | — | — | — | — | 2 | 2.5 | 3 | 4.0 | 5 | 5.0 | 5 |
| Subtotal academic | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 5.3 | 6.5 | 7.3 | 8.0 | 8.0 | 8.0 |
| TOTAL | | 25.7 | 29.5 | 34.3 | 33.7 | 47.0 | 57.3 | 67.3 | 69.3 | 70.6 | 79.9 | 100.8 | 120.6 | 120.3 | 122.6 | 137.4 | 143.6 | 146.7 |
| Sources: | | | | 852 | 806 | 266 | 388 | 388 | 285 | 806 | 17 | 17; 279 | 17 | 17 | 17 | 17; 308 | 17; 308 | 17; 243 |
| | | | | | | 806 | 806 | 806 | 806 | | 532 | 806 | 806 | 806; 999 | 244 | 806; 999 | 806 | 306; 806 |
| | | | | | | | | | | | 806 | 1000 | 999 | 1000 | 806; 999 | 1000 | 999 | 999; 1000 |
| Category | Name Institute | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Government | Research Branch | 66 | 71 | 83 | 84 | 94 | 107 | 117 | 139 | 145 | 145 | 151 | 160 | 161.5 | 163.0 | 164.5 | 166 | 160 |
| | CFRI | 4 | 6 | 6 | 7 | 9 | 11 | 13 | 13.0 | 13 | 15 | 18 | 23 | 23 | 25 | 27 | | |
| | CVRI | 11.0 | 13.0 | 15 | 17.5 | 20 | 25 | 21.3 | 17.7 | 14 | 13 | 13 | 12 | 12 | 11 | 11 | | |
| | FRD | 9 | 8 | 6 | 7 | 10 | 10 | 11 | 17 | 17 | 5 | 5 | 8 | 5 | 5 | 5 | | |
| | FPRDD | 9 | 4 | 5 | 5 | 7 | 8 | 9 | 16 | 5 | 4 | 3 | 4 | 3 | 4 | 4 | | |
| | FTRU/NCSSR | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8 | 9 | 9 | 11 | 11 | 9 | 9 | 8 | 6 | 5 | | |
| | LPRC/NCSSR | 18.4 | 19.6 | 20.7 | 21.8 | 22.9 | 24 | 25 | 20.5 | 16 | 16 | 14 | 12 | 11 | 12 | 11 | | |
| | TIRC/NCSSR | 3.9 | 4.1 | 4.3 | 4.6 | 4.8 | 5 | 6.7 | 8.3 | 10 | 10 | 8 | 7 | 9 | 7 | 6 | | |
| | WRRU/NCSSR | 8.2 | 8.8 | 9.3 | 9.9 | 10.4 | 11 | 10.7 | 10.3 | 10 | 10 | 7 | 7 | 7 | 5 | 5 | | |
| Government subtotal | | 136.6 | 142.4 | 157.3 | 164.7 | 186.1 | 209.0 | 222.7 | 1230.8 | 229.0 | 229.0 | 231.0 | 242.0 | 239.5 | 238.0 | 238.5 | | |
| Academic | SAS | 3.4 | 3.8 | 3.8 | 3.8 | 5.3 | 7.8 | 7.3 | 608 | 5.3 | 5.0 | 5.3 | 5.3 | 5.3 | 7.8 | 8.0 | | |
| | SVM | — | — | — | — | — | 1.2 | 3.2 | 5.2 | 8.0 | 8.0 | 12.4 | 12.4 | 11.2 | 16.4 | 16.4 | | |
| | SE/DAE | — | — | — | — | — | — | — | — | 0 | 0 | 0.7 | 0.5 | 0.8 | 0.9 | 0.6 | | |
| | RDSB | 3.5 | 2 | 4.0 | 6 | 5.5 | 5 | 6.5 | 8 | 6.3 | 4.7 | 3 | 3.5 | 4 | 4.0 | 4.0 | | |
| Subtotal academic | | 6.9 | 5.8 | 7.8 | 9.8 | 10.8 | 14.0 | 17.0 | 20.0 | 19.6 | 17.7 | 21.4 | 21.7 | 21.3 | 29.1 | 29.0 | | |
| TOTAL | | 143.4 | 148.2 | 165.1 | 174.5 | 196.9 | 223.0 | 239.6 | 250.8 | 248.6 | 246.7 | 252.4 | 263.7 | 260.8 | 267.1 | 267.5 | | |
| Sources: | | 17; 388 | 17; 388 | 17; 242 | 17 | 17; 27 | 17; 806 | 2 | 744 | 806 | 999 | 999 | 388 | 999 | 999 | 999 | 999 | 999 |
| | | 806 | 806; 999 | 806 | 806; 999 | 806; 979 | 999; 1000 | 806 | 806; 999 | 999 | 1000 | 1000 | 999 | 1000 | 999 | 1396 | | |
| | | 999 | 1000 | 999 | 1000 | 999 | 1409 | 1413 | 1000 | 1000 | 1417 | 1421 | 999 | 1000 | 999 | 1396 | | |

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

Appendix 5b: Expenditure totals, 1961-91

| Total Agricultural Research Expenditures (million current LCU) | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|--|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|----------|----------|--------|
| Government | Name institute | 0.253 | 0.306 | 0.387 | 0.398 | 0.726 | 1.042 | 1.259 | 1.375 | 1.846 | 1.680 | 2.500 | 2.182 | 2.284 | 2.344 | 2.871 | 3.511 | 3.537 |
| | Research Branch | 0.102 | 0.101 | 0.107 | 0.121 | 0.185 | 0.234 | 0.234 | 0.272 | 0.333 | 0.405 | 0.383 | 0.346 | 0.230 | 0.363 | 0.254 | 0.341 | 0.345 |
| | CFRI | 0.183 | 0.180 | 0.191 | 0.216 | 0.249 | 0.383 | 0.456 | 0.612 | 0.739 | 0.647 | 0.714 | 0.675 | 0.803 | 0.885 | 0.755 | 0.897 | 0.961 |
| | CVRI | 0.069 | 0.074 | 0.085 | 0.104 | 0.128 | 0.207 | 0.252 | 0.343 | 0.350 | 0.234 | 0.259 | 0.234 | 0.249 | 0.257 | 0.225 | 0.274 | 0.280 |
| | FRD | | | 0.019 | 0.043 | 0.075 | 0.096 | 0.096 | 0.112 | 0.137 | 0.122 | 0.156 | 0.160 | 0.191 | 0.125 | 0.153 | 0.143 | 0.161 |
| | FPRDD | | | | | | | | 0.089 | 0.110 | 0.105 | 0.098 | 0.153 | 0.211 | 0.269 | 0.230 | 0.289 | 0.353 |
| | FTR/NCNR | | | | | | | | | | | | | | | | | |
| | LPRC/NCNR | | | | | | | | | | | | | | | | | |
| | TIRC/NCNR | | | | | | | | | | | | | | | | | |
| | WRRU/NCNR | | | | | | | | | | | | | | | | | |
| Government subtotal | | 0.607 | 0.661 | 0.790 | 0.882 | 1.362 | 0.077 | 0.077 | 0.089 | 0.118 | 0.103 | 0.095 | 0.093 | 0.111 | 0.132 | 0.119 | 0.171 | 0.202 |
| Academic | SAS | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | SVM | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | SE/DAE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | RDSB | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Academic subtotal | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total (current Kwachas) | | 0.607 | 0.661 | 0.790 | 0.882 | 1.362 | 0.077 | 0.077 | 0.089 | 0.118 | 0.103 | 0.095 | 0.093 | 0.111 | 0.132 | 0.119 | 0.171 | 0.202 |
| Total (constant 1985 Kwachas) | | 6.060 | 6.711 | 7.546 | 7.455 | 10.010 | 12.365 | 14.332 | 15.177 | 15.680 | 17.541 | 24.477 | 22.023 | 19.943 | 19.655 | 23.829 | 25.812 | 25.369 |
| Total (constant 1985 PPP\$) | | 4.379 | 4.850 | 5.453 | 5.388 | 7.234 | 8.936 | 10.357 | 10.968 | 11.331 | 12.676 | 17.688 | 15.915 | 14.412 | 14.203 | 17.220 | 18.653 | 18.333 |
| Source: | | | | | | | | | | 1441 | 17 | 17 | 388 | 388 | 388 | 388 | 388 | 388 |
| Category | Name institute | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Government | Research Branch | 3.537 | 4.030 | 5.285 | 5.750 | 8.750 | 9.079 | 11.958 | 15.035 | 29.492 | 43.650 | 73.242 | 146.752 | 220.544 | 647.078 | 879.256 | 1618.658 | |
| | CFRI | 0.348 | 0.449 | 0.471 | 0.516 | 0.725 | 0.981 | 1.093 | 1.256 | 1.841 | 2.700 | 6.728 | 12.206 | 26.386 | 113.764 | 238.088 | | |
| | CVRI | 1.308 | 1.854 | 2.406 | 2.820 | 3.146 | 4.495 | 4.471 | 4.213 | 4.821 | 6.959 | 10.079 | 12.249 | 38.377 | 31.435 | 158.335 | | |
| | FRD | 0.295 | 0.311 | 0.381 | 0.331 | 0.397 | 0.457 | 1.220 | 0.701 | 0.445 | 0.777 | 3.337 | 5.879 | 5.286 | 9.005 | 22.885 | | |
| | FPRDD | 0.190 | 0.115 | 0.227 | 0.250 | 0.421 | 0.556 | 0.816 | 0.698 | 0.908 | 0.850 | 0.400 | 1.500 | 1.300 | 3.000 | 2.000 | 12.000 | 16.000 |
| | FTR/NCNR | 0.446 | 0.503 | 0.493 | 0.484 | 0.438 | 0.475 | 0.532 | 0.724 | 0.828 | 1.234 | 2.167 | 2.559 | 6.001 | 9.522 | 18.720 | | |
| | LPRC/NCNR | 0.888 | 1.073 | 1.119 | 1.167 | 1.128 | 1.327 | 1.277 | 1.413 | 1.690 | 2.320 | 3.088 | 5.681 | 9.932 | 19.180 | 46.887 | | |
| | TIRC/NCNR | 0.243 | 0.287 | 0.296 | 0.307 | 0.293 | 0.334 | 0.435 | 0.716 | 0.606 | 1.605 | 1.893 | 3.268 | 6.384 | 14.784 | 42.029 | | |
| | WRRU/NCNR | 0.450 | 0.548 | 0.579 | 0.616 | 0.605 | 0.715 | 0.988 | 0.940 | 1.964 | 2.048 | 0.940 | 1.624 | 3.639 | 3.263 | 11.607 | | |
| Government subtotal | | 7.704 | 9.169 | 11.258 | 12.241 | 15.903 | 18.419 | 22.520 | 25.744 | 43.596 | 62.144 | 101.874 | 191.719 | 317.848 | 851.030 | 1419.807 | | |
| Academic | SAS | 0.190 | 0.241 | 0.268 | 0.279 | 0.449 | 0.683 | 0.733 | 0.753 | 0.999 | 1.357 | 2.315 | 4.159 | 6.967 | 27.712 | 47.625 | | |
| | SVM | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.106 | 0.324 | 0.580 | 1.523 | 2.171 | 5.469 | 9.824 | 14.864 | 58.642 | 97.630 | | |
| | SE/DAE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.309 | 0.396 | 1.062 | 3.218 | 3.572 | | |
| | RDSB | 0.197 | 0.129 | 0.286 | 0.446 | 0.470 | 0.441 | 0.657 | 0.892 | 1.206 | 1.266 | 1.323 | 2.773 | 5.309 | 14.303 | 23.812 | | |
| Academic subtotal | | 0.388 | 0.370 | 0.555 | 0.725 | 0.919 | 1.229 | 1.714 | 2.225 | 3.728 | 4.794 | 9.416 | 17.152 | 28.202 | 103.876 | 172.639 | | |
| Total (current Kwachas) | | 8.092 | 9.539 | 11.813 | 12.966 | 16.822 | 19.648 | 24.234 | 27.969 | 47.324 | 66.938 | 111.289 | 208.871 | 346.050 | 954.906 | 1592.445 | | |
| Total (constant 1985 Kwachas) | | 25.037 | 24.182 | 26.787 | 27.420 | 33.565 | 33.023 | 34.244 | 27.969 | 25.863 | 24.723 | 28.587 | 28.292 | 23.452 | 33.229 | 20.801 | | |
| Total (constant PPP\$) | | 18.093 | 17.475 | 19.358 | 19.815 | 24.256 | 23.864 | 24.747 | 20.212 | 18.690 | 17.866 | 20.658 | 20.903 | 16.947 | 24.013 | 15.032 | | |
| Source: | | 17 | 388 | 388 | 17 | 388 | 388 | 2 | 388 | 388 | 388 | 388 | 999 | 999 | 999 | 999 | 999 | 999 |
| | | 388 | 1441 | 1441 | 388 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 | 1441 |

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

Appendix 6: Research staff development by institute

| Institute: Research Branch, Department of Agriculture | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|------|------|
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0.3 | 0.4 |
| MSc | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2.3 | 2.8 | 3.8 |
| BSc | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 4 | 7 | 10.5 | 10.9 | 13.8 |
| Subtotal | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 5 | 5 | 8 | 13 | 14 | 18 |
| Expatriates | 15.0 | 18.5 | 22 | 20 | 31 | 36 | 42 | 39 | 41 | 41 | 41 | 53 | 64 | 60 | 53 | 59 | 61 | 56 |
| Total | 15.0 | 18.5 | 22 | 20 | 31 | 36 | 43 | 40 | 42 | 42 | 43 | 56 | 69 | 65 | 61 | 72 | 75 | 74 |
| Source | | | 852 | 806 | 388 | 388 | 388 | 388 | 806 | 806 | 806 | 806 | 806 | 806 | 806 | 388 | 388 | 388 |
| Institute: Central Fisheries Research Institute (CFRI), Fisheries Department | | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 0.5 | 0.8 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 4 | 5 | | | | | | |
| MSc | 5.1 | 7.7 | 9 | 9 | 9 | 9 | 13 | 13 | 13 | 24 | 33 | 39 | | | | | | |
| BSc | 17.4 | 25.5 | 29 | 26 | 32 | 44 | 45 | 45 | 67 | 57 | 51 | 49 | | | | | | |
| Subtotal | 23 | 34 | 39 | 36 | 42 | 54 | 60 | 60 | 81 | 85 | 88 | 93 | 107 | 117.5 | 128.0 | 138.5 | 149 | 145 |
| Expatriates | 45 | 37 | 44 | 48 | 52 | 53 | 57 | 58 | 60 | 60 | 57 | 58 | 53 | 44.0 | 35.0 | 26.0 | 17 | 15 |
| Total | 68 | 71 | 83 | 84 | 94 | 107 | 117 | 117 | 139 | 145 | 145 | 151 | 160 | 161.5 | 163.0 | 164.5 | 166 | 160 |
| Source | 388 | 388 | 806 | 806 | 806 | 806 | 806 | 806 | 806 | 806 | 1417 | 1421 | 388 | | | | 999 | 999 |

| Institute: Central Fisheries Research Institute (CFRI), Fisheries Department | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|--|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | | |
| MSc | | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | | | | | | | | | | |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Expatriates | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.0 | 5.0 | 5.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Total | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 4 |
| Source | | | | | | | | | | | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Institute: Research Branch, Department of Agriculture | | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | | |
| MSc | | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | | | | | | | | | | |
| Subtotal | 1.0 | 2.0 | 3.0 | 3.0 | 4.0 | 5.0 | 6 | 8 | 8.5 | 9 | 11 | 13 | 18 | 18 | 20 | 22 | | |
| Expatriates | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | 5 | 5 | 5 | 4.5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | | |
| Total | 4 | 6 | 6 | 7 | 9 | 11 | 11 | 13 | 13.0 | 13 | 15 | 18 | 23 | 23 | 25 | 27 | 26 | |
| Source | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 2 | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |

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

| Institute: Central Veterinary Research Institute (CVRI), Veterinary Services Department | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | | | | | | | |
| MSc | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | | | | | | | |
| BSc | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.3 | 0.7 | 1 | 1.4 | 1.8 | | | | | | | | |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.3 | 0.7 | 1 | 1.4 | 1.8 | 1.8 | 2.2 | 2.6 | 3.0 | 3.4 | 3.8 | 4.2 | 4.6 |
| Expatriates | 4.0 | 4.0 | 4.0 | 4.0 | 4 | 4.7 | 5.3 | 6 | 5.6 | 5.2 | 5.2 | 5.1 | 5.0 | 4.9 | 4.7 | 4.6 | 4.5 | 4.4 |
| Total | 4.0 | 4.0 | 4.0 | 4.0 | 4 | 5.0 | 6.0 | 7 | 7.0 | 7.0 | 7.0 | 7.3 | 7.6 | 7.9 | 8.1 | 8.4 | 8.7 | 9 |
| Source | | | | | 286 | | | | 285 | | 532 | | | | | | | 243 |
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | |
| MSc | | | | 0.8 | 0.9 | 1 | 0.5 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| BSc | | | | 2.3 | 2.6 | 3 | 1.5 | 2.6 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | |
| Subtotal | 5.0 | 5.4 | 5.8 | 3.1 | 3.5 | 4 | 2.0 | 3.5 | 6 | 6 | 5 | 5 | 6 | 4 | 4 | 3 | 3 | |
| Expatriates | 6.0 | 7.6 | 9.2 | 6.2 | 7.0 | 8 | 4 | 7.0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| Total | 11.0 | 13.0 | 15 | 11.3 | 13.0 | 17 | 13 | 8.5 | 4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 13 | |
| Source | | | 242 | 17.5 | 20 | 25 | 17 | 15.5 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 999 | |

| Institute: Division of Forest Research, Forestry Department | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | | | | | | | |
| MSc | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | | | | | | | |
| BSc | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | | | | | | | |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0.2 | 1.5 | 1.7 | 2.9 | 3.2 | 4.4 | 4.6 |
| Expatriates | 3.7 | 4.0 | 4.3 | 4.7 | 5 | 6.3 | 7.7 | 9 | 7.5 | 7.5 | 6 | 5.8 | 5.5 | 5.3 | 5.1 | 4.8 | 4.6 | 4.4 |
| Total | 3.7 | 4.0 | 4.3 | 4.7 | 5 | 6.3 | 7.7 | 9 | 7.5 | 7.5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 |
| Source | | | | | 286 | | | | 285 | | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Nationals | | | | | | | | | | | | | | | | | | |
| PhD | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | |
| MSc | | | | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| BSc | | | | 1.0 | 1.9 | 2 | 2 | 2.0 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | |
| Subtotal | 4.8 | 4.1 | 2.3 | 2.5 | 4.8 | 5 | 5 | 3.0 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | |
| Expatriates | 4.2 | 3.9 | 3.7 | 3.5 | 6.8 | 7 | 7 | 5.0 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 5 | 5 | |
| Total | 9 | 8 | 6 | 7 | 10 | 10 | 11 | 7 | 2.0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | |
| Source | 17 | 17 | 17 | 17 | 17 | 17 | 2 | 744 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | |

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

| Institute: Forest Products Research and Development Division, Forestry Department | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MSc | | | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BSc | | | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 5 |
| Subtotal | | | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 5 |
| Expatriates | | | 1.0 | 2.0 | 3 | 3.0 | 3.0 | 3 | 3.0 | 3 | 4 | 4 | 4 | 2 | 3 | 2 | 1 |
| Total | | | 1.0 | 2.0 | 3 | 3.0 | 3.0 | 3 | 3.0 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 6 |
| Source | | | | | 286 | | | 285 | | 532 | 279 | 999 | 999 | 999 | 999 | 999 | 999 |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MSc | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| BSc | 5 | 4 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 2 | 4 | 3 | 4 | 2 | 2 | 2 |
| Subtotal | 5 | 4 | 4 | 4 | 5 | 5 | 6 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 2 | 2 | 3 |
| Expatriates | 1 | 0 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 6 | 4 | 5 | 5 | 7 | 8 | 9 | 6 | 5 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 3 |
| Source | 999 | 999 | 999 | 999 | 999 | 999 | 2 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |

| Institute: Food Technology Research Unit, NCSR | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.2 | 0.4 | 0.7 |
| MSc | | | | | | | | 0.0 | 0.0 | 0.0 | 0 | 0.3 | 0.7 | 1 | 1.3 | 1.7 | 2.0 |
| BSc | | | | | | | | 0.0 | 0.0 | 0.0 | 0 | 1.3 | 2.7 | 4 | 3.7 | 3.3 | 3.0 |
| Subtotal | | | | | | | | 0.0 | 0.0 | 0.0 | 0 | 1.7 | 3.3 | 5 | 5.2 | 5.4 | 5.7 |
| Expatriates | | | | | | | | 2.0 | 2.0 | 2.0 | 2 | 2.3 | 2.7 | 3 | 2.8 | 2.6 | 2.3 |
| Total | | | | | | | | 2.0 | 2.0 | 2.0 | 2 | 4.0 | 6.0 | 8 | 8.0 | 8.0 | 8.0 |
| Source | | | | | | | | | | | 279 | | | 244 | | | |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | 0.9 | 1.1 | 1.3 | 1.6 | 1.8 | 2 | 2.3 | 2.4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | |
| MSc | 2.3 | 2.7 | 3.0 | 3.3 | 3.7 | 4 | 3.7 | 3.0 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | | |
| BSc | 2.7 | 2.3 | 2.0 | 1.7 | 1.3 | 1 | 1.7 | 2.1 | 3 | 3 | 2 | 2 | 1 | 1 | 0 | | |
| Subtotal | 5.9 | 6.1 | 6.3 | 6.6 | 6.8 | 7 | 7.7 | 7.5 | 9 | 9 | 8 | 8 | 7 | 6 | 5 | | |
| Expatriates | 2.1 | 1.9 | 1.7 | 1.4 | 1.2 | 1 | 1.3 | 1.5 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | | |
| Total | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8 | 9 | 9 | 11 | 11 | 9 | 9 | 8 | 6 | 5 | | |
| Source | | | | | | 1409 | 1413 | 744 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | | |

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

| Institute: Tree Improvement Research Centre, NCSR | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.1 | 0.2 | 0.3 |
| MSc | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.2 | 0.4 | 0.7 |
| BSc | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.3 | 0.7 | 1 | 1.0 | 1.0 | 1.0 |
| Subtotal | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.3 | 0.7 | 1 | 1.3 | 1.7 | 2.0 |
| Expatriates | | | | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | 2.0 | 2.0 | 2 | 1.9 | 1.8 | 1.7 |
| Total | | | | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | 2.3 | 2.7 | 3 | 3.2 | 3.4 | 3.7 |
| Source | | | | | | | | | | | 279 | | | 244 | | | |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1 | 1.0 | 1.0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| MSc | 0.9 | 1.1 | 1.3 | 1.6 | 1.8 | 2 | 3.3 | 4.7 | 6 | 6 | 6 | 5 | 6 | 5 | 4 | 4 | 5 |
| BSc | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | 1.0 | 1.0 | 1 | 1 | 0 | 1 | 2 | 1 | 1 | 1 | 0 |
| Subtotal | 2.3 | 2.7 | 3.0 | 3.3 | 3.7 | 4 | 5.3 | 6.7 | 8 | 8 | 7 | 6 | 8 | 6 | 5 | 5 | 5 |
| Expatriates | 1.6 | 1.4 | 1.3 | 1.2 | 1.1 | 1 | 1.3 | 1.7 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total | 3.9 | 4.1 | 4.3 | 4.6 | 4.8 | 5 | 6.7 | 8.3 | 10 | 10 | 8 | 7 | 9 | 7 | 6 | 6 | 6 |
| Source | | | | | | 1409 | | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |

| Institute: Water Resources Research Unit, NCSR | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | 0 | 0.1 | 0.2 | 0.3 |
| MSc | | | | | | | | | | | | | | 2 | 2.1 | 2.2 | 2.3 |
| BSc | | | | | | | | | | | | | | 2 | 2.3 | 2.7 | 3.0 |
| Subtotal | | | | | | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4 | 4.6 | 5.1 | 5.7 |
| Expatriates | | | | | | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.6 | 1.8 | 1.9 | 2 | 2.0 | 2.0 | 2.0 |
| Total | | | | | | 1.0 | 1.6 | 2.2 | 2.9 | 3.5 | 4.1 | 4.8 | 5.4 | 6 | 6.6 | 7.1 | 7.7 |
| Source | | | | | | | | | | | | | | 244 | | | |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1 | 1.0 | 1.0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| MSc | 2.4 | 2.6 | 2.7 | 2.8 | 2.9 | 3 | 3.0 | 3.0 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| BSc | 3.3 | 3.7 | 4.0 | 4.3 | 4.7 | 5 | 4.3 | 3.7 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| Subtotal | 6.2 | 6.8 | 7.3 | 7.9 | 8.4 | 9 | 8.3 | 7.7 | 7 | 7 | 7 | 7 | 7 | 5 | 5 | 5 | 5 |
| Expatriates | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | 2.3 | 2.7 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 8.2 | 8.8 | 9.3 | 9.9 | 10.4 | 11 | 10.7 | 10.3 | 10 | 10 | 7 | 7 | 7 | 5 | 5 | 5 | 5 |
| Source | | | | | | 1409 | | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |

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

| Institute: Water Resources Research Unit, NCSR | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | 0 | 0.1 | 0.2 | 0.3 |
| MSC | | | | | | | | | | | | | | 2 | 2.1 | 2.2 | 2.3 |
| BSc | | | | | | | | | | | | | | 2 | 2.3 | 2.7 | 3.0 |
| Subtotal | | | | | 0.0 | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4 | 4.6 | 5.1 | 5.7 |
| Expatriates | | | | | 1.0 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.6 | 1.8 | 1.9 | 2 | 2.0 | 2.0 | 2.0 |
| Total | | | | | — | 1.0 | 1.6 | 2.2 | 2.9 | 3.5 | 4.1 | 4.8 | 5.4 | 6 | 6.6 | 7.1 | 7.7 |
| Source | | | | | | | | | | | | | 244 | | | | |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1 | 1.0 | 1.0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | | |
| MSC | 2.4 | 2.6 | 2.7 | 2.8 | 2.9 | 3 | 3.0 | 3.0 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | | |
| BSc | 3.3 | 3.7 | 4.0 | 4.3 | 4.7 | 5 | 4.3 | 3.7 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | | |
| Subtotal | 6.2 | 6.8 | 7.3 | 7.9 | 8.4 | 9 | 8.3 | 7.7 | 7 | 7 | 7 | 7 | 7 | 5 | 5 | | |
| Expatriates | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | 2.3 | 2.7 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | | |
| Total | 8.2 | 8.8 | 9.3 | 9.9 | 10.4 | 11 | 10.7 | 10.3 | 10 | 10 | 7 | 7 | 7 | 5 | 5 | | |
| Source | | | | | | 1409 | | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | | |

| Institute: School of Agricultural Sciences, UNZA | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | 0 | | | | 0 | | |
| MSC | | | | | | | | | | | 0 | | | | 0 | | |
| BSc | | | | | | | | | | | 0 | | | | 1 | | |
| Subtotal | | | | | | | | | | | 0 | | | | 1 | | |
| Expatriates | | | | | | | | | | | 8 | | | | 11 | | |
| Total | | | | | | | | | | | 8 | | | | 11 | | |
| FTE Researchers | | | | | | | | | | | 2.0 | 2.8 | 3.5 | 3.2 | 3.0 | 3.0 | 3.0 |
| Source | | | | | | | | | | | 1000 | 1000 | 1000 | | 1000 | | 1000 |
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | 12 | 11 | 10.0 | 9 | 17 | | | |
| MSC | | | | | | | | | | 3 | 6 | 6.5 | 7 | 7 | | | |
| BSc | | | | | | | | | | 0 | 0 | 0.0 | 0 | 1 | | | |
| Subtotal | | | | | 9 | 12.4 | 11 | | | 15 | 17 | 16.5 | 16 | 25 | 26.0 | | |
| Expatriates | | | | | 12 | 18.6 | 18 | | | 5 | 4 | 4.5 | 5 | 6 | 6.0 | | |
| Total | 13.5 | 15 | 15.0 | 15 | 21 | 31 | 29 | 27 | 23.5 | 20 | 21 | 21.0 | 21 | 31 | 32.0 | | |
| FTE Researchers | 3.4 | 3.8 | 3.8 | 3.8 | 5.2 | 7.8 | 7.2 | 6.8 | 5.9 | 5.0 | 5.2 | 5.2 | 5.2 | 7.8 | 8.0 | | |
| Source | | 1000 | | 1000 | 979 | 1000 | 2 | 1000 | | 1000 | 1000 | 1000 | 1000 | 999 | | | |

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

| Institute: School of Veterinary Medicine | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | |
| MSC | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | 4 | 4 | 15 | 15 | 11 | 21 | 21 | | |
| Subtotal | | | | | | | | | 16 | 16 | 16 | 17 | 20 | 20 | 20 | | |
| Expatriates | | | | | | | | | 20 | 20 | 31 | 31 | 28 | 41 | 41 | | |
| Total | | | | | | 3 | 8.0 | 13 | 36 | 36 | 47 | 48 | 48 | 61 | 61 | | |
| FTE Researchers | | | | | | 1.2 | 3.2 | 5.2 | 8.0 | 8.0 | 12.4 | 12.4 | 11.2 | 16.4 | 16.4 | | |
| Source | | | | | | 1000 | | 1000 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | | |

| Institute: Department of Agricultural Engineering, School of Engineering | | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | |
| MSC | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | 4 | 5 | 5 | 3 | 7 | 8 | 5 | | |
| Subtotal | | | | | | | | | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | |
| Expatriates | | | | | | | | | 6 | 7 | 7 | 5 | 8 | 9 | 6 | | |
| Total | | | | | | | | | 8 | 9 | 9 | 7 | 9 | 10 | 7 | | |
| FTE Researchers | | | | | | | | | 0 | 0 | 0.7 | 0.5 | 0.8 | 0.9 | 0.6 | | |
| Source | | | | | | | | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | | |

| Institute: Rural Development Studies Bureau, UNZA | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | |
| MSC | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | | | | | | | | | |
| Subtotal | | | | | | | | | | | | | | | | | |
| Expatriates | | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | | |
| Source | | | | | | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Nationals | | | | | | | | | | | | | | | | | |
| PhD | | | | | | | | | | | | | | | | | |
| MSC | | | | | | | | | | | | | | | | | |
| BSc | | | | | | | | | | | | | | | | | |
| Subtotal | | | | | | | | | | | | | | | | | |
| Expatriates | | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | | |
| Source | | | | | | | | | | | | | | | | | |

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