

Report to the Government
of Zimbabwe

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ISNAR R32e

**A REVIEW OF THE DEPARTMENT OF
RESEARCH AND SPECIALIST SERVICES,
ZIMBABWE**



International Service for National Agricultural Research
in collaboration with the
Department of Research and Specialist Services

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

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LIST OF ACRONYMS

AGRITEX	Department of Agricultural Technical Services and Extension
ARC	Agricultural Research Council
ART	Agricultural Research Trust
CART	Communal Area Research Trials
CBI	Crop Breeding Institute
COFRE	Committee on On-Farm Research and Extension
CPU	Crop Productivity Units
CSRI	Chemistry and Soils Research Institute
DR&SS	Department of Research and Specialist Services
FSR	Farming Systems Research
GDP	Gross Domestic Product
IAE	Institute of Agricultural Engineering
ISNAR	International Service for National Agricultural Research
MLARR	Ministry of Lands, Agriculture and Rural Resettlement
RELSCO	Research-Extension Liaison Subcommittee
SMS	Subject Matter Specialists
UDI	Unilateral Declaration of Independence

PREFACE

As part of its collaborative activities with the Department of Research and Specialist Services (DR&SS) in Zimbabwe, ISNAR organized a workshop on the Planning and Programming of Agricultural Research which was held at Nyanga in April 1986. The workshop was attended by the Directorate of DR&SS and the heads of the research institutes, stations, and other units in the Department. After considerable discussion, there was widespread agreement among participants that the planning, organization, and management of research and service activities in DR&SS should be comprehensively reviewed.

In response to a request from Dr. P.G.N. Chigaru, Director of DR&SS, ISNAR agreed in June 1986 to assist DR&SS in undertaking this review. The following terms of reference were agreed upon:

- to review the structure and organization of DR&SS and make proposals that would enable the Department to respond optimally to its mandate;
- to review current mechanisms and procedures for planning, priorities setting, and resource allocation, and suggest improvements;
- to review the programming of research and recommend mechanisms for improvement;
- to examine existing linkages between research and the client/user organizations and communities, and make recommendations for strengthening these linkages.

As part of the review process the Director also appointed a departmental task force charged with the responsibility of systematically examining key planning, organization, and management issues in DR&SS and working closely with the ISNAR team during their visit to Zimbabwe. The following staff were members of the task force:

Mr. T.J.T. Madziva (Chairman)
Mr. R. Fenner (Deputy Director, Crops)
Miss R.N. Mugabe (Deputy Director, Research Services)
Mr. O. Mufandaedza (Deputy Director, Livestock & Pastures)
Dr. G. McLaren
Dr. T.M. Musa
Mr. E.E. Whingwiri
Dr. P. Tawonezwi
Dr. M. Avila
Prof. C.L. Keswani
Mr. B.M. Taguta (Secretary)

The Departmental Task Force held several meetings and consultations in the period between June and November 1987. In preparation for the main review, it designed and executed a series of questionnaires which pooled valuable information and reactions on management issues from managers and policymakers at different levels in the Department, the Ministry, and associated institutions. The analysis of these questionnaires resulted in the identification of major issues of concern and helped to focus the terms of reference more sharply on discussions that would lead to recommendations for improved management of research and services.

The ISNAR review team visited Zimbabwe during the period of November 15 to December 5, 1986. They held intensive discussions with members of the local task force; visited a number of DR&SS research institutions and also the University of Zimbabwe; and held discussions with senior officials from AGRITEX, the Ministry of Lands, Agriculture and Rural Resettlement, other relevant ministries, client groups, and the Agricultural Research Council.

The ISNAR team comprised:

- | | |
|--------------------------|--|
| Dr. H.K. Jain: | Deputy Director General, ISNAR
Collaboration with National Research Systems
(Team Leader)
(Agricultural Research Planning, Organization
and Management, Crop Production) |
| Prof. T. Ajibola Taylor: | Senior Research Officer, ISNAR
(Agricultural Research Organization and
Management, Crop Production and Protection, and
Research Services) |
| Dr. P. Bennell: | Research Officer, ISNAR
(Planning, Policy, Organization, and
Socioeconomics) |
| Dr. P. O'Donovan: | Consultant, ISNAR
(Livestock and Pastures) |

The members of the departmental task force independently and collectively contributed in a large measure to the analyses, discussions, and the conclusions and recommendations in this report. ISNAR, however, takes full responsibility for the preparation of the report and the major views and recommendations contained in it.

CHAPTER ONE

INTRODUCTION

1.1 Agriculture in Zimbabwe

There are three main characteristics of the agricultural sector in Zimbabwe which profoundly influence the role and nature of agricultural research activities: the overall national importance of agriculture, the agroecological diversity of the country, and the marked segmentation of the agricultural sector into distinct groups of producers.

1.1.1 National development

While, in African terms, Zimbabwe has a relatively sophisticated and diversified economy, agriculture continues to remain the most important sector. Agriculture and forestry constituted only 11.6% of gross domestic product (GDP) in 1983, a significant decline from 17.6% in 1974. Nonetheless, approximately 75% of the total population derives its income from agricultural activities, 50% of manufacturing industry is dependent to some degree on agriculture, and 46% of total exports in 1984 were agricultural products. Over one-quarter of formal wage employment is accounted for by agricultural enterprises. The annual growth rates of agricultural output and GDP for the period 1980-1985 presented in Table 1 reveal quite clearly the dependence of the Zimbabwean economy on the performance of agriculture. This will continue to be true for the foreseeable future. Consequently, agricultural research in providing the new technologies for agriculture will be a primary engine of growth on which all national development efforts will ultimately hinge.

Table 1. Growth Rates of Agricultural Output and Gross Domestic Product, Zimbabwe, 1980-1985

<u>Year</u>	<u>Agricultural Output</u>	<u>G.D.P.</u>
1980	3.1	11.3
1981	8.3	13.0
1982	1.0	0.0
1983	-6.4	-3.4
1984	12.8	1.0
1985 (est)	25.0	6.0

Source: M.J. Blackie. The Elusive Peasant - Zimbabwe Agriculture Policy: 1965-1986. Paper presented at Conference on Food Security Research in Southern Africa, Harare, November 1986.

1.1.2 Agroecological diversity

The second dominant feature of agriculture in Zimbabwe is its complexity which in large part is due to the agroecological diversity of the country. Five natural regions can be delineated on the basis of rainfall (see Table 2 and Figure 1). The best soils occur mainly in natural regions II and III which, coupled with their higher, more reliable rainfall, makes them the most productive rain-fed cropping zones. The remaining two-thirds of the country is covered with sandy soils characterized by low natural fertility and poor water-retention capacity.

Such agroecological diversity has given rise to distinct types of farming production systems in each of the main natural regions. In addition, a very wide range of agricultural commodities can be grown. The ability to cater effectively to the technological needs that arise from such a complex agriculture represents a major challenge, especially for a national agricultural research system in a relatively small, resource-poor country such as Zimbabwe.

1.1.3 Sectoral segmentation

The agricultural sector in Zimbabwe is segmented into three distinct groups of producers:

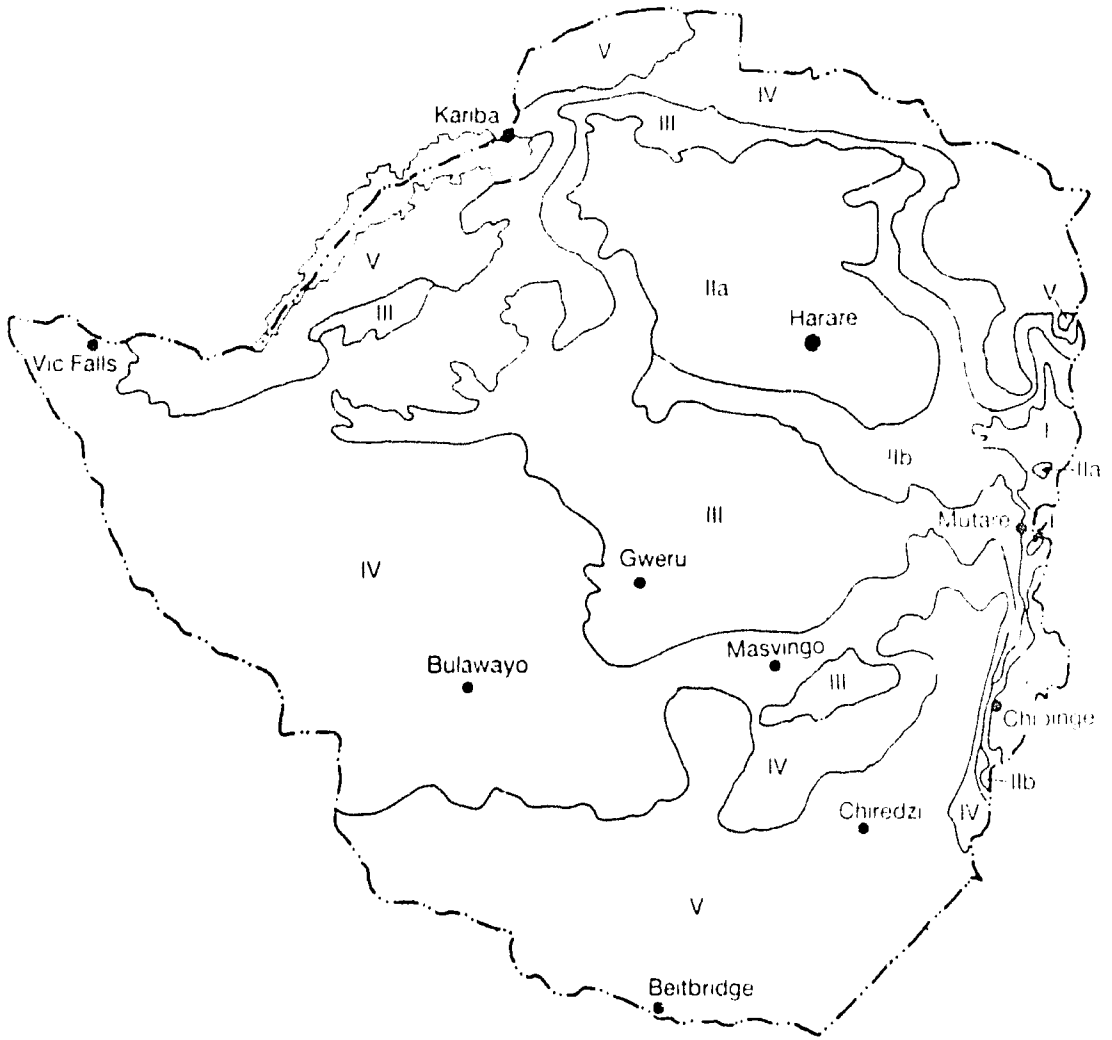
- Approximately 6000 large-scale commercial producers on 15 million hectares under freehold title. During the colonial period, agricultural land was formally allocated along racial lines with the result that European agricultural settlement was concentrated in the high-potential areas of the country in Natural Regions I, II, and III. Backed by excellent support services and favorable price support policies, European commercial agriculture developed rapidly after the Second World War. Utilization of advanced agricultural technology has resulted in high yields in the main crops cultivated, namely maize, tobacco, cotton, wheat, coffee, and soyabean (see Table 3).
- 8500 small-scale African commercial farms on 1.5 million hectares under tenancy and freehold title. These farms, known as African Purchase Areas prior to Independence, were created by the Land Apportionment Act of 1931. Farming systems and crop rotations are similar to those in the larger scale commercial sector but the area cropped is considerably less and yields are lower.
- 850-950,000 African smallholder family farms on 16 million hectares in the communal areas (formerly the Tribal Trust Lands) based on traditional rights assigned by local chiefs. Over 70% of the rural population live in the communal areas, 90% of which are located in the low rainfall natural regions III, IV, and V. Largely ignored by government prior to Independence, yields of the major crops grown in the communal areas continue to remain generally low (see Table 3). There are substantial differences in the production systems within the Communal Areas. While agro-pastoral production predominates in Matabeleland, the production system in Mashonaland is agricultural.

Table 2.1 Main Characteristics of Natural Regions

Region I: <u>Specialized and diversified farming</u>	Region IV: <u>Semi-extensive farming</u>
Rain: More than 1000 mm per annum in areas lying below 1700 m altitude and more than 900 mm per annum at greater altitudes.	Rain: 450-650 mm per annum. Periodic seasonal drought and severe dry spells during the rainy season
Production: Afforestation and production of fruit and intensive livestock. In frost-free areas tea, coffee, macadamia nuts, and other plantation crops.	Production: Livestock production, drought-resistant crops.
Area: 7000 sq km (less than 2% of the total area of Zimbabwe).	Area: 147,800 sq km (38% of the total area of Zimbabwe).
Farming: 74% is large-scale commercial land, 24% communal land and 2% small scale commercial land.	Farming: 62% is communal land, 34% is large scale commercial land and 4% small scale.
Region II: <u>Intensive farming</u>	Region V: <u>Extensive farming</u>
Rain: 750-1 000 mm per annum. In part of the region crop yields in certain years will be affected by relatively short rainy seasons or dry spells during the season.	Rain: Too low and erratic for production of even drought-resistant fodder grain crops.
Production: Crops and intensive livestock production.	Production: Extensive cattle ranching or game ranching.
Area: 58,600 sq km (15% of the total area of Zimbabwe).	Area: 104,400 sq km (27% of the total area of Zimbabwe).
Farming: Almost 74% is large-scale commercial land, 22% is communal land, and 4% small-scale commercial land.	Farming: Approximately 45% is communal land, 35% large-scale commercial land, and less than 20% national parks.
Region III: <u>Semi-intensive farming</u>	
Rain: 650-800 mm per annum. Fairly severe mid-season dry spells.	
Production: Livestock production together with fodder crops and cash crops. Marginal production of maize, tobacco, and cotton.	
Area: 72,900 sq km (19% of the total area of Zimbabwe).	
Farming: Approximately 49% is large-scale commercial land, 43% is communal land, and 8% is small-scale commercial land.	

Source: Statistical yearbook, 1985, Central Statistical Office, Harare.

Figure 1. Natural Regions of Zimbabwe



	RAINFALL
I - Specialized and Diversified Farming	1000 mm +
II - Intensive Farming Region	750 - 1000 mm
III - Semi-Intensive Farming Region	650 - 800 mm
IV - Semi-Intensive Farming Region	450 - 650 mm
V - Zambesi Valley Extensive Farming Region and below 600 mm in the Save-Limpopo Valley	Below 650 mm

Table 3: Food Crop production in Zimbabwe, 1951 to 1955 and 1976 to 1980

		Large-scale commercial farms			Small-scale commercial farms			Peasant Farms		
		Area ha	Product. t	Yield Kg/ha	Area ha	Product. t	Yield Kg/ha	Area ha	Product. t	Yield Kg/ha
Maize	1951-55	145.000	207.068	1.421				628.751	217.103	342
	1976-80	212.450	1.008.136	4.726	29.825	53.263	1.786	738.400	514.800	695
Munga	1951-55							97.853	52.233	531
	1976-80				1.444	878	606	339.800	130.990	385
Sorghum	1951-55	3.017	1.678	568				149.673	45.995	307
	1976-80	6.476	16.124	2.499	1.282	861	682	152.400	77.400	498
Ripoko	1951-55							91.347	55.368	606
	1976-80				2.995	2.238	762	116.500	50.340	493
Wheat	1951-55	494	634	1.235						
	1976-80	37.234	163.165	4.396	440	248	571	383	942	2.454
Barley	1951-55	291	352	1.202						
	1976-80	4.655	22.798	4.905				119	299	2.280
Cupini Cane	1951-55	709	21.670	35						
	1976-80	25.091	2.593.306	103						
Mushrooms	1951-55	1.789	12.018	6.709						
	1976-80	1.597	21.891	14.604	94	235	2.557			
Cassava Cassava	1951-55	2.908	1.562	560				175.604	45.462	258
	1976-80	3.394	7.980	2.335	11.811	6.559	551	250.000	123.400	481
Cassava Cassava	1951-55	231	97	470						
	1976-80	32.700	66.656	2.011	611	378	675	7.462	5.156	624
Peanut Groundnuts	1951-55	2.912	815	294				39.780	12.417	312
	1976-80	1.098	459	421	991	579	589	29.500	8.300	304
Cotton Cotton	1951-55	2.195	929	432						
	1976-80	3.074	1.688	545	4.733	2.593	530	29.400	11.800	401
Cotton Cotton	1951-55	5.102	1.428	256						
	1976-80	74.055	125.558	1.709	6.693	5.510	829	33.800	24.000	722

Source: J.R. Tattersfield. The role of research in increasing food crop potential in Zimbabwe. The Zimbabwe Science News, 16,1, January 1982

It is current government policy to eliminate the pronounced segmentation of the agricultural sector in Zimbabwe. Resettlement of African smallholders and landless people on commercial farms is the main policy initiative in this area. However, progress to date strongly suggests that the segmentation of the agricultural sector will persist for some time to come which in turn will mean that DR&SS will have to continue to serve markedly different clienteles.

1.2 The Department of Research and Specialist Services

Established in 1948, the Department of Research and Specialist Services is the most important agricultural research organization in Zimbabwe undertaking research in all commodities and disciplines (with the exception of tobacco, sugar, forest products, fish, pigs, and animal diseases). It also has responsibilities to provide various services to the agricultural industry, including major regulatory functions such as plant and dairy inspections, meat and cattle grading, seed certification and pesticide registration. It is a department of the Ministry of Lands, Agriculture, and Rural Resettlement (MLARR) and, as such, its administrative procedures are governed by central government rules and regulations.

The Department is organized into three main divisions: crops, livestock and pastures, and research services. Each division is headed by a deputy director who reports directly to the director. A separate executive branch deals with administrative and financial matters. The organization chart of DR&SS is presented in Figure 2. The locations and main responsibilities of DR&SS research and service institutions are as follows:

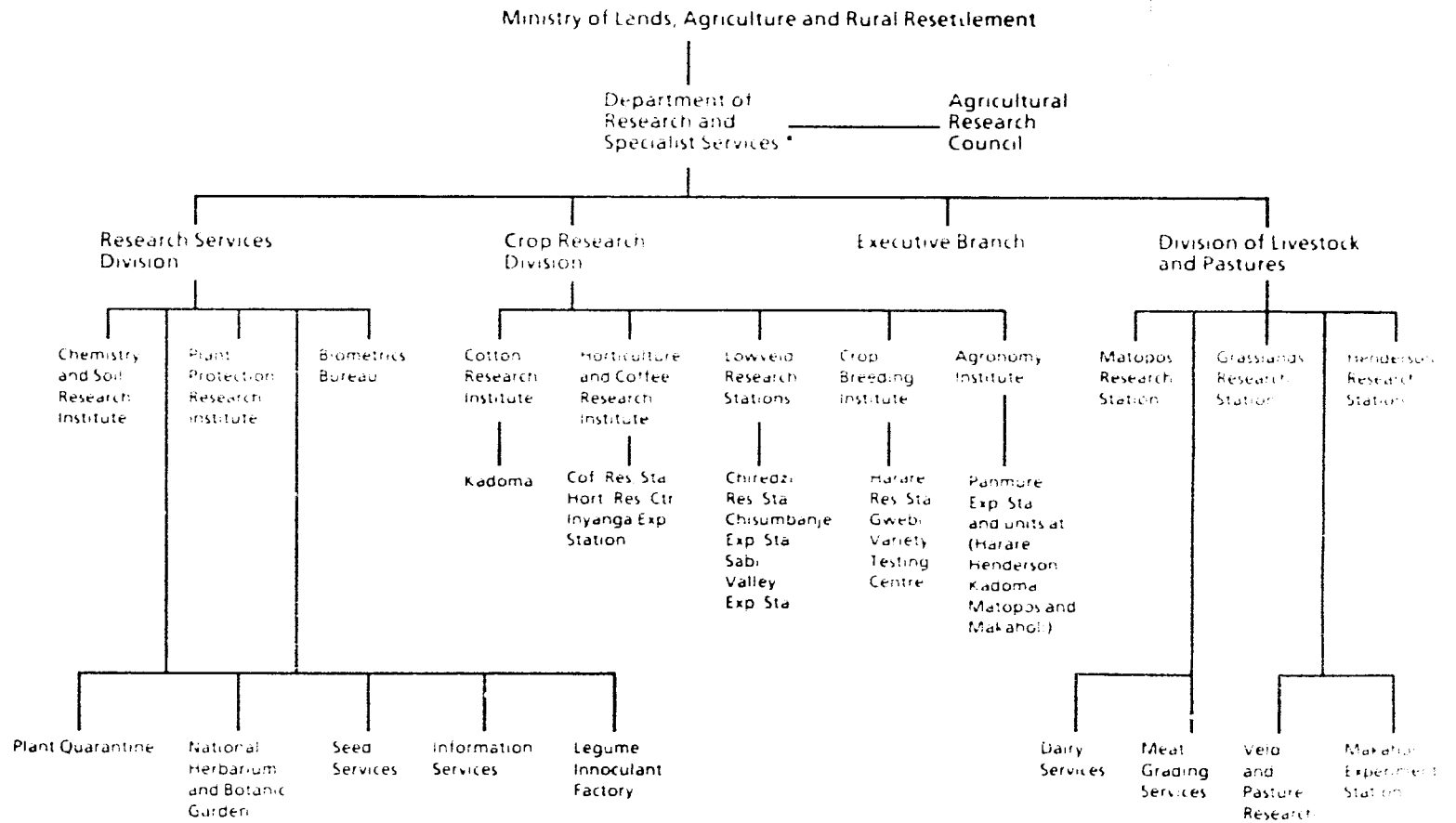
Crops Research Division

- Cotton Research Institute, Kadoma (agronomy, breeding, pest research);
- Horticulture and Coffee Research Institute (including the Coffee Research Station, Chipinge; the Horticultural Research Center, Marondera; and the Nyanga Experiment Station);
- Crop Breeding Institute, Harare (maize, oilseeds, potatoes, small grains, winter cereals);
- Agronomy Institute, Harare (crop ecology, physiology, production, farming systems, weed research);
- Lowveld Research Station, Chiredzi (irrigated and dryland crops).

Research Services Division

- Chemistry and Soil Research Institute Harare including the Soil Productivity Research Laboratory, Marondera (agricultural chemistry, crop nutrition, pedology, soil productivity, fertilizers and feeds registration);

Figure 2. Present Structure, Organization and Relationships of DR&SS



*The Farming System Research Unit directly responsible to the Director of DR + SS.

- Plant Protection Research Institute, Harare (entomology, nematology, pathology, pesticide registration, phytosanitary services);
- National Herbarium and Botanical Gardens, Harare;
- Biometrics Bureau, Harare;
- Seed Services Unit, Harare (seed laboratory and inspectorate, plant breeders' rights);
- Information Services, Harare;
- Technical Development Unit, Harare;

The Livestock and Pastures Division

- Matopos Research Station, Matopos (livestock breeding and production, veld management);
- Grasslands Research Station, Marondera (livestock, veld improvement);
- Henderson Research Station, Mazoe (animal nutrition, dairy, pastures, physiology, poultry);
- Makoholi Experiment Station, Makoholi (livestock breeding and production);
- Dairy Services;
- Meat and Cattle Grading, various locations.

The Farming Systems Unit, Harare, is the direct responsibility of the Director and is not therefore part of the present divisional structure.

The research stations and institutes in DR&SS serve one or more specific agroecological zones (unlike the main agricultural extension service, The Department of Agriculture Technical and Extension Services (AGRITEX), which is organized on a provincial basis). Furthermore, nearly all are located in large-scale commercial farming areas which is a direct legacy of the colonial period when DR&SS served almost exclusively this group of producers. Twelve of the seventeen main institutions are located in Natural Region II.

During the financial year 1986/87, DR&SS had a total staff complement of 1826. The main staff categories are shown in Table 4. Combined development and recurrent expenditure by DR&SS amounted to Z\$13.22 million during the financial year 1985/86. In 1984 (the latest year for which national account data are available) DR&SS expenditure amounted to 1.38% of agricultural gross domestic product. However, this figure increases to over 3% if government expenditure on all types of agricultural research in Zimbabwe is also included which is considerably higher than the recommended World Bank target of 2%.

Table 4. Main BRSS Staff Categories 1986/87

Category	Number
Professional staff (excluding expatriates)	142
Research technicians	106
Agricultural assistants	91
Technical assistants (Lab)	30
Extension assistants	9
Data processing assistants	2
Milk recorders and assistants	11
Meat graders and assistants	67
Cattle graders	4
Plant inspectors	4
Farm managers	6
Agricultural supervisors	15
Executive officers	11
Secretaries/typists/telephonists	46
Artisans/handymen	18
General, research and lab. hands, orderlies, watchmen, drivers, etc.	1253
Miscellaneous	11
Total	1826

Source: Computerized salary sheets.

CHAPTER TWO

AGRICULTURAL RESEARCH POLICY

The raison d'être of DR&SS as the main publicly funded agricultural research institution in Zimbabwe is to produce new agricultural technologies which most effectively serve the government's overall agricultural development policies. The key question therefore is to what extent DR&SS has managed, particularly in recent years, to translate these policies into a coherent set of agricultural research activities which have generated technological solutions to priority problem areas in the agricultural sector in Zimbabwe. This in turn requires an analysis of the main constraints encountered by DR&SS in formulating and implementing viable agricultural research policies.

There has been a fundamental reorientation of agricultural policies since Independence in 1980. Before considering these policies and the performance of DR&SS in responding to them, it is first necessary to review briefly the situation prior to Independence in order to comprehend the full significance of the change in the agricultural policy environment after 1980.

2.1 The Pre-Independence Period

Agricultural policy during the colonial period focused almost exclusively on the vigorous and sustained development of the large-scale commercial farming areas which were owned by European farmers and companies. The racial segregation of land ownership became the key factor in the development of the agricultural sector in Rhodesia, especially during the 1950s with the arrival of large numbers of white settlers in the country. The economic and political power of the commercial farming community increased rapidly so that by the 1960s it was the dominant force in the entire political process. Agricultural producer associations, most notably the Commercial Farmers Union and the Rhodesia Tobacco Association, were also established and were directly modelled on the powerful farm lobbies of Europe and North America. As a result, a comprehensive set of government agricultural policies were developed which were highly supportive of the commercial farming sector. Thus, new institutional structures were created to assist in financing and marketing of agricultural commodities and the generation and diffusion of new agricultural technologies. The combination of favorable agricultural policies and the capacity of commercial farmers to utilize advanced technology resulted in a rapid transformation of the commercial agriculture. Between 1965 and 1980, the UDI period, total marketed agricultural output increased nearly fourfold.

Agricultural research and DR&SS in particular played a key role in this transformation. The need to institutionalize and to expand the role of agricultural research increased rapidly after the Second World War when the focus of agricultural development shifted from the simple expansion of the land frontier to the intensification of agricultural production, requiring yield-increasing and cost-decreasing

technologies. Consequently, government commitment to the direct support of agricultural research activity increased considerably during the 1960s and 1970s (see Table 5). This allowed DR&SS to develop a highly skilled and experienced group of research scientists with excellent physical facilities. The rapid increase in the yields of the major agricultural crops, in particular maize, and the emergence of a highly sophisticated and successful livestock sector from the 1960s onwards testifies to the success of DR&SS in producing first-rate agricultural technologies.

Table 5. Indicators of Government Support to DR&SS, 1965-1986

Year	DR&SS% AGDP	DR&SS% Total govt.	DR&SS% MOA/budget
1965		1.30	19.4
1970		1.33	20.6
1975	1.23	0.75	18.0
1980	1.75	0.56	12.7
1985	1.19	0.36	7.7
1982	1.23	0.37	5.7
1983	1.51	0.29	4.0
1984	1.38	0.32	3.8
1985		0.34	4.9
1986		0.33	4.7

The relative neglect of African smallholder agriculture by the colonial state in Rhodesia was in marked contrast to the support given to the European commercial sector. Consequently, the productivity levels of the two farming communities steadily widened, especially during the war years of the 1970s when agricultural production deteriorated seriously in the African farming area. In accordance with government policy, DR&SS concentrated on the technical problems of commercial farmers and, while there were some relevant research spillovers which African farmers were able to benefit from (particularly new crop varieties developed for more marginal rainfall areas in Natural Region III), no major research programs were initiated that systematically addressed the special problems of predominantly subsistence, low-productivity, mixed farming systems in the communal areas. This persistent neglect of the research needs of African smallholders was a direct consequence of the European domination of the state and the overtly racist ideologies which underpinned the colonial regime in Rhodesia. However, more sophisticated arguments were also forwarded which were essentially based on the assertion that sociological and economic rather than technological factors were the most serious constraints to increasing the productivity of African agriculture and that these were best tackled by more direct extension and development initiatives.

2.2 The Post-Independence Period

2.2.1 The policy environment

The Zimbabwe government's policies for agricultural development are based on the following set of objectives set out in the National Economic Policy of Growth with Equity in 1982:

- effect an acceptable and fair distribution of land ownership and use;
- strive to achieve a rapid reduction in the levels of absolute poverty in rural areas together with an accelerated improvement in the standards of living of the rural population;
- increase both land and labor productivity in all forms of agriculture;
- achieve substantial increases in employment for the rapidly growing labor force;
- achieve and maintain food self-sufficiency and regional food security.
- increase the role of agriculture as a major foreign exchange earner and as a source of inputs to local industries;
- integrate the commercial and communal farming sectors;
- promote regional balance in agricultural development;
- develop human resources in the rural areas to their full potential;

Of particular importance has been the government's firm intention to work with all farmers but with special emphasis being given to redress the imbalance in access to public services and infrastructure on the part of the communal areas and at the same time promoting rapid increases in the productivity of existing smallholder mixed farming systems. Clearly, therefore, agricultural research as a primary service to the agricultural industry has a critically important role in fulfilling these objectives.

In one key respect there has been continuity between the colonial and post-Independence periods with respect to agricultural policy, namely, government recognition of the paramount role of the agricultural sector in sustaining national development with the corresponding need to provide an appropriate, highly supportive policy environment. This has been recently reaffirmed with the publication of the First Five Year Development Plan 1986-90 where it is stated that "meaningful development must place the agriculture sector in the center of the development strategy." Growth in agricultural output is targeted at 5.0% per year during the plan period with specific growth rates of 7-8% per year for communal and resettlement areas, 5-6% per year for the small-scale commercial areas, and 3-4% per year for the large-scale commercial areas. Production targets for specific commodities are also enumerated. These will be discussed in more detail in Chapter 5.

The implementation of the Growth with Equity objectives for agricultural development was seriously hampered by the three consecutive years of drought in Zimbabwe between 1982-1984. However, as is clearly evidenced by the record harvests for many of Zimbabwe's major crops during 1985 and 1986, some progress has been made towards meeting these objectives. Probably, the most notable achievement has been the rapid widening in the provision of services (most notably credit, extension, and transportation) to farmers in the communal areas which has resulted in major production increases, particularly in maize and cotton. As yet, however, significant increases in agricultural productivity in the communal areas have not occurred.

The most controversial area of agricultural policy since Independence (which is also of direct relevance to DR&SS and other agricultural research organizations in Zimbabwe) has been in determining the relative importance to be attached by government to achieving equity and production objectives given that there are significant trade-offs between the two sets of objectives, at least in the shorter term. This has tended to focus on the size of the resettlement program. While on equity grounds the merits of resettlement are clear, it is likely that if pursued too rapidly, agricultural production and productivity could be seriously undermined for decades to come. The Zimbabwe Government, being acutely aware of this problem, has decided to moderate the speed at which the resettlement program is implemented, thereby ensuring that a core of intensive, large-scale farms will continue to play a major role in agricultural development for at least the next two decades.

2.2.2 Responding to the challenge

The fundamental reorientation of agricultural policies in Zimbabwe since Independence has presented DR&SS managers and professional staff with a major new challenge. From catering to the research and service needs of fewer than 8000 large-scale, relatively sophisticated commercial farmers prior to Independence, the Department's primary mandate is now to generate viable agricultural technologies for nearly one million resource-poor African smallholders in the communal areas while at the same time maintaining the productivity of the large-scale commercial producers.

In general terms, DR&SS has responded positively to the new challenge. After some initial ambivalence, mainly on the part of the older generation of managers and researchers, a broad consensus now exists on the role of DR&SS in relation to its major clientele, in particular, in the communal areas. This in itself is a major achievement in such a relatively short period of time.

The Department's commitment to reorienting its research activities to the problems of the communal areas has been clearly demonstrated in the increased emphasis which has been given to on-farm adaptive and systems research, mainly carried out by the Farming Systems Research Team and the Agronomy Institute. Other research stations and institutes are also currently undertaking extensive surveys of the communal areas in addition to specific research projects that focus on smallholder agriculture in the marginal rainfall areas of the country. By 1986 nearly 20% of the total research effort (measured in researcher person years) was being devoted to on-farm research activities. The new research programs currently being proposed for agroforestry, crop residues, and goats are also indicative of this commitment.

While recognizing the achievements of DR&SS in responding to the new agricultural policies, its response still remains limited in scope. Of particular concern is the livestock research program which continues to remain of only marginal relevance to the problems faced by producers in the communal areas (see Chapter 5). Furthermore, most of DR&SS's major client groups in their replies to the Task Force questionnaire expressed some dissatisfaction with the Department in meeting their research needs. This is so despite the fact that DR&SS represents one of the best organized research services in Sub-Saharan Africa and has won wide acclaim from the international scientific community.

A number of specific problem areas can be identified which have constrained the effectiveness of DR&SS in recent years. While each of the main problem areas will be analyzed in detail in subsequent chapters, it is useful to summarize them here.

Research planning and programming: Faced with such a new and complex agricultural policy environment, it is essential that DR&SS develops a comprehensive research strategy which sets out the main objectives of carefully delineated research programs and makes precise allocations of existing and future resources to them. DR&SS management recognize the need for such a strategy but have not yet managed to develop one mainly because the Department has not created the capacity to undertake such an exercise. In the absence of a clear research strategy, it has been difficult to "sell" agricultural research because politicians, senior policymakers and clients have not been sufficiently well informed of the Department's on-going research activities and its current and future objectives and priority areas. Equally important is the fact that research managers and scientists located in the various research stations and institutes have lacked a clear sense of direction in formulating their research projects and other activities.

Organizational structure: DR&SS existing organizational structure is not appropriately designed to meet the research needs of the Department's major clientele in the communal farming areas. The major weaknesses mainly concern the excessive centralization of research facilities and activities in the higher potential agricultural regions and the absence of effective mechanisms for the coordination of research and collaboration between researchers in different disciplines.

Financial resources: There has been a noticeable decline in the real value of government resources committed to DR&SS since 1980/81 (see Table 6). During the 1960s and early 1970s approximately 20% of the Ministry of Agriculture's budget was allocated to DR&SS. By the mid 1980s this figure had fallen to below 5%. In short, therefore, at a time when the research and service responsibilities of DR&SS have been expanded enormously, there has been a contraction in the financial resources available. An important consequence of this has been that the proportion of DR&SS's total expenditure which is now devoted to staff emoluments has increased markedly - from around 50% in the mid 1970s to nearly 75% in 1986/87. The corresponding decline in the availability of operating funds has adversely affected the productivity of the research effort.

Table 6. DR&SS Expenditure 1980-1986

Year	Expenditure Z\$2 million	Current Prices	Expenditure Index (1980=100) constant 1980 prices
1980/81	8.07	100	100
1981/82	7.73	96	36
1982/83	8.24	102	77
1983/84	8.98	113	74
1984/85	10.85	134	78
1985/86	13.22	164	85
1986/87	15.04	186	87

Financial contributions to DR&SS by the main commercial-sector producer associations (most notably the Commercial Farmers Union and the Cattle Producers Association) have also declined in real terms. This is no doubt partly due to the emergence of private-sector agricultural research organizations since 1980 (in particular the Agricultural Research Trust) which have been strongly supported by these associations and which make an important contribution of their own. This points to the need for a future strategy which must aim at strengthening both the public and private sectors so that they develop synergistic interactions in their research.

Human resources: The scientific personnel available to DR&SS have been severely limited both in terms of quantity and quality. Independence in 1980 resulted in a transformation of staffing patterns in DR&SS. Within four years nearly two-thirds of the mainly experienced cadre of European scientists left to be replaced by generally inexperienced African university graduates. This has seriously weakened the capacity of DR&SS to respond effectively in the short term to the new set of demands placed on the Department.

Table 7 presents 1984 data on the allocation of available professional research person-years to each of the main agricultural commodities covered by DR&SS's mandate. It can be observed that the research effort for most of the major commodities is very limited. This problem is likely to be further aggravated by the growing proportion of professional time that DR&SS commits to fulfilling its service and advisory responsibilities which at present amounts to between 25-35% of the total.

Research-extension linkages: Prior to Independence research-extension linkages in the commercial areas were very highly developed. In the communal farming areas, on the other hand, they were extremely weak. While DR&SS and AGRITEX have been endeavoring to build up appropriate research-extension linkages in the communal farming areas since Independence, effective mechanisms for the dissemination of DR&SS technologies are still relatively weak.

Table 7. Researcher Person-Years Directly Devoted to Commodity Research, DRSSS, Early 1984*

A.	Plants	Researcher Person-Years	%
	Cereals		
	Maize	4.5	12.6
	Wheat	0.9	2.5
	Barley	0.3	0.8
	Rice	1.0	2.8
	Sorghum	0.9	2.5
	Millet	0.6	1.7
	Other n.s.	2.1	5.9
	Oil Crops		
	Soyabean	0.3	0.8
	Sunflower	0.6	1.6
	Groundnut	1.3	3.6
	Fiber Plants		
	Cotton	6.1	17.1
	Horticulture and Grain Legumes		
	Fruit Trees & Crops	1.3	3.6
	Citrus Trees & Crops	0.2	0.6
	Green & Leafy Vegetables	0.4	1.1
	Bananas	0.4	1.1
	Leguminous Grains & Vegetables	2.0	5.6
	Horticulture n.s.	2.0	5.6
	Coffee	0.9	2.5
	Cassava	0.6	1.7
	Pastures	4.8	13.4
	Other crop research	4.5	12.6
	Sub-Total	<u>35.7</u>	<u>100.0</u>
B.	Animals		%
	Beef Cattle	10.7	60.4
	Dairy Cattle	1.9	10.7
	Sheep	1.6	9.0
	Goats	0.8	4.5
	Poultry	0.8	4.5
	Other animal research	1.9	10.7
	Sub-Total	<u>17.7</u>	<u>100.0</u>
C.	Research n.s./general	16.0	100.0
	Grand Total	<u>69.5</u>	<u>100.0</u>

* Professional staff in the Directorate, farming systems research unit, and those undertaking postgraduate degree training have not been included. All time spent on training, management, and administration and advisory and service activities has been excluded.

2.3 The Future Role of DR&SS

DR&SS played a critically important role in the transformation of European commercial agriculture after the Second World War. It is now faced with new challenges, namely to provide the agricultural technologies that will transform the productive capacity of the communal areas. Without these new technologies, this transformation will not be possible and other interventions by government will ultimately founder.

Numerous reports and studies have highlighted the serious situation in the communal areas. As the 1982 Commission on the Agricultural Industry emphatically stated: "The existing farming systems currently followed in large areas of Zimbabwe are simply not sustainable at today's population levels. Unless Zimbabwe plans now for major increases in national agricultural productivity, the trend towards declining food self-sufficiency will continue" (pp.4-6). Approximately 60% of the communal areas are of poor to very poor agricultural potential: over 65% of these areas are currently in excess of their population carrying capacities and this pressure is considered to be "excessive" in 40% of the communal areas. Serious soil degradation is widespread and worsening at an alarming rate.

Meanwhile, the demand for food and other agricultural commodities continues to grow rapidly. Total population is expected to increase from 7.5 million in 1982 to between 12.5-13.0 million in 2002 and 20-25 million by 2032. It is estimated that the population in the communal areas will double during the next 15 years.

DR&SS is in a fragile condition at present. It is confronted with the dilemma of having to rebuild and expand its institutional capacity to undertake research, which is a long-term process, while at the same time being expected to produce very quickly new technological solutions for the primary problems of the communal farming areas.

While DR&SS has made considerable progress in adjusting its research effort to meet the needs of the communal farming areas, the technologies that are needed to transform these areas are still not available. It must be recognized that it will take at least another 10-20 years of considerable and sustained effort in order to produce the necessary technological advances. It is essential therefore that the capacity of DR&SS to undertake high-quality agriculture research is increased substantially. In this regard, the recent downward trend in real resource provision to DR&SS is worrying. The team strongly recommends therefore that government support for DR&SS is accorded the highest priority during the coming decades. To achieve the increase in agricultural research capacity that is urgently needed, we recommend that the Department's budget should be increased (in real terms) by 5% per year for at least the next 10-15 years. It should be pointed out that this is the same rate of growth as has been targeted for the agricultural sector as a whole during the present five-year National Development Plan 1986-1990.

CHAPTER THREE

ORGANIZATIONAL ISSUES

The structure of any organization can be defined as the institutional forms and mechanisms through which human, physical, financial, and information resources are brought together in order to achieve certain tasks and outputs. With regard to DR&SS, therefore, the primary concern is to assess the appropriateness of the current organizational arrangements in relation to, on the one hand, agricultural development and research objectives and priorities and, on the other hand, the capacity of DR&SS to plan and manage the necessary agricultural research and service activities.

There are two main aspects of organizational appropriateness which need to be examined. First, the organizational status of DR&SS as a ministerial department and, second, the internal organizational structure of DR&SS. While both are clearly interrelated, it is important that they are treated separately.

3.1 Organizational Status

The desirable organizational status of DR&SS as a public research institution has been the subject of periodic debates and investigations during the last twenty years. The fundamental issue has been whether agricultural research should be organized as a ministerial department or whether there are alternatives, more appropriate types of organization, most notably the autonomous or semi-autonomous statutory organization. Accumulated evidence from a large number of both developed and developing countries shows quite clearly that different organizational arrangements have had markedly different consequences for the effectiveness of the agricultural research effort. It is essential, therefore, that in a comprehensive review of this kind, the issue of the future organizational status of DR&SS be directly addressed.

Prior to independence, the pressure to establish an autonomous agricultural research organization grew with the progressive development of the large-scale commercial farming areas (and the political power of the producer associations) coupled with a growing awareness of the importance of agricultural research. In 1966 the Plessis Report concluded that DR&SS should remain under direct government control. However, the establishment of the Agricultural Research Council (ARC) as a statutory body in 1970, was largely in response to demands by commercial farmers for more participation, and thus influence, over DR&SS activities and agricultural research undertaken elsewhere. Almost immediately, in 1971, the ARC established a special subcommittee to consider the overall organizational status of DR&SS. Its report recommended the creation of an agricultural research organization with its own council to which would be affiliated a number of autonomous research institutes and which in turn would have their own governing boards. The report also recommended that DR&SS branches and stations should be reorganized into commodity-based research institutes (cotton, other crops, livestock, soils, and pasture) with "research and technical

services" as a separate institute. While this proposal for full-scale reorganization was not accepted by government, the internal reorganization of DR&SS in 1973 (see below) where separate crops, livestock and pastures and research services divisions and a new cotton research institute were established was consistent with many of the subcommittee's recommendations and as such represented a compromise arrangement.

In 1975 the ARC was given direct control over the operational funds for research in DR&SS. Producer associations played a major role - via their participation in the ARC itself, in the Technical Committee and commodity subcommittees which had already been established earlier, and also as a result of their direct financial contributions to research in DR&SS. Although these never amounted to more than 20% of the available resources, there was a close correspondence between the breakdown of these contributions among the different producer associations and the overall allocation of total resources to the various areas of agricultural research.

The Child Report of 1979 represented the most concerted attempt by the ARC to transform DR&SS into a semi-autonomous statutory research organization. Once again, the report recommended the establishment of a new, autonomous agricultural research organization to which in due course all existing agricultural research would become affiliated. The Report noted that "the evolution towards greater control over agricultural research through greater authority vested in the ARC, had led to a number of paradoxes," the most notable being the division of responsibility between the Ministry of Agriculture, the ARC, and DR&SS itself for planning and managing the activities of the Department. The Report presented a number of arguments in support of the creation of a new autonomous agricultural research organization. The most important of these related to the need for flexible planning and management policies and procedures which could not be incorporated within the existing civil service structure. A strong recommendation was also made to transfer most regulatory and advisory services undertaken by DR&SS to another department within the Ministry of Agriculture, since it was argued that the new organization should confine itself exclusively to agricultural research activities.

Apart from the commercial producer associations and DR&SS itself, the response of many of the most important agricultural organizations to the proposal to create a new statutory research body was largely negative since it was feared that "much of the pressure for an agricultural research organization comes from the commercial farming community which equates such control with commodity orientated research regulated by producers." This fear was also shared by the immediate post-Independence government which rejected the main recommendations of the Report in 1981. In 1982, the statutory power of the ARC to allocate the agricultural research grant was withdrawn and the ARC reverted to its original, purely advisory role.

Since 1981 there has been no further serious discussion within DR&SS, the ARC or elsewhere concerning the organizational status of DR&SS. In large part, this has been because there have been other more pressing institutional development and research priority issues which have had to be confronted since Independence.

It is recognized that there are several arguments that can be advanced in support of the creation of an autonomous or semi-autonomous agricultural research organization. However, at the present time we do not believe that there is a sufficiently strong case for the establishment of this type of agricultural research organization in Zimbabwe. Although DR&SS is a ministerial department, it nevertheless enjoys considerable autonomy with regard to both the planning and execution of its research and service activities. It is true that there are a number of administrative regulations and procedures which are particularly restrictive for an organization like DR&SS which needs to have considerable flexibility in its operations. We would recommend, therefore, that the management of DR&SS, with backing from its parent ministry, make concerted attempts to modify those regulations which are particularly onerous on the basis of submissions and representations to the appropriate government bodies. But on the whole, however, DR&SS is not unduly constrained by the civil service bureaucratic environment in which it has to operate.

The other main reason why we do not feel that it would now be appropriate to establish a new semi-autonomous research organization in Zimbabwe is because there are more serious problems with the internal organizational structure of DR&SS which should be given highest priority. (These will be discussed in the next section.) Although we do not recommend that a semi-autonomous research organization should be established now, the creation of such an organization may have to be reexamined during the next 10-20 years as the agricultural sector continues to grow rapidly and become increasingly sophisticated.

3.2 The Organizational Structure of DR&SS

The present internal organizational structure of DR&SS is almost exactly the same as at Independence in 1980. Given the fundamental change in the policies and priorities of DR&SS since then, it is important to assess the appropriateness of the inherited organizational structure from the pre-Independence period.

With the progressive development and sophistication of large-scale commercial agriculture after the Second World War, DR&SS priorities and activities became increasingly focused on more applied, component research. In organizational terms, this resulted in a number of important changes which collectively led to a decisive shift away from crops and livestock, research undertaken at regional research stations towards a more "vertical" organizational structure based on (1) disciplinary specialization in separate crops, livestock and research services units and (2) greater centralization of effort with considerably less focus on regionally specific research activities. As noted earlier, the demand by commercial producer associations for national commodity research institutes was symptomatic of this.

In 1948 when DR&SS was established, there were 11 distinct "branches". By the mid 1960s this somewhat fragmented organizational structure had been reduced to some extent with the grouping of branches into research services and specialist services. The number of branches was reduced to 7 in 1968 - crop production, animal production, biology

and ecology, chemistry and soils, plant protection, biometrics, and agricultural education. This process of consolidation culminated in 1973 in the establishment of the present-day divisional structure - of crops, livestock and pastures, and research services. In effect, the three most important regional research stations, Matopos, Henderson, and Grasslands became livestock research entities. Some crops research did continue at these stations but this was effectively downgraded (in the form of "crop productivity units (CPUs) and the Weed Research Unit at Henderson") and, in general, crops research became increasingly centralized in Harare, especially with the growth of the Agronomy Institute which was also responsible for the CPUs and off-station trials. The Research Services Division was also highly centralized in Harare, which was a rational arrangement given the concentration of its farmer and research clientele in Natural Region II.

3.3 The Organization of Agricultural Research: General Considerations

These then are the historical forces which have shaped the present organizational structure of DR&SS. But in Zimbabwe more than in any other developing country, subsistence agriculture with its low level of productivity exists in large areas of the country along with a commercial sector which is very modern. Following Independence in 1980 the scientific transformation of agriculture has become the major agricultural policy goal of the government. In many other developing countries of Asia, Latin America, and Africa, important policy decisions to bring about this kind of transformation were taken during the early 1970s. These decisions were responsible for giving a lead role to research in spearheading the process of agricultural modernization and reorganizing and strengthening it for this purpose.

The fundamental change has been in respect to the institutional framework in which research is organized with a strong focus on development and with the mobilization and integration of all of its resources. Three levels of integration have been particularly important in evolving this new research focus. The first of these is achieved by clearly defining the mandates of the different research stations so that their work becomes highly complementary.

Four main types of agricultural research can be delineated:

- a) basic research - that designed to generate new understanding (e.g., how the partitioning of assimilates is influenced by plant height);
- b) strategic research - that designed for the solution of specific research problems (e.g., technique for detecting dwarfing genes in wheat seedlings);
- c) applied research - that designed to create new technology (e.g., breeding new varieties of dwarf wheat that can respond to high levels of nitrogen without lodging);
- d) adaptive research - that designed to adjust technology to the specific needs of a particular set of environmental conditions (e.g., incorporating dwarf wheats into farming systems of specific rain-fed areas).

In many developing countries characterized by a great deal of agroecological diversity, a large part of research has to be organized on a regional basis to respond to the location-specific needs of the farming community. It is not considered necessary, however, that applied and strategic research for technology generation be carried out independently in each of the different agroecological zones of the country. This type of research is best organized for the country as a whole in a few selected national institutions which can be equipped with all the needed resources for this purpose. The regional institutions build on their materials and techniques through a process of adaptive and on-farm research and transform them into production packages relevant to the local conditions. The organization of these two types of stations has been favored in recent years by many countries for optimum use of their limited scientific resources. For countries whose resources are very limited, the international agricultural research centers have attempted to meet their needs with respect to applied research, and national scientists, in turn, have concentrated on adaptive work.

The division of responsibility between the institutes and research stations serves its purpose only if their research work is built into a fully coordinated program structure. The concept of the nationally coordinated research programs which help to achieve this has been widely adopted. The coordinated programs involving the participation of scientists from the institutes and research stations have been conceived as an instrument to mobilize the country's available scientific resources for focusing attention on urgent problems of agricultural production. The programs help to generate close inter-institutional collaboration, ensure complementarity in the work of different stations, provide a mechanism for joint evaluation of the new technologies, and arrive at collective recommendations for the release of these new technologies to farmers.

The second level of integration of scientific resources is achieved for the different disciplines. The fundamental approach to the transformation of traditional agriculture has been the creation of high genetic potential for crop yields and expression of these potentials on farmers' fields through the manipulation of the agronomic environment. In this latter process, a key role is played by the agronomists and soil scientists. The plant pathologists, entomologists, and other scientists help both in creating the higher genetic potentials and in protecting these against pests and pathogens. The multidisciplinary approach becomes even more important in stress environments where genetically-improved varieties will be able to make their contribution only when new management practices are developed through research in soil and water conservation, weed control, and development of farm tools. This kind of applied and adaptive research, calling for an integration of efforts from different disciplines, is very different from theoretical or pure research in which the role of the individual scientist is more important.

Recognizing this need for multidisciplinary support, the international agricultural research centers have built their institutional organization around commodity programs rather than the disciplines. Most developing countries have not followed this model. They have opted for a departmental structure so that scientists from different disciplines located in the different departments of an

experimental station can be brought together around major programs of research. This kind of institutional organization serves two important purposes. First, it helps to generate the needed multidisciplinary support, and second, the departmental structure offers the scientists belonging to a particular discipline a focal point to interact with one another and in this way promote their professional growth.

The third level of integration is achieved through a clear definition of program priorities. The national agricultural research systems committed to providing support to the country's programs of agricultural development must evolve priorities in their work. In practice, the head of the research system and his senior colleagues may find that they have few specific reference points in the development plans of the government to which they can relate in evolving their own priorities. Most developing countries do prepare development plans for agriculture because the objectives are often stated in general terms such as the achievement of self-sufficiency, import substitution, and export promotion. The research systems have attempted to respond to this situation by carrying out an analysis of their own on the basis of the available data. Many of them create a special unit for an analysis of this kind. The senior management of the research system, thus, has to assume important responsibilities in this area of agricultural research policy, leaving most of the day-to-day management of the research programs with the scientists in the research stations.

3.4 Internal Organizational Weaknesses of DR&SS

Five main problem areas in the present organizational structure of DR&SS can be clearly identified.

- Research and service institutions are too geographically centralized. Almost 80% of professional staff employed by DR&SS are based in Natural Region II. Centralization of crops research activities is particularly serious with the four main research institutes in Harare (crop breeding, agronomy, chemistry and soils, and plant protection) accounting for nearly 75% of all crops researchers. This high degree of centralization is a direct legacy of the colonial period when crops research in DR&SS focused on European farmers concentrated in Natural Region II.
- The disciplinary divisional structure and arrangement of research and service institutions hampers effective coordination and collaboration between researchers working in the various disciplines. This has been particularly serious at the regional level. The location of the chemistry and soils and plant protection research institutes in the Research Services Division has also frustrated the development of multidisciplinary crop research teams.
- Adaptive and systems-based research undertaken at well-defined regional research units is inadequate, especially for crops. This is a result of the gradual process of specialization and centralization of DR&SS research activities prior to Independence with the major emphasis being given to applied research.

- DR&SS is required to undertake a much higher proportion of service and advisory activities than is normally expected of a research organization. The rapid expansion in demand for these services and advisory activities since Independence has had an adverse impact on research undertaken by "service" units. However, provision of advice and services has ensured that researchers are well informed of farmers' problems.
- There is no uniform research program structure in DR&SS. Where research programs are specified, they generally have only a single-discipline, single-commodity focus, e.g., the maize agronomy program.

3.5 Reorganizing DR&SS

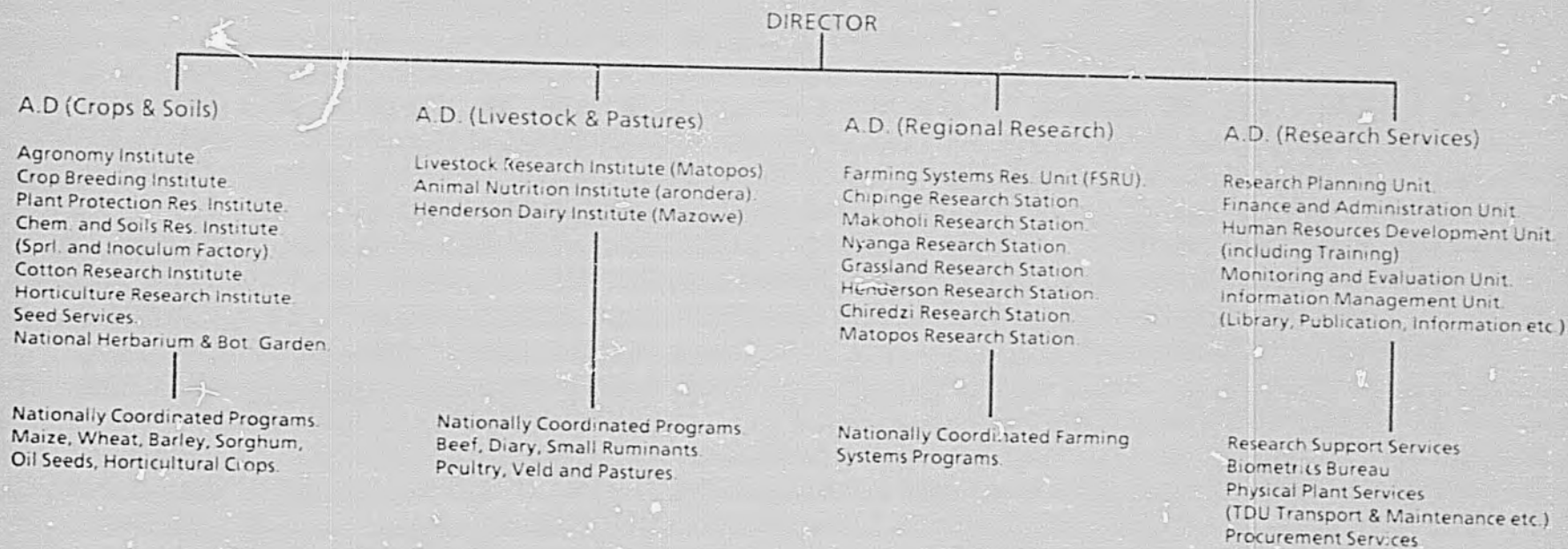
The effectiveness of DR&SS in meeting national agricultural development objectives is seriously constrained by its present organizational structure. This structure evolved during the colonial period in response to a set of needs and objectives which have little relevance in Independent Zimbabwe.

There is an urgent need, therefore, for a comprehensive reorganization of DR&SS which will provide the basis for significant improvements in the effectiveness and efficiency of the Department's research and service activities. In addressing this problem, the team have endeavored to devise an appropriate organizational structure for DR&SS which will fulfill the following objectives:

- provide strong managerial attention for the expanded regional mandate; in particular, to facilitate the direction and coordination of research aimed at the communal farming sector;
- enhance planning and administrative capacities within the directorate;
- increase management decentralization with a greater leadership role for heads of research and service institutes and centers;
- lead to greater geographical decentralization of research and service activities;
- result in a more precise distinction and balance between applied and adaptive research;
- encourage considerably more cross-disciplinary collaboration and more effective coordination of research activities;
- improve information and communication flows within DR&SS and between it and its major clientele.

On the basis of a detailed examination of a wide range of possible organizational changes, the team recommends that the reorganization of DR&SS should be comprised of three major components: the establishment of a network of national and regional research and service institutions, the phased introduction of national research programs, and changes in the functions and responsibilities of the directorate.

Figure 3. Proposed organizational structure of "Department of Research and Specialist Services".



3.5.1 The Directorate

As noted earlier, the senior management of the DR&SS located in the Directorate at the Agricultural Research Center, Harare, consists of a Director and three Deputy Directors. It is the Assistant Directors who have responsibility for the direct management of the research station network in their capacity as divisional heads of the Crops, Livestock and Pastures, and Research Services divisions. Their role at present is as much in the direct administration and management of the institutes and stations as in the areas of policy-making and planning. The result is that their roles as policymakers and planners suffer because of this preoccupation with administration and management.

The present organization of the Directorate and the functions which the senior management staff perform provides an example of another kind of centralization in the DR&SS. This centralization of authority does not promote the building up of scientific leadership at the research institutes and stations. Also, it isolates the Director of DR&SS from more direct contacts with the scientific work and the leadership of the research institutes.

The other important problem concerning the Directorate is that inter-institute research coordination and collaboration is very much more difficult with institute and station heads reporting to different divisional assistant directors. Clearly, a strong directorate is essential, especially as DR&SS's research and service activities continue to increase in scope and complexity. However, a more effective organizational arrangement would be to comprehensively redefine the responsibilities of the deputy directors, to focus more specifically on research for the various natural regions, and to strengthen the Directorate in the management areas of planning, finance and administration, human resources, information, and research support services. More specifically, the review mission recommends that there would be the following three assistant director positions:

- Assistant Director (Crops, Soils);
- Assistant Director (Livestock and Pastures);
- Assistant Director (Regional Research);
- Assistant Director (Regional Services);

The Director and the Assistant Directors would operate as a senior management and supervisory team with overall responsibility for policy, planning and evaluation of all research and service activities within DR&SS. This would involve the development of a comprehensive research strategy with specialist inputs from their broad subject areas and management expertise, and the formal approval of all research programs and projects on a regular basis. They would be assisted in performing these tasks by a small planning unit which would be an integral part of senior management (see Chapter 4). In view of the critical importance of policy formulation, planning, and evaluation functions in DR&SS, it is essential that senior management of the Directorate be able to devote themselves exclusively to undertaking these planning, management, and operational responsibilities.

An important objective of this reorganization of the Directorate would be that, by dividing the responsibilities of the Assistant Directors on a functional (rather than strictly disciplinary) basis, close working relationships between the Assistant Directors and the Director as a genuine and productive management team would be stimulated and encouraged.

Some of the functions which the Director and his senior colleagues would commonly perform in helping to evolve the national research policy and in implementing it are:

- a) plan the national strategy for agricultural research in support of government's program of economic and social development;
- b) evolve research priorities for major crop commodities, animal production programs, and development and conservation of the resource base of the country's agriculture, taking into consideration the needs of different natural regions, groups of farmers, and the emerging needs of the country in relation to the projected population growth;
- c) assist research institutes and stations in translating national research priorities into scientific programs and projects and review them for their relevance and scientific content;
- d) monitor and evaluate the performance of the research institutes and stations and take corrective action at appropriate stages;
- e) organize national research programs around important commodities and factors of production which would build up the national and regional research stations;
- f) improve the productivity and impact of the work of DR&SS scientists by creating institutional links with other research bodies and organizations, including the University, the private sector, and above all, the Extension Service;
- g) plan the development of research station infrastructure, keeping in view the future needs of the research service;
- h) coordinate research at inter-institutional and interdisciplinary levels;
- i) prepare the budget of the research service for its total investment, its balance in respect of different institutions and national programs, the needs of the different sectors of the farming community, and the regions;
- j) project the image and needs of the research service in the higher counsels of the government.

3.5.2 Justification for the reorganization of the Directorate and the creation of an additional post of Assistant Director

At present, there are three Assistant Directors in the Department of Research and Specialist Services. These are Assistant Director (Crops), Assistant Director (Livestock and Pastures), and Assistant Director (Research Services).

The proposed reorganized structure which aims at higher priority focusing on research for the various natural regions (regional research) and the strengthening of the Directorate in the management areas of planning, policy formulation, finance and administration, human resources, and information management will require an additional post of Assistant Director. This position would restore the situation that existed when there was a post of Deputy Director and should not involve extra financial provision.

The reorganization proposed will involve both an increase and redistribution of responsibilities in the Directorate in order to strengthen policy formulation and direction, scientific leadership, regional focus, and efficient administrative and services support. The main justification is based on the following advantages which will accrue to the system:

- a) the strengthening of DR&SS response to the increased mandate stemming from added emphasis on communal farming and the increasing importance of the horticultural industry;
- b) greater attention to the considerably expanded mandate for research systems which will be required to cater directly to farming communities in various agroecological regions (Regional Research);
- c) improved liaison and coordination of the major portion of research activities which would shift to regional research stations in the conceived national programs of research (Regional Research);
- d) the forging of effective linkages between DR&SS and AGRITEX through the network of research stations located in the agroecological regions and provinces served by the technical and extension services (Regional Research);
- e) the functions of financial and administrative management would be specifically assigned to an experienced senior officer who will establish and maintain effective linkages with the Ministry and other Government agencies on these matters; this would relieve the other Assistant Directors of being overly involved in administrative duties and enable them to devote time to technical research planning, supervision monitoring, and evaluation (Research Services);
- f) the need for the generation of data, methodology and mechanisms for planning, priority setting, and resource allocation would be met by the development of a research planning unit under the Assistant Director (Research Services); this would facilitate the development of a medium-term strategy for the Department and provide the basis for more effective allocation of resources and more effective response to the priority objectives of Government and the farming community. Such planning would involve socioeconomic as well as technical considerations, with Research Services initiating basic data and analysis for strategic considerations (Research Services).
- g) the upgrading and strengthening of the training unit into a Human Resources Development and Management Unit under Research Services. This would enable the Department to address issues such as recruitment and staffing policies, productivity, basic and continuing

training, professional development, absorption, analysis of human resource requirements, compensation, and evaluation procedures more comprehensively and with special expertise; The strengthening of the directorate in this regard would enable the appropriate division to produce and continually update a comprehensive medium-term plan for human resource development geared to the overall strategy of the department in research and services.

- h) the improvement of information resources and information management as a service to both research and the clients of research (see Chapter 4) where specific recommendations are made for the upgrading, reorganization, and strengthening of information and publication services. A management information component in this unit would further strengthen decision-making in the directorate (Research Services).
- i) the evaluation and monitoring of agricultural research which has been noted as weak in most developing countries of sub-Saharan Africa, including Zimbabwe, would be strengthened by the development of the capacity for this function of research accountability in Research Services. A monitoring and evaluation unit would contribute to efficiency in the deployment of resources and in ensuring that goals and objectives are kept constantly in focus in the execution of programs (Research Services).
- j) the recognition, support and development of the essential research support services such as the Biometrics Bureau, which provides assistance to research in experimental design, data processing, and other forms of analysis; the Physical Plant Services, comprising the present Technical Development Unit and maintenance, which would be upgraded to provide for the essential maintenance of research infrastructure, facilities, and scientific equipment for the entire research network; and procurement services which would take care of the development of long-term procurement policies and plan various aspects of resource procurement in line with approved strategy and programs (Research Services).

In view of the above, we strongly recommend the creation of an additional post of Assistant Director (Regional Research) and the redistribution of functions as indicated in Fig. 3. This we believe will be in the best interest of the agricultural industry and agricultural research.

3.5.3 Responsibilities of Assistant Director (Research Services Division)

The proposed reorganized structure of the Department of Research and Specialist Services (DR&SS) calls for redefinition of the responsibilities and mandate of each of the Assistant Directors. The expanded and redefined responsibilities of Assistant Directors are aimed at improved efficiency of agricultural research output for DR&SS, mainly in view of the shift in government policy of redirecting agricultural research from commercial sectors in the country.

In order to achieve the above objectives, the Assistant Director (Research Services Division) will have mainly the following functions:

- 1) produce and update from time to time the overall research strategy for DR&SS;
- 2) produce and maintain a financial plan for DR&SS;
- 3) manage and administer human resource development program for DR&SS;
- 4) monitor the allocation and use of resources;
- 5) manage Information Services, including reports, journals, pamphlets and manuals, media presentations, and public relations;
- 6) manage research services, including biometrics, physical plant services, and procurement.

In order to facilitate these functions and coordinate the research planning process, the Assistant Director (Research Services Division) should be the Chairman of a Technical Advisory Committee (TAC) (see Chapter 4) and will require the services of the following units and institutes which will comprise the Research Services Division.

- a) Research Planning Unit;
- b) Finance and Administration Unit;
- c) Human Resource Development Unit (including training);
- d) Monitoring and Evaluation Unit;
- e) Information Management Unit;
- f) Biometrics Bureau;
- g) Physical Plant Services;
- h) Procurement Services.

- a) Research Planning Unit: This unit will be mainly responsible in assisting the Technical Advisory Committee (TAC) in the planning of a national strategy for agricultural research in line with government's program of economic and social development. The unit will develop research priorities for major crop commodities, animal production programs, development and conservation of a resource base of the country's agriculture, keeping in mind the needs of the different agro-ecological zones, groups of farmers, and projected population growth.

The planning unit is expected to play an important and vital role in the organization of nationally coordinated research programs around important commodities and to assist in the strengthening of research stations around the country, while keeping in view the needs of the research services.

- b) Finance and Administration Unit: Presently, the finance and administration unit reports directly to the Director of DR&SS and has practically no appreciation of agricultural research and its importance to the national economy. Probably, this is due to the level of staff, training, and supervision. This has caused some inefficiency in agricultural research output.

Therefore, it is proposed that the Finance and Administration Unit be brought under a technical Assistant Director, namely AD (Research Services), who could lead this unit in the efficient performance of its duties and responsibilities. The main functions of this unit

would include the preparation of budget estimates, upkeep of day-to-day revenue and expenditure records, internal audit, salary leave, and promotion records. Additionally, it is envisaged that this unit will actively assist the institutes, stations, as well as individual researchers, in the preparation of internally and externally funded research projects.

- c) Human Resource Development Unit (including training): Human resources are generally a scarce commodity in most developing countries, and Zimbabwe is no exception in this respect. Presently, most of the technical personnel in DR&SS are young and inexperienced, and at the same time, there is a high turnover of staff due to various reasons. This issue will be duly dealt with in Chapter 6 of this report. It is obvious that issues in human resource development in DR&SS are a priority.

Therefore, it is envisaged that this unit will assist the senior management of DR&SS in developing short- and long-term strategic human resource development plans. Specifically, this unit will prepare and update the roster of technical and nontechnical staff in various institutes and stations, plan staff requirements, and establish levels of required qualifications and experience, in view of the nationally coordinated research programs and anticipated future development of research stations. Obviously, staff requirements will change according to departmental and national research priorities (so will the human resource development plans) thus, the anticipated process of human resource development planning would be dynamic.

This unit will also have the responsibility for planning short- and long-term training of DR&SS and AGRITEX staff (in order to strengthen the linkages). Training development should include the liaison of this unit with institutes of higher learning in Zimbabwe and overseas, as well as the international agricultural research Centers (IARCs) such as ICRISAT, IITA, CIAT, ILCA, ISNAR, IRRI, and other organizations such as FAO, Rockefeller and Ford Foundations, SACCAR, USAID, DANIDA, NORAD, GTZ, IAEA, British Council, etc. Again, the unit needs to be headed by an experienced person, well acquainted with training requirements of staff and the available opportunities for agricultural research and administration, training and development.

- d) Monitoring and Evaluation Unit: In view of the scarce human, financial, and physical resources available in developing countries, especially for agricultural research, this aspect of overall agricultural research administration is gaining importance. Therefore, it is expected that this unit will monitor and evaluate the performance of research institutes, stations, and nationally coordinated research programs on a regular basis. These monitoring and evaluation recommendations to the senior management of DR&SS could be vital in making short- and long-term research policies and plans as well as for taking corrective measures at appropriate stages.

It should be emphasized that at present, DR&SS does not have any formal monitoring and evaluation machinery for its research and development activities. Therefore, monitoring and evaluation procedures and methodologies will have to be developed, which may

vary from program to program, institution to institution, and/or project to project. In this respect, some external assistance may be necessary, at least in the initial stages, until the Zimbabwean staff are made conversant with the procedures. In order to carry out this activity, a group of experienced researchers within and outside the department (AGRITEX, UZ, TRB, etc.) may be co-opted. The coordination of the Monitoring and Evaluation Unit would be under the overall direction of the Assistant Director (Research Services).

- e) Information Management Unit: The information Management Unit will mainly consist of library, publications, public relations, etc. At present Information Services of DR&SS consists of a small library containing books and annual reports on general agriculture. It is also responsible for photocopying, publication of three journals (Zimbabwe Agricultural Journal, Zimbabwe Journal of Agricultural Research, and KirKia), and publication of departmental annual reports. Specific recommendations are made for its strengthening organization and responsibilities in Chapter 4.
- f) Biometrics Bureau: The Biometrics Bureau is an institute of DR&SS, which undertakes the following functions:
- 1) assisting researchers in other institutes of DR&SS with the statistical design of experiments and surveys;
 - 2) providing monitoring and advice on the execution and data collection phases of the projects;
 - 3) providing advice and facilities for the statistical analysis of research results;
 - 4) assisting researchers with the interpretation and presentation of statistical analysis;
 - 5) operating and maintenance of Scientific Computing facilities for the department;
 - 6) training researchers in computer use and statistics;
 - 7) conducting research on statistical methods for design and analysis of agricultural experiments.

In addition, the Biometrics Bureau provides some administrative computing assistance to the head office, information services, and Chemistry and Soils Research Institute. The Bureau is headed by a Chief Biometrician at the level of Branch Head II and has six additional research officers and three technicians.

The team's recommendations on the reorganization of DR&SS has several consequences for the Biometrics Bureau. For example, regionalization and decentralization will increase the training requirements of staff in statistics and computer use. Organization of research on a program basis will provide opportunities for biometricians to become more closely involved in research projects. Regionalization and program-based research would permit the Biometrics Bureau to better account for the services rendered. Lastly, formalization of planning and monitoring functions will require the technical design and analytical services of the bureau in the same way as any other research project.

- (g) **Physical Plant Services:** This service unit, presently known as the Technical Development Unit, will continue to provide maintenance services for equipment, farm machinery, buildings, glasshouses, and grounds at the Harare Research Station. However, there is a serious deficiency in the unit in the sense that it has no store of its own. In order to get satisfactory services, institutes are required to purchase their own raw material, such as nails, paint, wood, wire, iron (sheet or rods), glass, spare parts, etc., resulting in a wasteful drain on technical manpower. It is recommended that Physical Plant Services should have a small store containing the basic necessities for day-to-day operation; thus relieving the institute staff.

This unit also requires the services of an electronic technician, who could service electrical and electronic equipment located in the institutes and stations, except the equipment and instruments which are under warranty to be serviced by the manufacturer. On a long-term basis, the DR&SS management may wish to expand the role of physical plant services to include in-service training of physical plant service artisans and technicians based at different research stations in the country.

- (h) **Procurement Services:** In the present organizational structure of DR&SS, the procurement of various items required for smooth conduct of research is the responsibility of individual institutes and stations. These items include seed, fertilizers, chemicals, pesticides, equipment, etc. This has resulted in undue pressure on the time of technical and professional staff at the cost of research activity. Therefore, it is recommended that under the Assistant Director (Research Services), a procurement service unit be established, so that all purchase requisitions from various institutes and stations could be directed to this unit. In addition, this service would be responsible for the conduct of a movable-asset inventory undertaken by each institute/station each year. It is envisaged, that the acquisition and replacement of transport at periodic intervals would be the responsibility of this unit.

3.5.4 Institutes and research stations

The main responsibilities of the reorganized research institutes of the DR&SS would be to generate and test improved technologies for key commodities, factors of production, and production systems as a whole and to undertake specialized services and advisory functions. They would, therefore, be mainly engaged in applied research activities.

The team considered the option of divesting DR&SS of its advisory and service responsibilities. It has been proposed in the past that a new service division be created within AGRITEX or elsewhere. Such organizational separation of research and service exists in many countries. However, given the serious resource constraints (in particular of skilled personnel), the task force does not consider the option to separate services from DR&SS to be realistic at the present time. Nevertheless, the need for separate service organizations will become more pressing as the agricultural sector in Zimbabwe continues to develop. Consequently, the feasibility of such a separation will need to be seriously reconsidered, probably within the next 10-15 years.

The Task Force recommends that in order to insure effective coverage of the most important areas of research, the Department of Research and Specialist Services (DR&SS) be reorganized as presented in Fig. 3. A brief description of the mandate of each institute and station is given below.

Agronomy Institute

The Agronomy Institute will provide technical inputs into nationally coordinated research programs such as maize, millet, wheat, rice, oil seeds (sunflower, soyabean, groundnut, castor bean, etc.) In the long term, the Institute will be expected to provide agronomists at various research stations located in different parts of the country. The proposed mandate of the Agronomy Institute does not in any way preclude individual agronomists from conducting basic or applied research in their areas of interest and expertise. In addition, like all other institutes, the Institute will continue to be responsible for the planning of the career development of its staff and the recruitment and performance evaluation of its agronomists. The Institute will also be expected to contribute to the planning of both short- and long-term strategic research in agronomy.

Crop Breeding Institute

The main responsibility of CBI will be to conduct research on the improvement of food and oil seed crops by genetic manipulation of germ plasm through conventional and mutation breeding as well as by means of plant tissue culture. The crop Breeding Institute is expected to provide plant breeding inputs into the national crop improvement research programs. The Institute would be expected to assist the various research stations in their respective plant breeding experiments and in the evaluation of improved materials for the natural regions and systems of production

Plant Protection Research Institute

The Plant Protection Research Institute (PPRI) is expected to conduct research on the entomological, plant pathological, and plant nematological problems of crops of economic importance in Zimbabwe, except tobacco and sugarcane. The Institute will continue to provide advisory services to different categories of farmers on plant protection aspects of crop production. This service will be available from the Harare Research Station and through its newly established substations in various parts of the country. The institute will also provide plant protection inputs to nationally coordinated research programs. In addition to research and advisory services, PPRI will continue to assume responsibilities for pesticide screening, registration, and plant quarantine services.

Chemistry and Soils Research Institute

The Chemistry and Soils Research Institute (CSRI) will mainly be responsible for the conduct of research in the areas of soil chemistry, plant nutrition, pedology, and soil surveys. It will continue to provide services in the areas of fertilizer recommendations and foliar, soil, and water analyses. In addition, CSRI will also provide analytical services in the area of analysis of pesticides and aflatoxin in food, feed, soil and water. The Chemistry and Soils Productivity Research Laboratory (SPRL) will be located at Grasslands Research Station in Marondera. The

Institute will also be responsible for research on and production of bacterial inoculum for leguminous crops (and in the future, for cereals) at the Inoculum Factory, also located at Grasslands Research Station.

Cotton Research Institute

The Cotton Research Institute (CRI) will continue to carry out both applied and adaptive research in all aspects of cotton production. In the future, it is expected that cotton-based cropping systems research will be carried out at CRI, Kadoma.

Horticulture Research Institute

In view of the increasing importance of horticulture (vegetables, fruits, flowers) to the country, especially in terms of nutrition and domestic and export markets, it is proposed that a Horticulture Research Institute be established. The primary responsibility of the institute will be to contribute to horticultural research policy planning and to execute research programs designed to carry out these policies. The research in the area of horticulture will continue to be conducted at Nyanga, Chiredzi, and Marondera, and members of the Institute will be involved in basic, applied, and some adaptive research.

Seed Services

Seed Services, located at the headquarters of the Department of Research and Specialist Services in Harare, would be expected to continue to carry out duties such as seed certification and seed production field inspection. In addition, it is expected that Seed Services would expand its research activities on seed-borne organisms, the development of improved methodologies for seed health testing, as well as research on the control and elimination of seed-borne pathogens, pests, and nematodes.

National Herbarium and Botanic Gardens

The national Herbarium and Botanic Gardens, located adjacent to the Harare Research Stations will continue to serve the community and researchers on the identification of plants, compilation of flora of Zimbabwe, conservation and multiplication of indigenous and exotic plant species, and in the exchange of germ plasm. In addition, it will provide training facilities in taxonomy of plants to colleges and schools. The National Herbarium and Botanic Gardens will undertake research in the area of phytoecology in various parts of the country.

The Institutes and services whose functions are briefly described above will be under the direction of Assistant Director (Crops and Soils). In addition, the Assistant Director (Crops and Soils) will be responsible for policy planning of nationally coordinated programs on food, oil, fiber, and horticultural crops.

Livestock Research Institute

The Livestock Research Institute (LRI) would be located at Matopos. Its main mandate will be to conduct basic and applied research in the area of animal production, especially in the breeding of large and small ruminants. The choice of Matopos as one of the main livestock breeding stations is primarily based on its suitability for livestock breeding and its long-established tradition of animal breeding research. In order to

decentralize livestock research, it is further envisaged that part of the research on range ecology, animal nutrition, veld, and pasture will also be carried out at Matopos. In addition, LRI at Matopos will be responsible for cattle and meat grading services in the south and southwestern parts of the country.

Since the Department of Research and Specialist Services intends to move towards multidisciplinary research, facilities will also be available at LRI, Matopos, for Crops and Farming Systems Research, especially on crops such as sorghum, millet, and food legumes.

Animal Nutrition Institute

The Animal Nutrition Institute (ANI) is proposed to be based at the Grasslands Research Station, Marondera. It will deal with nutritional aspects of animal research, including cattle and goats. The Animal Nutrition Institute's further mandate will include screening and breeding of veld and pastures suitable for different parts of the country. In addition, ANI will also be responsible for carcass evaluation and grading, as well as training of meat inspectors. Grasslands Research Station is well equipped and has full facilities for this type of research and service activity. These facilities include laboratories and veld and pasture experimental and production units.

Farming Systems Research Unit

Farming Systems Research (FSR) was initiated in the Department of Research and Specialist Services (DR&SS) in 1980. In recognition of the important catalytic, interInstitute role it could play in focusing technology development, adaptation, and testing on the problems of small-scale and communal farmers, a semi-autonomous FSR unit, headed by a team leader, which reported directly to the Director of DR&SS was created.

The specific objectives of the FSR unit were:

- a) to study the maize crop and livestock production systems in communal areas and identify the production constraints to improved crop and livestock production;
- b) to adapt, develop, and test improved crop and livestock production technologies and systems;
- c) to train and involve DR&SS personnel in on-farm research;
- d) to provide information for the formulation of agricultural development policies and programs for communal areas.

The FSR perspective and approach, which also involved the assessment and verification of the socioeconomic and technical feasibility of technologies developed by the research programs has proved to be largely successful. It has validated the urgent need for interdisciplinary research and intensive interaction with communal farmers in the development and testing of appropriate technologies. The wider application of such interdisciplinary research and intensive interaction with communal farmers is envisaged through the development and strengthening of a network of regional research stations as proposed. However, in order to respond to the needs of the total research system, the nationally coordinated research programs, and the regional research

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The section below was inadvertently omitted from page 36. It should follow the section on the Animal Nutrition Institute.

Henderson Dairy Institute

Henderson Dairy Institute will primarily be responsible for work on dairy aspects of animal production. The animals include dairy cattle and goats. The institute will be responsible for coordinating research and services for all sectors of the dairy industry from production to marketing of milk and dairy products. It will serve as a technical unit to AGRITEX and carry out certain extension, advisory and training functions. It will also be responsible for implementation of the appropriate development aspects of the dairy development strategy.

The Assistant Director (Livestock and Pastures) will be responsible for overall policy and coordination of research at the Livestock, Dairy and Animal Nutrition institutes. In addition, the Assistant Director (Livestock and Pastures) will be responsible for policy planning, monitoring and evaluation of nationally coordinated programs in honeybees, fish, dairy, small ruminants, poultry, wild and pasture research.

stations as they evolve to full status, it is proposed to retain a Farming Systems Research Unit under the reorganized Assistant Directorate (Regional Research). A unit such as FSR would have the following objectives:

- a) assistance to research stations in the natural regions in the further development and application of farming systems strategies in their programs;
- b) collaborative research in the development and refinement of farming systems methodologies;
- c) coordination of training of DR&SS personnel in the tools of farming systems and on-farm research;
- d) initiation of interinstitute and interstation nationally coordinated production systems research programs.

The intention is to ensure that the Unit continues to play a stimulating role in the process of stabilizing the FSR perspective and strengthening on-farm research in the Department.

Research and Experiment Stations

There are at present seven research stations and five experiment stations in the country. The differences between research and experiment stations are mainly those of size, number of staff, and in some cases restricted mandates such as coffee, cotton, horticulture, etc. Most of these research and experiment stations are located in Natural Regions I and II, perhaps a past legacy of where research focused principally on the commercial agricultural sector. At present these experiment and research stations are headed by an officer in charge or head of stations whose overall responsibility is the operation and administration of the station. In addition, the head of station or officer in charge conducts research in his/her area of interest and expertise in line with national priorities based on the agroecology of the location.

Some of these stations have well equipped laboratories, irrigation facilities, ample land, and fairly well-established libraries. Others are poorly equipped with meager infrastructure. One common denominator for almost all stations is the lack of critical masses of trained manpower in organized multidisciplinary teams. This situation is mainly due to overcentralization of staff at various institutes based at Harare and the high turnover of staff in the post-Independence era. Consequently, the research output of many of these research/experiment stations has not been very beneficial to the farmers, especially the communal farmers in the areas in which they are situated.

It is hoped that the reorganization of DR&SS research and research direction proposed in this review, and the creation of the post of Assistant Director (Regional Research), would overcome these shortcomings and focus attention on the priority needs for technology development and adaptation for the regions served by these stations. In order to initiate the setting up of multidisciplinary teams, which would build up to a critical mass of scientists per research station, it would be necessary to place at least one agronomist, one plant protectionist, one livestock scientist, and, if possible, a socioeconomist at each regional station. However, as the research programs develop and critical needs

for technological inputs are identified, additional staff such as soil scientists, breeders, irrigation scientists may be necessary. Initially research officers with B.Sc. or M.Sc. degrees should be able to cope with well-articulated programs mainly of adaptive and, in some cases, applied research. It is estimated that it would take between 5-10 years to fully staff, equip, and develop the infrastructure for these stations. Since this regional research focus would be based on existing research stations, there should be little or no additional costs at the beginning, but in the long run and as the research activities of the Department and research stations increase, it is expected that more resources would be needed.

In any case, it is anticipated that with the reorganization of the structure and management of DR&SS, the research and experiment stations would progressively be better equipped, the infrastructure developed, and the programs staffed to undertake the broad-based multidisciplinary research needed to meet the technology requirements of communal farmers in their respective areas.

The proposal in this review represents a modest approach to research and services for the main natural regions of the country, and especially for the strategy to focus on increasing productivity in the small-scale and communal farmers' sector. The research stations in the natural regions cover fairly wide agroecological areas and there may be the need for these research stations to develop substations where the diversity of the broader agroecological zones require them. Future policy would need to consider these, especially in relation to the largely neglected northern and northwestern parts of the country. Some of the existing research activity units established in these areas might serve as nuclei for experiment/substations in the future.

Chipinge Research Station

Chipinge Research Station, which is at present a coffee research station will have its mandate broadened to serve the specialized and diversified farming of Natural Region I. While it will continue to conduct and coordinate coffee research, research activities for the development and testing of technologies involving horticultural crops, agroforestry, and intensive livestock production and management will be initiated and developed. The ultimate objective will be to research, introduce, and apply technologies that would focus on the management of the natural resources of the region for increased agricultural productivity on a sustainable basis.

Makoholi Research Station

It is proposed that Makoholi Experiment be upgraded to a Research Station with specific mandate for production systems research and technology development for Natural Regions III and IV. The present station although located in Natural Region IV, is well placed to serve Natural Region III, and the proposed experiment station outside Kweke is likely to further facilitate this role in the future. The mandate of Makoholi, while retaining a major livestock input, should focus on the semi-intensive to semi-extensive farming practices in the arid to semi-arid areas with emphasis on crop/livestock production systems and soil and water management for increased production of crops such as beans, sorghum, sunflowers and large and small ruminants.

Nyanga Research Station

Nyanga Research Station which is presently charged with research responsibility for temperate fruits will have its mandate expanded to include research on vegetable crops and floriculture and the production systems associated with these crops in Natural Region IIB. In addition, it will cater to production systems research on field crops such as wheat, oats, and barley, adapted to the natural region.

Grasslands Research Station

Grasslands Research Station will serve Natural Region IIA in the development and testing of technologies for the intensive crop and livestock production systems of the region. Special emphasis will be accorded animal nutrition, veld and pastures research, soil fertility and soil productivity research (SSPRL), and horticulture research. The station will be the location of the Animal Nutrition Research Institute and will continue work on symbiotic nitrogen fixation and the maintenance of the legume inoculum factory service.

Henderson Research Station

Henderson Research Station at Mazowe will focus on research and services for the natural region and clients around Harare and Mazowe. In addition to housing the Dairy Research Institute, it will undertake research in apiculture, fisheries, poultry, sheep and goats, and some aspects of plant protection. The station will continue to serve as a reference point for research and service to the large- and small-scale commercial farming communities. It is envisaged that in the near future the National Plant Quarantine Station would be located at the station.

Chiredzi Research Station

This station is presently known as the Lowveld Research Station. It is the major station on which tropical crops research is conducted. The mandate of the station will in future focus on the development and testing of improved technologies for increasing the productivity of crop/livestock production systems in Natural Region V. These systems will include such crops as tropical fruits, vegetables, rice, oilpalm, and animal production. It will focus on the management of low and erratic rainfall for improved field crop and fodder productivity. In addition, it will continue research and development work on small scale irrigation and provide training facilities in this area. In view of the diversity of the agroecology of the region, the two substations now established at Chisumbanje and proposed for Sabi Valley will be maintained, and providing an opportunity for expanded programs of multidisciplinary research addressing the problems of the natural region on a broad basis.

Matopos Research Station

Matopos Research Station located in the southwestern part of the country will be mandated to research and test technologies suitable for improving the productivity of the farming systems in Natural Region IV. Its focus will be on drought-resistant food and fodder crop/livestock production systems and the improvement of veld and pasture productivity through ecological range research. Specific emphasis will be given to the breeding and management of communal farmers' crops, such as

sorghum, millet, marginal soils, and environment for sustainable production. In addition, Matapos will be the location for the Livestock Research Institute which will focus on cattle and small ruminant breeding and improvement and the development of livestock production systems compatible with resource management in the natural region.

All the Research Stations in the report are referred to by the names of places at which they are located. This is deliberate in order to move away from the association of stations meant to concentrate on developing and testing technologies for natural regions with specific crops or commodities. The staffing of these stations would be multidisciplinary and would interact closely with AGRITEX and other extension field staff and the FSR Unit in systems analysis, development, testing, and verification of technologies. The AD (Regional Research) would ensure complementarity in all these research and service activities.

Harare Research Station

The central laboratory and services facilities at the Harare Research Station will continue to be available to all programs. It will also respond to the needs of research and services in the Harare area and provide facilities for such crop improvement programs as maize, wheat, barley, sunflower, soyabean, and groundnut. As the home of some major research and service institutes, attempts will be made to emphasize the efficient sharing and utilization of capital and equipment resources and to assist in the maintenance of essential scientific equipment throughout the system.

3.5.5 National research programs

The development of national research programs comprising multidisciplinary teams of researchers which focus on specific commodities (or groups of commodities), factors of production and production systems would considerably improve the capacity of DR&SS to generate viable agricultural technologies. At present, practically no effective organizational mechanisms exist in DR&SS ensure that researchers from different stations and institutes who are undertaking research on the same commodities, factors of production, or production systems pursue common, well-defined research objectives and adequately coordinate their separate activities. By establishing national research programs, researchers would be formally obliged to become members of multidisciplinary research teams whose membership would be drawn from the relevant national and regional centers. Program members would be expected to work together as a team in order to formulate the research priorities and objectives of the program, determine the precise contributions that each member will be expected to make towards achieving these objectives, and evaluate periodically the results of their coordinated, collaborative research activities. Working in program teams in this manner not only improves the planning, programming, monitoring, and evaluation of agricultural research but enhances the individual productivity of each member who benefits from having clear research objectives, strong collegial support, and from the overall synergy of team work.

The proposed national research programs should have complete responsibility for undertaking the full range of both applied and adaptive research activities. Normally, however, applied research will

tend to be concentrated at the national research institutes while more adaptive research (including on-farm experimental trials) would be the responsibility of program members at the relevant regional research stations located in various parts of the country.

Research on maize is a good example of the benefits which would accrue from a national research program. Program members would be drawn from institutes and experimental stations covering the major disciplines of crop breeding, agronomy, chemistry, soil science, plant protection, and socioeconomics. Each member would continue to be attached to his/her own research/station but would participate as required in the maize program. They are also likely to be involved in other national research programs. Thus the national programs can be viewed as an additional organizational dimension which overlies the research institute and central network. This matrix organizational structure, which is now a common feature of research organizations throughout the developed and developing worlds, promotes focused, multidisciplinary, problem-oriented research on specific commodities or other well-defined research areas while allowing researchers the benefit of continuing to belong to specialized disciplinary or regional institutions. Table 8 lists the national research programs which, on the basis of the present and likely future agricultural research priorities and research capacity of DR&SS, the team recommends should be established during the next five years. Suggested commencement dates are also given. The rationale for these programs is discussed in Chapter 5, which focuses on research priorities and resource allocations.

3.6 Reorganization Perspective

The team recognize that the first component of the proposed reorganization of DR&SS, namely the creation of research institutes and regional research centers, has the most far-reaching consequences. It could be argued, therefore, that only the implementation of the second and/or third reorganization components should be contemplated at this stage. However, the team strongly believes that all three components are essential for the future viability of DR&SS as a research and service organization. There are three main reasons why we feel that this is the best course of action. First and foremost, the rationalization of existing DR&SS institutes, stations, and other units into national institutes and regional centers is the most important organizational change that needs to be undertaken since it will allow DR&SS to serve the needs of the smallholder farmers in Zimbabwe most effectively. And, without this rationalization, the proposed changes in the organization of the directorate and the introduction of national research programs will have much less impact and may even founder. In other words, each of the components of reorganization change that have been proposed are complementary and mutually reinforcing.

Second, the proposed relocation of the agricultural research center in Harare in the next few years will provide an excellent opportunity to undertake much of the proposed rationalization without incurring significant additional costs. This would mean that the proposed national crops and soils research and institutes and the central service units could be built at appropriate new locations.

And third, with the exception of Makoholi Experimental Station which will need to be upgraded in order to serve as a regional research and service center for Natural Region III, the proposed rationalization will not require any major capital development of the existing research and experimental station network.

Table 8. Proposed National Research Programs and Commencement Dates

Commodity: Crops	Commencement Date
Maize	1989
Wheat and barley	1989
Sorghum and millet	1990
Oilseeds	1990
Cotton	1989
Horticulture	1991
Commodity: Livestock	
Beef cattle	1990
Dairy	1991
Small ruminants	1990
Pastures and velds	1989
Factor	
Soil fertility	1989
Soil and water conservation	1991
Irrigation and drainage	1991
Production Systems Research	1989

CHAPTER FOUR

RESEARCH PLANNING AND PROGRAMMING

No agricultural research system or organization, however large and well organized, can hope to solve all problems affecting agricultural production in a country. Consequently, it is essential that a research strategy is formulated which clearly specifies research priorities and objectives and allocates existing and future resources to each main area of research. Once this strategic planning exercise has been undertaken, the research organization must then decide upon a specific set of activities which will most optimally fulfill the overall objectives of the research strategy. These two separate but closely related aspects of the planning process are referred to as strategic planning and programming, respectively. Both are on-going functions of any research organization and are impossible without efficient methods of reviewing research results and monitoring resource allocation.

In this chapter, the existing planning and programming procedures in DR&SS are reviewed, structural and functional changes to facilitate the planning process are proposed, and the means of instituting these changes are suggested.

4.1 Traditional Procedures

Prior to independence, the overall research strategy of DR&SS was largely defined by the Department's most important clientele, namely producers in the large-scale commercial agricultural sector. In general terms, these demands were precisely articulated and confined to a relatively limited range of commodities and subject areas. During the 1970s, the ARC also played an active role in strategic planning. A Technical Committee was established with overall responsibility for research priority setting and was assisted in this task by a number of commodity subcommittees. However, a comprehensive strategy document as such was never produced.

Since Independence, with the major changes in agricultural policy, DR&SS has been faced with an extremely complex task in effectively planning its research and service activities. With a dramatic increase in the size of its research clientele in very different agroecological zones and complex farming systems but no major increase in resources measured in real terms, the need for more systematic, disciplined planning has increased accordingly.

As was discussed in Chapter 2, MLARR has provided DR&SS with general policy guidelines for agricultural research. These however are not sufficiently elaborated to constitute an operational agricultural research strategy for DR&SS. It would be unrealistic to expect MLARR to do this. The responsibility to translate overall policies and priorities into a comprehensive research strategy must therefore be the

Department's, although clearly this will have to be developed in close collaboration with senior officials in MLARR and other relevant ministries and institutions.

During the period immediately after Independence, strategic planning in DR&SS was largely confined to developing the capacity of the Department to conduct high-quality research rather than focusing on the formulation and implementation of a comprehensive research strategy *per se*. The National Agricultural Extension and Research Project has focused therefore on institution-building in DR&SS and AGRITEX. More recently, some attempt has been made to formulate a "blueprint" for DR&SS but this has not yet progressed very far. In part this has been due to the limited capacity of DR&SS to undertake the required analysis coupled with a lack of appropriate organizational mechanisms to develop such a strategy on an on-going basis.

In the absence of a comprehensive, operational research strategy for DR&SS as a whole, the separate divisions and, to an even larger extent, the research units themselves are responsible for nearly all aspects of the planning process. As before Independence, this has mainly involved the preparation of research projects and annual work plans by individual researchers and the submission of annual budgets and establishment requirements by unit heads. The stages in the annual project/work plan and budgetary cycles are presented in Tables 9 and 10. Projects are developed in consultation with section and unit heads and must be formally approved by unit heads and the appropriate divisional assistant director. These procedures are well established and understood by researchers and managers.

A number of major weaknesses in the existing planning and programming procedures in DR&SS can be identified:

- a) While research "programs" do exist in a number of DR&SS units, they are generally very narrowly defined both in terms of research priority areas and the disciplinary composition of researchers. Furthermore, these programs are not consistently defined among the various DR&SS units.
- b) Resources are allocated by unit rather than program or research priority area. As can be observed in Table 11 there has been relatively little change in the percentage allocations of operating resources to units in DR&SS during the last ten years. This is indicative of the dominant role of the precedent budget criterion in the allocation of resources in DR&SS, i.e., increases in resources have tended to be made to units on an equal percentage basis across the board.
- c) The planning and budgeting activities at the unit level are separate, unrelated activities since budgets have to be submitted well in advance of the program/project formulation process. Nor is any specific budget attached to each project, which means that it is not possible to ascertain the precise allocation of resources to individual projects and, at a higher level of aggregation, to major research priority areas on a commodity, factor, and locational basis.

Table 9. Main Programming Cycle in DR&SS

From October/November to August/September

- August: Preparation of annual work plans and new project proposals for forthcoming year/main cropping season
- September: Annual planning meeting
- October: Approval of workplans for on-going and new projects
- Nov-May: Implementation of work plans
- May-Aug: Data-analysis and presentation of experimental results for main season research activity

Table 10. Budgeting Cycle in DR&SS

- June: Institution budget allocation finalized
- July: Start of financial year
- October: Institution budget submissions to Directorate for next financial year
- Nov-Dec: Analysis and readjustment of division and institution budgets and submission to parent Ministry
- January: Submission to Treasury
- Feb-March: Discussions DR&SS/MLARR with Treasury
- June-July: Approved department budget announced, final division and institution readjustments

Group	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84
Crop Breeding Inst.	8.3	8.8	6.3	6.7	6.9	6.2	7.2	7.8	7.7
Agronomy Institute			2.6	2.4	3.1	3.0	2.9	2.7	3.3
Makoholi CPU	0.6	0.6	0.8	0.8	0.8	0.8	1.7	1.9	1.9
Matopos CPU	0.6	0.6	0.5	0.5	0.6	0.7	0.7	0.8	0.8
Panmure E.S.	1.1	1.3	1.3	1.0	1.5	1.1	0.8	0.9	1.0
Weed Research Unit	1.3	1.5	1.4	1.3	1.5	1.3	1.2	1.3	1.3
Lowveld R.S. & Chikum. E.S.	7.9	8.2	8.4	8.3	8.3	6.8	6.9	7.5	7.7
Cotton R.S.	9.3	9.3	9.7	9.9	9.2	8.1	7.1	7.7	8.6
Coffee R.S.	4.1	4.3	4.9	5.2	5.5	5.0	5.0	4.1	4.2
Horticultural R.C.	1.4	2.0	1.8	2.2	2.5	2.9	2.7	2.8	2.8
Nyanga E.S.	1.8	1.9	2.0	2.0	2.3	1.9	2.2	2.0	2.0
Sabi E.S.	4.1	2.0	0.8	0.1	0.0	0.0	0.0	1.5	0.0
	42.6	43.3	42.2	41.6	42.7	38.1	39.2	42.4	43.2

Livestock and Pasture Division

Grasslands R.S.	9.5	10.1	10.3	10.4	10.7	10.8	12.3	10.4	9.6
Matopos R.S.	16.3	16.0	15.5	12.2	14.5	14.7	13.7	11.1	13.5
Makoholi R.S.	4.1	3.5	3.6	3.7	4.4	4.3	3.4	3.5	3.7
Henderson R.S.	15.1	15.2	15.3	15.1	14.5	15.9	14.5	14.5	13.7
	45.8	44.8	45.2	44.6	44.4	45.9	44.2	42.5	40.6

Research Services

Biometrics Bureau	2.4	2.0	2.0	3.1	2.6	3.2	2.5	2.2	2.1
Chemistry and Soils Research Inst.	4.4	5.5	4.6	4.7	4.8	6.4	5.8	5.1	6.7
PP Research Inst.	4.1	3.0	2.4	2.7	2.8	3.2	3.9	4.4	4.0
Technical Development Unit	0.6	0.7	0.4	0.3	0.2	0.3	0.5	0.3	0.4
Information Services	0.0	-	2.7	2.6	2.4	2.7	2.6	1.9	2.8
	11.5	11.2	12.2	13.6	12.9	15.9	15.3	14.9	16.2

- d) Primary emphasis on research projects does not generally encourage sufficient interdisciplinary interaction among researchers, particularly at the program formulation and evaluation stages. At present this interaction is confined to the annual planning meetings which researchers from other units are invited to attend. In general this is too limited, especially where planning meetings are primarily "show-and-tell" events for outside clients.
- e) Given the absence of a broader program-based framework, research projects often appear to be ad hoc and based on the research preferences of individual researchers rather than directly emanating from predetermined program objectives. In other words, the planning process is too bottom-up and individualistic, resulting in excessively fragmented and often poorly coordinated research activities. While the team is impressed by the awareness and commitment of researchers in DR&SS to the government's agricultural policies, particularly as these concern the communal areas, the lack of a comprehensive, systematic program framework has resulted in serious imbalances in research activities, as evidenced by excessive dispersal of the research effort, coupled with both gaps and duplications in research activity.
- f) Evaluation of research has been relatively weak, with the result that a considerable number of projects have been allowed to continue long after they should have been terminated. Again, with so much fragmentation of activities, it is considerably more difficult to assess the overall performance of DR&SS. Client groups have only been marginally involved and in many cases this has resulted in a lack of understanding of DR&SS's research objectives and some dissatisfaction with research outputs.

4.1.1 The Committee for On-Farm Research Extension

In 1986, the Committee for On-Farm Research Extension (COFRE) was established to alleviate some of these weaknesses in the planning process as well as to promote linkages with AGRITEX. The committee operates through subcommittees responsible for groups on agricultural commodities; they evaluate proposals for on-farm research and demonstration projects and monitor their progress. These subcommittees have functioned increasingly like program committees although limited to on-farm research, and this experience provides a starting point for the improvement of planning and programming throughout the Department.

4.2 Improving the Planning Process and Mechanisms

In view of the above weaknesses in the planning process, the Team believes that there is an urgent need to improve the planning process in DR&SS. In this section, improved planning and review processes and mechanisms are described, based on the concept of research programs defined in Chapter 3. We also describe the organizational structure required to operate research activities by programs.

4.2.1 Technical advisory committee

At present, there is no formally constituted committee of managers and other senior research personnel in DR&SS responsible for advising the

Directorate on on-going and future research and service activities. While meetings for this purpose are held occasionally, they tend to be somewhat *ad hoc* and irregular. The team recommends therefore that a Technical Advisory Committee (TAC) should be established in DR&SS which should meet at least every six months in order to review research programs and other research and service activities so as to ensure that DR&SS's overall objectives are being fulfilled as effectively as possible.

4.2.2 Research and service programs

The basic assumption of the planning mechanism to be described is that all activities of the department will be organized by programs. Research programs were discussed in Chapter 3, and there is no reason why eventually service activities could not also be organized as programs so that planning, resource allocation, monitoring, and reporting can be standardized for all activities.

The fundamental implications of this assumption for DR&SS are:

- a) Research activities would be organized according to specific scientific or development objectives related to commodities, systems, or factors of production rather than to scientific disciplines.
- b) Projects would have access to multidisciplinary resources for both planning and execution.
- c) Resource allocation to institutes and stations would be through programs and based on the cost of activities carried out by those institutes for specific programs.
- d) Budget allocation and monitoring would be carried out by programs, allowing justification or redistribution of resources according to priority objectives and facilitating negotiations with funding organizations for increases in resources.
- e) Reporting of research results and service activities would be according to programs. This should focus reports according to specific objectives and target clients and facilitate evaluation of progress and returns from the research efforts.
- f) The program structure should greatly simplify linkages with outside organizations which would be able to participate in all phases of projects in which they are interested without having to deal with several institutes.

4.2.3 Composition and functions of the Technical Advisory Committee

The central planning and review body of the Department would be a committee of senior members of DR&SS including the following:

- a) The Director;
- b) The Assistant Directors;
- c) Head of the Planning Unit;
- d) Two senior program coordinators;
- e) Two other senior researchers drawn from institutes, stations and units;

- f) The Director of AGRITEX or his senior representative;
- g) Information Management Officer as Secretary (*ex officio*).

The Committee should be able to co-opt other members as necessary. The TAC will be appointed for a period of two years and members will be eligible for reappointment by the Director.

The function of the TAC would be as follows:

- a) Draw up and periodically revise the research strategy for DR&SS. This should clearly set out the research priorities and objectives of the Department, together with the corresponding resource requirements and allocations.
- b) Solicit and interpret research requirements from political, development, extension, and farming sources.
- c) Define the research programs of the Department, including their objectives, time-tables, resource requirements, and allocations.
- d) Monitor progress of the research and service programs and identify and rectify bottlenecks and constraints.
- e) Formulate and monitor strategies for linkages within the Department, with client groups, other research organizations, extension agencies, and the Agricultural Research Council.
- f) Formulate and advise on strategies for the effective dissemination of research results.

The first specified function is the major objective of the TAC, and it assumes the remaining functions to a large extent. It also means that the TAC is responsible for advising the Directorate on the interpretation of government policies and directives in terms of agricultural research objectives as well as translating requirements of different farming clients into these objectives. Close contact with the Ministry, AGRITEX and farmers' unions will obviously be essential for this. The production of a medium-term research strategy is required not only for internal technical purposes but, equally important, to demonstrate to government and client groups that the Department has a clear sense of direction and thus can serve as a powerful tool for development planning and the generation of political and financial support.

4.2.4 Program committees and program coordinators

Each research or service program would have a program committee to plan and review the program. The program committees would comprise senior scientists in the department as well as members of outside organizations, research or client groups such as AGRITEX, or the University of Zimbabwe, who have a technical interest and input into the specific programs.

One member of DR&SS would be the program coordinator. The program coordinators are appointed by the director for a period of three years.

The responsibilities of the program coordinators supported by the program committees would be as follows:

- a) Define the technical objectives of the program and the expected products. This involves the translation of the research strategy put forward by TAC, in light of the technical capacity of the Department and the availability of resources.
- b) Define the technical content of the programs in terms of projects. This involves proposing projects and research teams designed to meet program objectives as well as soliciting, evaluating, and prioritizing project proposals from researchers and other interested groups.
- c) Identify the institutes, stations, and staff who will be responsible for carrying out all activities in the program, thus enabling the designation of multidisciplinary teams to tackle specific projects. It also allows cooperation with outside research organizations and inclusion of outside scientists in the program committee.
- d) Prepare resource requirements of all activities in the programs. This includes manpower and operating costs broken down by activity or project and by institute or station to facilitate resource allocation by the TAC. These must be prepared in close cooperation with heads of institutes and stations.
- e) Monitor the progress of program research and service activities.
- f) Prepare annual reports covering all activities of the program based on analysis of data provided by the different officers responsible for the program activities.
- g) Specify other reports, publications, workshops, or seminars required by different audiences and arrange for their publication or presentation through the Information Management Unit. In particular where applied research is involved, it is the responsibility of the program coordinator to draw up production recommendations from the scientific and experimental results of the program.
- h) Identify manpower requirements for the program and make recommendations on program needs for training and manpower development.

The program coordinators should be senior scientists and will probably be heads of institutes or stations in most cases. The coordination responsibilities are likely to account for as much as 50% of their time, and this must be allowed for. In cases where a program coordinator is not a head of institute or station, he should be compensated for the extra responsibility and work involved through some mechanism such as the Control Post Allowance. Program coordinators would not handle any operational resources except those allocated for the coordination function. Resources would still be allocated to institutes or station heads but now in line with program budgets and according to the activities undertaken by each institute for the various programs.

4.2.5 Head of institutes and stations

A major consequence of the program structure is to separate the program and administrative responsibilities of heads of institutes and stations.

Staff in the department will still be directly responsible to their institute or station heads and it becomes part of the heads' responsibilities to see that staff fulfill their commitments to various programs. The head would still be responsible for annual staff reports and career development for his/her staff but should consult with and receive inputs from program coordinators on these matters.

The main new responsibility of heads is to work with program coordinators in the identification of staff and facilities required for various project activities. The heads must also submit cost estimates to program coordinators for all activities they are to undertake and then to monitor expenditure on these activities.

The separation of program and administrative responsibilities also allows heads of institutes to be relieved of some burden so that they may undertake specific important research projects and thereby maintain their professional interests.

4.2.6 Support services for planning and evaluation

The TAC and program committees will require some support services to enable them to carry out their functions efficiently. Such support would be provided by the Research Planning, Information Management, Finance and Administration, Human Resources Development, and Monitoring and Evaluation Units, and other Research Support Services from the Assistant Directorate (Services).

a) Research Planning Unit

The Team recommends the establishment of a small research planning unit as soon as possible. This unit would have the following responsibilities:

- 1) Operation of a resource management information system. This would be the main information system on the activities, products, and costs of the department. The basis of the system would be a set of data sheets for each activity in each program, containing detailed information about research objectives, anticipated impacts, estimates of human, physical, and financial resource inputs. Examples of such data forms are given in Annex B.

This information would be computerized into a data base so as to be available for analysis in various summaries, such as expenditure by program, commodity, objective, etc.

This system will provide information to TAC to enable it to make recommendations on the allocation of resources and to monitor progress and costs. Examples of resource breakdowns which could be obtained are given in Table 12. For the system to work

effectively, it is imperative that all activities in all programs are entered into the system before approval, funding, and execution.

- 2) Production of the research strategy. The Head of the planning unit is the member of the TAC who would be responsible for producing the research strategy paper from TAC deliberations and interaction with Ministry, other research organizations, AGRITEX, and client groups.
- 3) Periodic evaluation of completed research activities with the particular objectives of assessing impact, cost effectiveness, and adoption of technologies derived from the research. These would provide valuable information for TAC to help with priority setting and resource allocation and should provide important inputs into the Information Management Unit and services.
- 4) Economic analysis of national agricultural production with a view to anticipate changes in the production pattern which will require research and development.
- 5) Assessment of probable outcomes of future research activity. The planning unit would have to develop methods for this ex ante evaluation as information about research and its impact becomes available. This would be an important input for the TAC priority-setting function, and the planning unit would be responsible for developing more objective methods of performing this task. Initially a method of scoring activities according to a set of criteria would be the most suitable. Some examples of relevance factors are given in Table 13.

Table 12. Major Resource Breakdowns Using a Computerized Program Budgeting System

-
1. Time and Financial Budgets Breakdowns
 - By operation/projects
 - By program aggregations
 - By commodity or group of commodities
 - By thematic or systemic programs
 - By discipline of specific fields of specialization
 - By natural, agroclimatic, or administrative regions
 - By research stations in the natural regions
 2. Manpower Time or Operation Costs
 - By scientists, technicians, or any category of personnel
 - By groups of categories of personnel (same discipline)
 - By comparative groups or categories of personnel
 - By specific research or development objectives
 - By target groups
 3. Overloaded or Underemployed Personnel
 - Identification of overloaded personnel by individuals, by category, or by discipline or field of specialization
 - List of personnel and profile of specialization requested
 - Identification of underemployed personnel by individuals, by field of specialization, or category of personnel
 - List of personnel overemployed by different breakdowns (degrees, staff categories, staff grade, etc.)
 - List of personnel underemployed and free for other activities
 4. Aggregation of Any Variable Data
 - By development objectives
 - By research objectives
 - By target groups
 - By types of users
 5. Breakdowns of Direct Operating Costs
 - By bookkeeping items
 - By programs/projects
 - By discipline
 - By research station in a natural region
 6. Linkages or Associated Institutions
 - By program/projects
 - By discipline
 7. Any other combinations of variable inputs expressed in actual figures, relative percentages, or graphic representations (block diagrams)
-

Source: R. Devred and B. Solinger. A Program Budgeting System Using Microcomputers, ISNAR, September, 1986.

Table 13. Key Relevance Factors Used in Evaluating
Proposed Agricultural Research Activities

Importance of commodity in aggregate terms

- value of production (national, regional)
- area harvested
- agroecological suitability
- trends in total production
- yield trends

Relevance to target producer and employment groups

- numbers directly and indirectly involved
- nutritional factors (protein, calorie contributions)
- on-farm consumption and monetary income
- food security
- regional balance

Relevance to target consumer groups

- numbers
- consumption (percent household budget)
- future consumption patterns (demand elasticities)

Relevance to nation's foreign exchange position

- current and potential export earnings
- current and potential expenditures on imports

Relevance to national food self-sufficiency

- current imports
- future growth in national consumption

Initially the Planning Unit should be staffed by an experienced economist, preferably with some experience in agricultural research. Such a person will need to work closely with the Economics and Market Branch of MLARR, the Central Office of Statistics, the Management Services Branch of AGRITEX, and the relevant faculties and departments of the University of Zimbabwe.

b) Information Management Unit

There is an urgent need to improve communications and publications in DR&SS. The team recommends therefore that information services in DR&SS be upgraded to an Information Management Unit. Information services at present has only one research officer and a research technician assisted by three junior administrative staff. It has no facilities of its own for the design and production of publications and therefore depends largely on the government printer for the production of the annual reports of DR&SS institutions and other miscellaneous publications. The result is that many publications are held up in production even when they have been processed and edited in time. The team noted that most of the annual reports of the institutes and services are behind schedule and there is very little flexibility for publications. In addition, the service has no qualified person in communications and information, and has little or no facilities for the acquisition, management, and dissemination of information for both internal and external use.

It is suggested that the proposed Information Management Unit should have an establishment of three senior staff:

- a Communications and Publications Officer (trained in information sciences and/or agricultural journalism);
- an Editor;
- a Production Officer or Assistant

The functions of the Unit will be:

- 1) to organize the materials produced by the research officers and research technicians into suitable communication literature and to publish these;
- 2) to produce and publish the annual reports and other scientific articles produced in the Department (it may be possible for it to also publish the Zimbabwe Agricultural Journal);
- 3) to organize and produce some training materials for the joint training activities in which the Department will participate;
- 4) to provide scientific illustration services to research and research-related activities;

- 5) to serve as a repository for reports and other scientific publications and to circulate these or extracts of them to research officers and technicians.

In the discharge of these functions, the Unit will require modest facilities for the preparation and production of publications, e.g., word-processing equipment, type-setting equipment, and a printing machine. Some capital outlay for equipment would therefore be required in setting up the upgraded Unit, but that requirement is more than fully justified by the potential improvement in communication and information that would result for the Department.

c) Human Resources Development and Management Unit

Human resources development and management is a major function of the department; this is dealt with comprehensively in Chapter 6. It is proposed that in view of the importance of the planning, management, and monitoring aspects of this function, a special unit for Human Resources Development and Management be created from the present Training Unit. The Unit will address major issues in recruitment, staffing, training, absorption, analysis of human resource requirements, compensation, and evaluation. It will also advise the Directorate on strategies and programs for strengthening human resources development in the department. It is envisaged that the Unit would be staffed initially from the present establishment of training officer but would grow as departmental and program needs develop.

4.2.7 The Agricultural Research Council

The Agricultural Research Council made up of client groups and other members with their valuable perspectives from outside the research service should continue to play its important advisory role concerning agricultural research activities in Zimbabwe as a whole. It has certain statutory responsibilities to report on agricultural research to the Minister, but should also be used as a valuable resource by the TAC and the Directorate in defining research requirements, monitoring progress, and evaluating results.

The main functions of the Council would be:

- a) to provide guidance in evolving the country's research priorities by providing feedback on problems affecting agricultural production both in the smallholder and commercial sectors;
- b) to review periodically the progress of research programs and projects and make an assessment of developments at the different research stations as regards relevance to the needs of the farmers in the different agroecological regions and farming sectors;
- c) to promote close linkages between the research and extension services of the Ministry;

- d) to recommend to the government improved personnel policies for improving the productivity for research work in the DR&SS;
- e) to generate funding support for the work of DR&SS both within the government and outside it.

The team recommends that in order to strengthen its role, the ARC should set up a number of national review committees. Each committee would periodically review major areas of commodity, factor, and systems research. The following committees are proposed: cereals, oilseeds, horticulture (including root crops), coffee and tea, cotton, beef cattle, dairy and small ruminants, veld and pastures. Membership of each committee would include the appropriate program coordinator(s) from DR&SS and subject matter specialists from AGRITEX, representatives from large-scale commercial and smallholder producer associations, and other interested individuals and institutions. The committees should probably meet at least twice a year and submit formal annual reports to ARC.

4.2.8 Medium-term strategic planning

DR&SS urgently needs to develop a medium-term strategy which clearly sets out its main research priorities and objectives and corresponding resource requirements and allocations. This strategy statement is required not just for internal technical/scientific purposes but, equally important, to demonstrate to government and its clientele that the Department has a clear sense of direction and thus serve as a powerful tool in generating both political and financial support. Furthermore, the strategy should not be regarded as a rigid blueprint but rather be sufficiently flexible to accommodate changes as they are required in the future.

The proposed improvements to the planning process will collectively greatly facilitate the elaboration of a comprehensive medium-term strategy. In particular, the establishment of national research programs with clear objectives and priorities are the building blocks of the research strategy to which can be added carefully reasoned estimates of future resource requirements. The proposed resource management system will enable DR&SS to make precise breakdowns of existing and future resources to each major research priority area, and the program coordinators along with the Planning Unit will be able to provide support to the Directorate in formulating the research strategy. It is the absence of these skills and of management and organizational mechanisms that have effectively prevented a research strategy being developed to date.

4.3 Attainment of the Improved Planning Mechanism

As outlined above, the identification of the weaknesses in the present planning process have already prompted several changes in certain areas of research planning. These changes could be formalized and expanded without undue demand for new resources and the resulting structures would go a long way towards meeting the specifications of the improved planning mechanism.

4.3.1 Establishment of the TAC

The Committee for On-farm Research and Extension (COFRE) should be asked to continue its functions until the TAC is formally established. When TAC is established, COFRE, including its AGRITEX members, should be reconstituted as a subcommittee of TAC and charged with the responsibility for research-extension liaison (Research-Extension Liaison Subcommittee - RELSCO). The Subcommittee would have the functions outlined in Chapter 7.

The planning officer should be appointed as soon as possible as he will have a key role to play in the establishment of the program structure and the initiation of the deliberations of TAC.

The first tasks of TAC should be:

- a) to update the existing Project Index for DR&SS (PIRSS) to reflect all current work being conducted by the department;
- b) to review the current work being conducted, draw up a list of programs, and allocate all activities to them. This would provide an initial program structure which would be the raw material for its initial deliberations. In this process the TAC must establish a mechanism for verifying recommendations emanating from research work as regards their applicability, economics, risk, and adaptability. It also must involve close AGRITEX participation and could be assigned as an initial task to the Research-Extension Liaison Subcommittee.
- c) advise the director on the appointment of program coordinators for each program.

The next tasks to be undertaken by TAC should be as follows:

- a) define a mechanism whereby the coordinators can estimate the costs (human, physical, and financial) of all activities of the present research and service programs in the current year. This involves careful consideration of the data forms to be completed by all personnel responsible for each activity;
- b) draw up detailed specifications for a computerized resource information management system to incorporate and expand the old PIRSS system and make arrangement for its implementation;
- c) recommend the appointment of program committees;
- d) collect and consider the cost information for present activities through the program committees;
- e) prepare a summary of the present activities of the department according to program objectives and resource allocations.

Following these activities, TAC will be in a good position to commence its major task of producing a research strategy. A preliminary strategy could be produced by an internal review and evaluation of

present activities; this should be formally submitted to the ARC and Ministry for comment and contributions. An improved strategy document should then be subjected to wider circulation and discussion before a final version is produced.

4.3.2 Program committees

As soon as the program committees are established, they should undertake the following tasks under the direction of the TAC:

- a) collect cost data on all activities in the current research and service programs and prepare a report for TAC summarizing the human, physical, and financial costs of the program according to various criteria specified by TAC;
- b) prepare a report detailing the problems being tackled and the objectives of all activities in the program, highlighting strengths and weaknesses.

CHAPTER FIVE

FUTURE RESEARCH PRIORITIES AND RESOURCE ALLOCATIONS

Given the large number of agricultural commodities that can be produced in Zimbabwe, coupled with the increasingly complex policy environment for agriculture, DR&SS is faced with a major challenge in developing an appropriate set of research priorities and resource allocations. The following discussion sets out some of the major research priority areas which the team believes must be comprehensively tackled by DR&SS. However, given both time and data constraints, it is only possible at this stage to make general observations and recommendations. It will be the task of senior management in DR&SS, assisted by the proposed Planning Unit, to provide more detailed analyses and proposals which collectively will constitute a comprehensive agricultural research strategy for Zimbabwe.

DR&SS will need to focus most of its research activity on developing viable production technologies for the main smallholder farming systems in the country even as it helps to maintain the high levels of productivity in the commercial sector, which has an infrastructure of its own. The importance of the large-scale commercial farming areas will decline in relative terms over time as the resettlement program is implemented. Furthermore, private-sector crops research in Zimbabwe should be able to satisfy many of the most pressing research needs of producers in the commercial sector, although this is unlikely to be the case for livestock production unless appropriate steps are taken to encourage more private-sector research in this area. The nature of the two sectors of research working in close collaboration cannot be overemphasized.

As was briefly discussed in Chapter 4, a research strategy for DR&SS must be based not only on a priority assessment of what is desirable in terms of improving the agricultural productivity of crops and livestock systems but, equally important, the capacity of the research organization to develop viable technological solutions. Given the still limited capacity of DR&SS, and the modest increases in resources that are proposed, careful consideration must be given to how research personnel are to be deployed over time. As a general rule, the overall objective must be to ensure the optimal build-up of critical masses of disciplinary and commodity expertise within DR&SS. It is unlikely that this capacity-enhancement process will correspond in a simple fashion with the fulfillment of all research objectives. What must be avoided at all costs is the excessive dispersal of researchers, especially those who are better qualified and experienced over a wide range of commodities, disciplines, and geographical locations.

5.1 Applied and Adaptive Research

DR&SS's research strategy must be based on careful assessment of the correct balance between applied and adaptive research activities. There is a danger that undue emphasis may be given to adaptive research,

especially as DR&SS comes under increasing pressure from government and farmers to produce research results that can be adopted as soon as possible. While this pressure is healthy, it must be recognized that most of the technological advances that are required in the communal farming areas (in particular those in the low-potential regions) can only be achieved by sustained, long-term applied research. Clearly, adaptive research based on client-oriented, farming systems methodologies have a critically important role to play but to devote too large a proportion of available resources to this type of research activity would undermine the viability of the entire research effort. On the other hand, however, DR&SS as a small research organization, does not, and will not, have the capacity to undertake applied research in all the required priority areas. DR&SS will need therefore to delineate clearly what applied research it will focus upon, while at the same time, taking the necessary steps to ensure that it can draw upon applied research in other key areas undertaken by other research organizations in Zimbabwe and overseas. Of particular importance in this respect will be the role of the Southern African Center for Cooperation in Agricultural Research (SACCAR) which has been established under the auspices of SADCC to develop a coordinated approach to agricultural research and to ensure effective inputs from and linkages with the CGIAR agricultural research centers and other national and international agricultural research organizations. It will be the task of the research institutes and stations in DR&SS to assess the value of the research undertaken elsewhere.

The overall breakdown between applied and adaptive research in DR&SS will clearly depend on the nature and type of research program objectives and the allocation of resources to meet them. Since this has not yet been undertaken in a comprehensive fashion, it is not possible at this stage to estimate what this breakdown should be. However, given the need to build up the capacity of the regional research stations (where the bulk of adaptive research will be conducted) as quickly as possible, probably around 35-40% of all research scientists in DR&SS should be working at these stations by 1995, with the remainder engaged in mainly applied research activities at the research institutes.

Available data on past and projected production and consumption of the main agricultural commodities in Zimbabwe are presented in Annex 3. The following discussion will outline the main priority research areas which should be pursued by DR&SS on the basis of the three main types of national research programs (commodity, factor, and system) which have been proposed.

5.2 Crops Research Priorities

Cereals

Maize is comprehensively supplanting traditional crops, most notably sorghum and millet, in the communal farming areas, although with this high degree of monocropping, environmental degradation has become a serious problem. Despite drought conditions between 1982 and 1984, production has grown rapidly in the communal farming areas as a result of the increased availability of hybrid seed and other inputs and improved marketing arrangements since Independence. However, this has largely

been attributable to increases in cultivated area (as opposed to yield increases) and, with existing technology, present levels of production are not likely to be sustained in the future.

Currently, Zimbabwe is faced with a serious oversupply of maize (an expected 1.7 million-ton carryover for 1986/87) with very limited export opportunities given low international prices. The need therefore to diversify out of maize production into other food and export crops is becoming increasingly urgent. Nevertheless it is clear that maize will continue to be the most important agricultural commodity in Zimbabwe during the next 20 years. Target production under the 1986-1990 Five Year Development Plan has been set at 3.5 million tons for 1990, which is considerably in excess of expected domestic consumption.

The outstanding success of maize research conducted by DR&SS during the last forty years is well known. However, there is still considerable scope for increased productivity which would, by reducing producer prices, result in large gains in consumer surplus (given the price-inelastic domestic demand for maize) and reduce the level of government subsidy. DR&SS must continue to undertake research into all aspects of maize production but, in view of the need for diversification, the team recommends that the resource commitment to the proposed maize research program should be maintained at the present level for at least the next 5-10 years.

Wheat is grown as an irrigated summer crop in the large-scale commercial farming areas. On the basis of a very successful research program started in the 1960s, a number of dwarf and semidwarf varieties have been released. Zimbabwe was self-sufficient in wheat up until the 1970s but production has been unable to keep pace with rapidly increasing domestic demand since Independence in 1980. With the present cost and price structure, wheat is not very attractive to farmers, and with high domestic resource costs, Zimbabwe does not have any apparent comparative advantage, at least for the foreseeable future. However, government attaches high priority to achieving wheat self-sufficiency. Domestic consumption is expected to at least double by the year 2000. Under the Five Year Development Plan, target production for wheat has been set at 275,000 tons for 1990. Average annual production between 1980-1985 was only slightly more than half this level.

Given the high priority attached to wheat production by the Government, the team recommends that DR&SS immediately establish a national wheat research program which will undertake comprehensive, multidisciplinary research with particular emphasis on breeding, pathology, economics, and water management. This will require a significant increase in research personnel during the next five years - from around 1.0 researcher person-year in the mid 1980s to 4-5 person-years in the early 1990s.

Sorghum and millet have traditionally been the two most important crops in the peasant smallholder sector, especially in areas of low, erratic rainfall in Natural Regions III, IV, and V. For mainly economic reasons, they have been increasingly supplanted by maize despite the fact that maize production is high risk in the marginal rainfall areas. However, both crops are still extremely important, and given their suitability for production in the low-rainfall areas, a sustained research effort will be required in the future.

Prior to Independence, only a very limited amount of research was undertaken by DR&SS on sorghum, and virtually nothing on millet. While the research effort has expanded since 1980, it is still relatively small. DR&SS will benefit considerably from the SADCC/ICRISAT Sorghum and Millet Improvement Program which is now well established at Matopos but will still need to considerably enhance its own research capacity.

Like maize, Zimbabwe currently has an oversupply of sorghum and, given current consumption patterns, future growth in demand for both sorghum and millet will remain sluggish. This highlights the need for increased research emphasis on the processing and utilization of these crops, in particular sorghum.

In spite of fairly serious demand constraints, improving sorghum and millet production will continue to be a first-order research priority for DR&SS. The team recommends therefore, that DR&SS establish a national sorghum and millet research program with a strong emphasis on the development and testing of new varieties and hybrids; insect, disease, and weed control; and food processing/utilization. A realistic target size for this program for the early 1990s would be at least 5 person-years. Given the presence of the SADCC/ICRISAT group of researchers at Matopos, DR&SS should concentrate more on adaptive research in these crops.

Rice

Rice production is very limited in Zimbabwe, being roughly equally divided between the large commercial and smallholder sectors and communal farming areas. Annual outputs have been declining in recent years. Production costs remain high.

Projected demand for rice will remain limited during the coming decades, although, in percentage terms, the expected increase is high. However, given other research priorities and likely resource availabilities, rice should not be considered a priority crop for DR&SS for at least the next decade. Instead, DR&SS should rely primarily on applied rice research undertaken elsewhere, in particular within Southern and Eastern Africa, and develop enough capacity to conduct a small amount of adaptive research and the testing of promising improved varieties.

Oilseeds

Groundnut is grown mainly as a subsistence crop in Zimbabwe. In terms of area of production, it is the fourth most important crop in the communal farming areas. However, overall production has fallen dramatically during the last five years, mainly because of the low profitability of groundnuts vis-a-vis the other major crops, most notably maize, and the general unavailability of seed for planting.

No major government research was undertaken by DR&SS prior to Independence. The scope for improvements in productivity are significant.

Soyabean is grown mainly by large-scale commercial farmers. With cotton seed, it rapidly replaced groundnuts as the major source of vegetable oil and meal from the mid 1960s. Unlike maize and sorghum, the local production of oilseeds for processing is currently well below local requirements.

Sunflower production is concentrated in the communal farming areas and, since becoming a centrally marketed "controlled" crop in 1984, production has expanded rapidly - from 8.3 thousand tons to an estimated 18.3 tons in 1985. The outlook for sunflower is generally very promising.

The team recommends that the proposed oilseed research program be accorded high priority with a target size of 7 researcher person-years by 1992 as compared with around 2-3 in 1985.

Fruit and Vegetables

The scope for the expanding production of fruit and vegetables (including field beans and root crops) in Zimbabwe is considerable. The available data are limited but it is estimated that 80-85% of vegetables are produced by farmers in the communal farming areas. Citrus and deciduous fruit production, on the other hand, is mainly confined to the large scale commercial sector. Citrus research is undertaken by the private sector.

Only a limited amount of research has been undertaken on fruit and vegetable production in the communal farming areas. This needs to be rectified as quickly as possible with the establishment of a national fruit and vegetable research program and a rapid build-up of multidisciplinary research expertise to around 10 person-years by the mid 1990s. The UNDP Horticulture Project which is expected to start work in 1987 should be of considerable assistance to DR&SS during the next 4-5 years. In addition to undertaking research on crops that are mainly consumed domestically, attention should also be focused on high value, low volume products which could be developed into major foreign exchange earners in overseas markets.

Fiber Crops

Cotton has been another major research success story during the last twenty years. It is of major importance for both commercial and smallholder farmers with production in 1986 being roughly equally divided between the two groups. Target production has been set at 460,000 tons by 1990 on 275,000 hectares with the communal farming areas expected to contribute 50% of total output.

Cotton research has been of consistently high quality and has played a critically important role especially in the development of new varieties and pest control strategies. The team recommends that the cotton research program be maintained at the present levels of support at least until the early 1990s. With regard to the other major Fiber crops (jute, kenaf, sisal), however, future demand will not be sufficient to justify any significant research other than limited adaptive research trials.

Coffee and Tea

Coffee and tea are relatively minor crops in Zimbabwe in terms of area planted but are of considerable economic significance because of their high unit value and export earnings. In 1986, of all the controlled crops, only coffee was financially self-supporting.

DR&SS needs to develop a small coffee research program. At present only one expatriate researcher is in post. This is clearly unsatisfactory and, as a matter of priority, a counterpart should be appointed as soon as possible and the number of researchers gradually increased to 3-4 by 1992. With regard to tea, while DR&SS should continue to rely mainly on the research undertaken at the Central Africa Tea Research Board in Malawi, it is important that Zimbabwe develop a limited national research capacity for this important commodity.

5.3 Livestock Research Priorities

Types and Contributions of Livestock

While estimates of livestock populations vary considerably, it is clear that there has been a significant downward trend in cattle numbers. There was in excess of 6 million cattle during the 1960s but the figure had declined to about 5.6 million in 1983/84. The 1985 estimate was 4.9 million, and with the current trend in high slaughter rates (which includes female stock), the population may reach as low as 4.5 million head by the end of 1986. Of the 5.6 million cattle in 1983/84, 2.2 million head were in the commercial sector, with the communal sector having the balance of 3.4 million or slightly in excess of 60%. The 1982/83 livestock census enumerated four main cattle populations:

- cattle on communal areas (3.1 million head);
- the commercial cattle herd (2.2 million head), mainly beef cattle, plus some 105,000 dairy cattle (adult cows + young stock) owned primarily by large-scale commercial farmers;
- small-scale farming herds (200,000 approx.);
- resettlement area herds (slightly in excess of 80,000).

Most of the current meat and milk production comes from the large-scale areas. Animal offtake from commercial farms is about 20%; with 2.2 million cattle, this means that 440,000 head are slaughtered for beef annually. Offtake estimates for the communal sector are 2-4%, resulting in a mean offtake of 93,000 head annually. The 1986 estimate of milk production from commercial farms is 200 million liters; as much as another 65 million liters is produced within communal areas, practically all of which is consumed locally.

Figures for sheep and goats are less readily available and vary widely. The 1980 estimates of the Central Statistics Office were 573,000 head of sheep, 400,000 of which were owned by communal farmers. Goats are confined essentially to communal farms, with about 50,000 of the total goat population of 1,350,000 goats being owned by commercial farmers. Data which emerged from a survey of Chibi communal area revealed that 5% of the farmers had sheep, with an average of 7.7 head per family; 52% of the farmers had goats, with an average of 6.2 head per family. Goats are both well suited to the lower rainfall communal areas and constitute an important means of livelihood in the form of goat meat and cash income (sold at strategic times, when money is in short supply, to buy essential food items).

Livestock Production Systems

As with crops, livestock production systems in Zimbabwe differ markedly between the large-scale commercial and communal farming areas. Within the commercial sector, there are two main beef production systems. In the marginal cropping regions, particularly Matabeleland, cattle ranching is prevalent. This type of beef production entails pen feeding and winter feed supplementation. In Mashonaland, on the other hand, much of the beef produced comes from good-quality sown species of grasses and legumes, supplemented by pen feeding.

Milk production in the commercial farming areas is based on specialized dairy herds, ranging from 15-20 to 600 cows (largely Friesian/Holstein), and there are almost 550 producers at present. About one half of total milk production is delivered to the Harare milk processing plant. This and the other 5 plants located at Chipinge, Mutare, Bulawayo, Kadoma, and Gweru are operated by the parastatal Dairy Marketing Board. Average milk yields are reportedly 4,500 liters per cow per lactation, with some individual yields of 12,000 liters per lactation having been recorded.

Livestock production in the communal farming areas is based on mainly subsistence, mixed farming systems. Consequently the major roles of cattle are draught power (both oxen and cows are used), milk, manure, and meat production. Communal grazing of livestock is the other major characteristic of these production systems. Overgrazing of these lands has become progressively serious over the years.

Survey figures reveal that there are, on average, 3 head of cattle per household in the communal areas; some 75% of farmers have fewer than 6 cattle consisting of 3 oxen, 1 cow, and 2 calves. As noted earlier, goats are also of great economic importance, particularly in the drier more arid parts of Natural Regions IV and V.

Current Livestock Research Activities

A representative sample of 17 major research projects undertaken at the four livestock and pastures research stations in DR&SS was evaluated by the Team. In Table 14 the relevance of each project in meeting the needs of the commercial and communal farming areas has been rated. Of the 17 projects, 5 (29.4%) were found to have no relevance to the needs of communal farmers. Another 6 (35.3%) were of low or medium priority. While 6 of the projects can be classified as being of high priority in terms of their subject matter area, inappropriate research approaches are being pursued in at least two of them and are unlikely to generate meaningful and applicable results. Even for the large-scale commercial livestock sector, the relevance of the sampled research projects is hardly satisfactory, with only 3 out of the 17 projects being classified as high priority.

Within the Livestock and Pastures Division as a whole, certain disciplines have a disproportionate number of staff (with correspondingly high allocations of financial and physical resources) in relation to their potential impact on production, while others are seriously underrepresented. This is particularly serious in the following disciplines:

Table 14. Evaluation of Selected Livestock Research Projects with Regard to Their Relevance to the Commercial and Communal Farming Areas

Research Station	Description of research project or line of work	Ranking (high, med, low priority)					
		Commercial sector			Communal sector		
		High	Med	Low	High	Med	Low
Henderson	1. Intensive production of milk (largely on concentrates) from Friesian-Holstein cows		X				X
	2. Reproductive studies (fertility) Brahman, Afrikander, Hereford, Mashona + Nkone breeds		X				X
	3. Milk studies on cows grazing grass and grass/legume pastures	X					X
	4. Laboratory: Immunoassay work on hormones; progesterone levels in milk			X			X
Grasslands	1. Studies involving Hereford, Afrikander, Brahman, and Charollais breeds		X				X
	2. Measuring pasture intake by cattle/sheep in grazing trials			X			X
	3. Grazing-management studies on sown grass and grass/legume pastures	X				X	
	4. Use of maize stover and other crop residues for dry-season feeding			X	X		
	5. Legume inoculant factory - inoculum supplied to farmers (crop legumes)	X			X		
Makoholi	1. Performance testing Mashona cattle - service to commercial sector farmers			X			X
	2. Evaluation of goat breeds: Boer and Matabeleland breeds (initial stages)		X		X		
	3. Grazing trials on legume-reinforced veld pastures (introduced legumes)	X				X	
	4. Evaluation of the establishment and nutritive value of indigenous legumes (about to start)		X		X		
Matopos	1. Pure and crossbreeding studies with <u>Bos taurus</u> X <u>Bos indicus</u>	X					X
	2. Stocking rate studies on native veld			X	X		
	3. Leucaena/legume testing - testing of suitable veld reinforcement plants		X			X	
	4. Evaluation of prod. and reprod. chars. of native goats and sheep breeds			X	X		

Animal breeding: Investigations at the four main livestock research stations, but particularly at Matopos and Makoholi, have received undue attention. The relevance of much of this work to communal farming areas is minimal and probably of only moderate relevance to commercial livestock farmers.

Grazing management: Studies both on sown pastures (grass and grass/legume) and on native pastures have received inadequate attention.

Animal nutrition: The key discipline of animal nutrition is very weak.

The present geographical distribution of livestock researchers in DR&SS is indicative of the continued bias in favor of the commercial sector. Matopos Research Station has the highest number of researchers (15), followed by Henderson (13), Grasslands (8), and Makoholi Experiment Station (2). The disparity in size between these four research stations (as measured by their professional scientific establishments) is almost in inverse relation to the needs for livestock research in the main agroecological and production systems in the country.

Future Livestock Research Priorities

In accordance with government priorities, livestock research in DR&SS must be effectively reorientated to produce viable technologies for the communal farming areas while at the same time maintaining the productivity of the commercial livestock production systems. Four main priority areas for livestock production have been identified in the National Five Year Development Plan 1986-1990:

- improvement of livestock production systems in the communal farming areas with particular emphasis on better land management and stock control;
- improvement of the role of small animals (in particular, sheep and goats) in the communal farm areas;
- development of low-cost milk production from cheap home-grown feed (as opposed to concentrates) in order that retail milk prices can be kept within the means of the main consumer groups;
- reversal of the decline in the number of breeding cows in the commercial farming areas.

The projected domestic demand for most livestock products in Zimbabwe is expected to increase rapidly during the next twenty years (see Annex 3). Livestock research has therefore a key role to play in ensuring that these demands can be met efficiently by domestic producers.

To achieve a more appropriate balance between livestock research for the commercial and communal areas will require a considerable change in research emphasis and corresponding resource allocations. The recommended proportions of livestock research undertaken at the four main centers for livestock and pastures research in DR&SS which should be devoted to the research needs of the commercial and communal farming areas are shown in Table 15. In aggregate terms, the Team recommends

Table 15: Suggested Proportions of Livestock Research for the Commercial and Communal Farming Areas at Each of the Main Livestock Research Stations in DR&SS

Research Station	Commercial	Communal
Henderson	40	60
Grasslands	30	70
Makoholi	20	80
Matopos	30	70

that at least 70% of all livestock research in DR&SS should be oriented explicitly to improving livestock production systems in the communal farming areas. This will require a significant increase in the numbers of livestock researchers working at research stations in or near the communal farming areas. The proposed regional research station at Makoholi serving Natural Region III will have a particularly important role to play and the team recommends therefore that the numbers of livestock researchers at this center should be increased progressively from the two at present to at least seven as soon as possible.

The team's main recommendations concerning the main livestock research priority areas which should be pursued in the immediate future are set out in Table 16. Also shown are the recommended allocations of researchers to each of these priority areas, assuming no increase in the number of livestock researchers currently employed by DR&SS.

In relation to the proposed national research program structure, the team recommends that the following four main livestock commodity research programs should be established: beef cattle, dairy, small ruminants, and veld and pastures. In addition, livestock research activities will also form key components of the production systems research program.

5.4 Production Factors and Resources Research

As Zimbabwe embarks on major plans of development of its agriculture in the communal areas of Natural Regions III, IV, and V, the most important factor affecting production will be the endowment of soils and water resources. With the limited and fragile nature of these resources, research in soils and water management must receive the highest priority. While the Chemistry and Soil Research Institute will continue

Table 16: Proposals for Future Livestock Research
Priority and Researcher Deployments

Research Station	Suggested future disciplines and areas of research	Proposed number researchers	%
Henderson	1. <u>Animal Breeding and Reproductive Physiology</u> : 80% of work with indigenous breeds; applied reprod. physiology work	2	15
	2. <u>Animal Nutrition/Husbandry</u> : Grazing management studies grass/legume pasture, beef and dairy cattle, dry-season feeding and fattening	3	35
	3. <u>Intensive Dairy Production</u> : Studies on feeding/management/disease control, etc. (service to commercial sector)	1	10
	4. <u>Pasture Research/Grazing Management</u> : Grass/legume evaluation grazing studies with staff of (1) and (2) above	3	30
	5. <u>Poultry Production</u> : Feeding and management research, layers and broilers, mainly geared to needs of communal farmers	2	10
	6. <u>Animal Health</u> : Disease investigation on farms and low-cost control methods - 1 post can be added as funds/staff are available	--	--
	Subtotals	11	100
Grasslands	1. <u>Pasture and Range Research</u> : Grass/legume evaluation, grazing management studies; range management/grazing work - some at grasslands and input at Makoholi	3	30
	2. <u>Animal Breeding and Reproductive Physiology</u> : 70% + work on indigenous breeds; input to and assist with Makoholi work in these areas	1	10
	3. <u>Dairy, Beef, and Sheep/Goat Production</u> : Pasture/range-based trials with these species, largely (but not exclusively) with indigenous breeds	2	25
	4. <u>Animal Nutrition/Husbandry</u> : Grazing management work in collaboration with pasture staff; dry season feeding, crop residue usage, etc; support programs at Makoholi and coordinate research projects		
	5. <u>Legume Inoculants</u> : Continue existing work and extend the service (crop + forage, rhizobial strains) to more communal farmers	1	10
	6. <u>Animal Health</u> : Disease investigation on farms supported by on-station research; also conduct program at Makoholi + Matopos with vet. assts. - 1 post can be added as funds/staff are available.		
	Subtotals	7	100
Makoholi	1. <u>Animal Breeding & Reproductive Physiology</u> : Breeding studies (mainly indigenous) with cattle, sheep and goats; coordinate work in both breeding and physiology with Matopos Research Station	1	15
	2. <u>Pasture and Range Research</u> : Mainly (but not exclusively) veld improvement and grazing. Input of assistance from Grasslands staff	2	30
	3. <u>Dairy Beef and Sheep/Goat Production</u> : Largely pasture- and range-based trials with these species - mainly indigenous breeds	2	25
	4. <u>Animal Nutrition/Husbandry</u> : Grazing management jointly with staff of (2) and (3), dry-season feeding, crop residue usage, etc.	2	30
	Subtotals	7	100
Matopos	1. <u>Animal Breeding & Reproductive Physiology</u> : Breeding/Physiology studies, mainly indigenous cattle, sheep, and goats; coordinate work with Makoholi	2	20
	2. <u>Animal Nutrition/Husbandry</u> : (Prev. Range Livestock Nutrition) veld grazing/management, dry-season and crop residue feeding, etc.	3	25
	3. <u>Dairy Beef and Sheep/Goat Production</u> : Range-based and confinement rearing, management aspects	3	25
	4. <u>Veld Management & Ecology</u> : Veld improvement and management studies, some jointly with above disciplines	3	30
	Subtotals	11	100

to be at the center of this research effort, multidisciplinary collaboration throughout DR&SS and with other research organizations will be required. The basic approach would be to develop technologies which will make it possible to place greater reliance on soil moisture resources to increase crop production in lower rainfall environments and in bad years. This will call for a great deal of applied research in the field of watershed management, runoff reduction, improved tillage techniques, moisture retention, crop and fallow sequences, water balance, and crop agronomy. Close collaboration with the Institute of Agricultural Engineering will be necessary in planning and executing these programs.

Closely related to research in soil and water management would be studies in the field of soil fertility. Declining soil fertility as the intensity of agriculture increases in these communal areas could emerge as a major factor contributing to low crop yields in smallholder agriculture. Indeed, maintenance of soil fertility should be an important problem even in areas of intensive agriculture with soils which have traditionally supported less demanding crops. The setting up of a soil fertility network by linking together the institutes and regional research stations should receive major attention. Similarly, priorities should be given to coordinated agronomic experiments carried out on a multilocation basis to generate suitable recommendations with respect to the use of chemical fertilizers and other soil amendments. Some of these experiments should help to identify the role of chemical fertilizers in the dry lands where they may have an important role in increasing yields with placement techniques. The role of fodder and grain legumes in building up soil fertility should receive particular attention in these environments.

5.5 Program Resource Allocations

Given the main research priority areas that must be addressed by DR&SS, the target size of each national research program in 1992 have been tentatively estimated (see Table 17). This has been undertaken on the assumption that (a) with a 5% per annum real increase in expenditure, DR&SS will be able to employ 195 professional staff by 1992; this would be less with the exclusion of the researchers from the Institute of Agricultural Engineering. (b) Approximately one-third of professional staff time will be devoted to advisory and service activities, leaving 135 persons-years available for research activities.

It must be stressed that these estimates are highly tentative and are presented here mainly to illustrate the importance of deriving target resource allocations for national research programs. Clearly, this will have to be done by DR&SS itself on the basis of the kind of detailed and comprehensive analysis outlined in Chapter 4. It can be expected that a better balance between resources allocated to crops and livestock research should emerge in the closing years of the century.

5.6 Production Systems Research

Production systems research will have a major role to play in the development of viable agricultural technologies, especially in Natural Regions III, IV, and V. The major objectives of systems research are as follows:

Table 17. Target Allocations of BRSS Professional Researchers to National Research Programs, 1992/93

Crops	Researcher person-years
Maize	6
Wheat and barley	5
Sorghum and millet	5
Oilseeds	7
Cotton	8
Fruit and vegetables	10
Coffee and tea	3
Other crops (inc. rice)	5
	<hr/>
Subtotal	<u>49</u>
Livestock	
Beef cattle	16
Dairy	5
Small ruminants	6
Veld and Pastures	8
Others (mainly poultry)	2
	<hr/>
Subtotal	<u>37</u>
<u>Production factor and resources</u>	
Soil fertility	7
Soil and water conservation	9
Irrigation and drainage	6
Engineering	6
	<hr/>
Subtotal	<u>28</u>
<u>Production systems: Subprograms</u>	
N.R. I	4
N.R. II	4
N.R. III	5
N.R. IV	5
N.R. V	4
	<hr/>
Subtotal	<u>22</u>

- characterization of the key agricultural production systems;
- identification of key problem areas which can be taken up by the relevant commodity and factor research programs;
- substantial applied and adaptive research activities which address the main production constraints which have been identified. The bulk of this research activity will seek to integrate promising technologies produced by the main commodity and factor research programs so that they can be successfully incorporated into each production system. In the communal farming areas, the critical importance of crop-livestock interactions and intercropping practices are two key areas where this integrative role of systems research will be of primary concern.

The Team recommends, therefore, that a national farming systems research program be established as soon as possible. The program should be divided into five subprograms which would undertake systems research in each of the main natural regions in Zimbabwe. With the establishment of these decentralized, regionally based teams, the present FSR Unit should be reorganized. As noted earlier, while there would be obvious advantages in establishing a centrally located socioeconomic unit in DR&SS, the team believes that this degree of centralization would frustrate the effective involvement of social scientists in the system's subprograms.

Given the nature of systems research, membership of these subprograms must be multidisciplinary. This includes social scientists, who have a particularly important role to play, especially in the areas of system characterization and problem identification. The team strongly recommends therefore, that DR&SS take immediate steps to recruit 3-5 social scientists. Along with the majority of the other production system program members, these social scientists should be based at the research stations located in the natural regions.

In view of the importance of the national farming system program, the team recommends that a full-time program coordinator be appointed. Ideally, this person should be a highly competent social scientist with considerable scientific and management experience of production system research. He/she will probably need to be based at the Farming Systems Research Unit at headquarters of DR&SS.

CHAPTER SIX

HUMAN RESOURCES PLANNING AND DEVELOPMENT

6.1 Past and Current Human Resource Situation

Prior to Independence, DR&SS had a relatively compact but highly experienced cadre of professional and technical staff mostly serving the large scale commercial agriculture sector. With Independence in 1980 there was a major transformation in the senior staff situation in DR&SS. Within four years, 75% of the European researchers and technicians employed in the late 1970s resigned to be replaced by mainly young African Zimbabweans. Whereas there had been only 4 African researchers in 1977, this had leapt to 115 by 1986. Given that the large majority of new recruits lacked any previous professional research experience and had not received specialized postgraduate training, senior management in DR&SS has been faced with the major task of developing as rapidly as possible the skills of these staff. However, this is clearly a long term process.

The grade and experience profiles of professionals and technicians employed at each of the main research and service units in DR&SS in early 1986 are presented in Tables 18 and 19. It can be observed that, in overall terms, between 50-60% of national professionals in each of the three divisions have less than six years of experience since graduating from the university and that this figure is particularly high in the Agronomy Institute (85%), the Biometrics Bureau (83%), and the Horticulture and Coffee Research Institute (75%). As would be expected, there has been some improvement in these experience profiles during the last three years but, as can be seen in Table 20, this has been largely confined to the ranges of 3-5 and 6-10 years of experience. In the crops division, the percentage of researchers with more than 10 years of experience has actually fallen. It has remained unchanged in the livestock and pastures division. In short, the situation is still very fragile given the paucity of experienced researchers. It is mainly for this reason that DR&SS has progressively increased the number of foreign researchers - some 22 were employed in late 1986. These officers have a crucial role to play in supervising and providing on-the-job training for their mainly inexperienced counterparts.

After some initial hesitation, DR&SS is now strongly committed to the need for focused postgraduate degree training during the early stages of the researcher's career. The percentage qualification profiles of professional staff in 1984 are presented in Table 21. While more recent data are not available, the proportions of M.Sc. holders have increased considerably and, in overall terms, had reached 40-45% in late 1986. During the last three years, 10-15 professionals have completed M.Sc. degrees each year. Major reliance has been placed on the 9-12-month degree courses offered by U.K. universities. Where possible, researchers have also registered for the two year M.Phil. research degree offered by the University of Zimbabwe. The Faculty of Agriculture at the university however has not yet been able to offer master degree courses in the main subject areas.

Table 18. Grade and Experience Profiles of Professional Staff in DR&SS, 1986

	Grade							Research Experience (years)					
	Nationals	Head	CRO	PRO	SRO	RO	ARO	0-2	3-5	6-10	11-15	16-20	20+
Directorate	4 (0)	4	0	0	0	0	0	0	0	1	0	1	2
<u>Crops</u>													
Agronomy I	13 (0)	1	0	0	0	1	11	8	3	1	1	0	0
Cotton RI	5 (2)	1	1	0	0	1	1	0	2	1	0	1	1
Crop Breeding I	9 (0)	1	0	1	2	2	3	2	1	3	2	1	0
Horticulture and Coffee RI	4 (2)	0	1	0	0	0	3	1	2	0	0	0	1
Lowveld RS	5 (1)	0	0	0	0	2	3	0	3	2	0	0	0
Subtotals	36 (5)	3	2	1	2	7	21	11	11	7	3	2	2
<u>Livestock and Pastures</u>													
Henderson RS	14 (0)	1	1	0	2	3	7	4	5	1	2	1	1
Grasslands RS	7 (1)	2	0	0	0	1	4	3	1	1	1	0	1
Matopos RS	13 (2)	1	0	1	0	3	8	3	5	2	1	1	1
Makoholi ES	2 (0)	1	0	0	0	0	1	0	1	1	0	0	0
Dairy Services	6 (0)	1	0	0	0	5	0	1	3	1	0	0	1
Subtotals	42 (3)	6	1	1	2	12	20	11	15	6	4	2	4
<u>Research Services</u>													
Plant Protection RI	14 (1)	1	0	0	1	8	4	3	6	3	2	0	0
Chemistry & Soils RI	21 (5)	1	0	1	0	14	5	3	6	8	1	2	1
Biometrics Bureau	6 (0)	1	0	0	0	5	0	2	3	1	0	0	0
Herbarium & Botanic Gdn.	6 (0)	1	1	0	1	1	2	2	0	1	0	1	2
Seed Services	8 (0)	1	0	1	0	4	2	2	2	2	2	0	0
Information Services	1 (0)	0	0	0	0	1	0	0	0	1	0	0	0
Subtotals	56 (6)	5	1	2	2	33	13	12	17	16	5	3	3
FSR Unit	4 (2)	0	0	0	1	3	0	1	2	1	0	0	0
TOTALS	142 (16)	18	4	4	7	55	54	35	45	31	12	8	11

() = foreign personnel.

Table 19. Grade and Experience Profiles of Research Technicians in DRSS, 1986

	Nationals	Grade			Research Experience (years)				
		PR1	SRT	RT	0-5	6-10	11-15	16-20	20+
<u>Crops</u>									
Agronomy I	12	2	0	10	5	3	1	0	2
Cotton RI	7	0	0	7	7	1	2	0	0
Crop Breeding I	8	1	1	6	4	1	1	0	2
Horticulture & Coffee RI	5	0	1	4	2	1	1	0	1
Lowveld RS	5	0	0	5	3	0	1	0	1
Subtotals	37	3	2	32	19	6	6	0	6
<u>Livestock and Pastures</u>									
Henderson RS	6	0	1	5	1	1	1	3	1
Grasslands RS	7	0	0	7	3	0	0	2	2
Matopos RS	8	1	9	7	2	2	2	0	2
Makoholi ES	4	0	0	4	1	1	1	1	0
Dairy Services	5	0	0	5	3	2	0	0	0
Subtotals	30	1	1	28	10	6	4	6	5
<u>Research Services</u>									
Plant Protection RI	11	0	0	11	5	3	2	0	0
Chemistry & Soils RI	12	0	0	12	6	1	2	1	2
Biometrics Bureau	3	0	0	3	1	0	1	1	0
Herbarium & Botanic Gdn.	3	0	0	3	0	1	1	0	1
Seed Services	4	0	0	4	3	1	0	0	0
Information Services	1	0	0	1	1	0	0	0	0
Subtotals	34	0	0	34	16	6	6	2	3
<u>FSR Unit</u>	3	0	0	3	2	1	0	0	0
TOTALS	104	4	2	97	47	19	16	8	14

Table 20. Percentage Experience Profiles of Professional Staff in DR&SS by Division, 1984 and 1986

Division	Year	Experience (years)				
		0-2	3-5	6-10	11-15	16+
Crops	1984	48	16	10	6	20
	1986	30	30	20	2	10
	Change	-18	+14	+10	+2	-10
Livestock & Pastures	1984	50	19	8	6	17
	1986	26	36	14	9	14
	Change	-14	+17	+6	+3	-3
Research Services	1984	42	32	13	4	9
	1986	21	30	29	9	11
	Change	-21	-2	+16	+5	+2

Table 21. Percentage Qualification Profiles Among Professional Staff by Division, 1984

	B.Sc.	M.Sc.	Ph.D.
Crops	52	38	10
Livestock and Pastures	67	28	5
Research Services	64	27	9

There are still relatively few national researchers with Ph.D. or equivalent degrees in DR&SS. Indeed, the percentage of researchers with this level of formal training declined in the crops and research service divisions between 1984-1986 and remained unchanged in the livestock and pastures division.

A critical factor influencing the rate of improvement in experience and qualification profiles of professional and technical staff in DR&SS is the loss (or attrition) of these personnel as a result of retirement, voluntary resignations, and dismissals. As can be observed in Table 22, the numbers of professional and technical staff leaving DR&SS each year have fallen considerably from the very high levels prevailing in the early 1980s, but they are still relatively high with annual percentage rates of attrition of approximately 9% and 11%, respectively, during 1985 and 1986.

Table 22. Appointments and Resignations of Professional and Technical Staff, 1981-1986

Year	Researchers		Technicians	
	Appts.	Resig.	Appts.	Resig.
1981	25 (7)	30 (28)	21 (6)	37 (32)
1982	13 (4)	27 (20)	12 (2)	9 (7)
1983	42 (6)	22 (18)	17 (2)	16 (4)
1984	15 (2)	20 (3)	n.a.	5 (1)
1985	14 (3)	10 (0)	n.a.	10 (0)
1986*	14 (2)	16 (3)	n.a.	12 (3)

* up to November.

() = Europeans.

In addition to the localization of professional staff since 1980, the number of professionals employed has also increased from around 107 in 1977 to 161 in early 1986 (see Table 23). The percentage distribution of professional staff among the three divisions in 1986 was crops 28.6%, livestock 31.2%, and services 40.1%. The corresponding figures for the mid 1970s indicate that the proportions, of livestock researchers has increased during the last ten years (from 23.1% of the total in 1974), while the proportions of crops and service researchers have declined (from 35.9% and 41.0% respectively in 1974), and research services has remained at approximately the same level.

Table 23. Professional Officers and Research⁺ Technicians Employed by DR&SS, 1970-1986

Year	Crops			Livestock and Pastures			Research Services			Total		
	P	T	T:P	P	T	T:P	P	T	T:P	P	T	T:P
1970	29	28	0.96	23	39	1.69	44	36	0.81	96	103	1.07
1974	42	43	1.02	27	37	1.37	48	85	0.73	117	115	0.98
1977	32	40	1.25	28	36	1.28	47	34	0.72	107	110	0.97
1984	35	34	0.97	38	26	0.68	56	26	0.46	129	86	0.67
1986	42	37	0.88	46	30	0.65	63	34	0.53	161	104	0.64

* excluding Director.

+ includes nonnationals and FSR unit.

The disciplinary breakdown of national professional staff is shown in Table 24. If the time devoted by professionals to purely service and advisory functions is deducted, then the full-time equivalent commitment of professional staff in DR&SS to research activities proper is unlikely to exceed 100. The absence of economists and other social scientists is particularly noticeable as are the small numbers of researchers in some of the main disciplines, in particular, crop breeding, pathology, horticulture, pastures, and veld and range management.

Nearly 70% of the total of 1876 DR&SS employees are unskilled. National professional staff represent approximately 8% of the total labor force. The overall technician-to-professional ratio is 0.64, which is considerably lower than the figure of approximately 1.0 that prevailed during the 1970s (see Table 23).

Table 24. Disciplinary Breakdown of National Researchers⁺, Early 1986

Discipline	Number	Number of units
<u>Crops</u>		
Crop Breeding	9	1
Agronomy	21	4
Soil Chemistry/Biochemistry	13	1
Soil Microbiology	3	1
Pedology/Soil Survey	5	1
Entomology	8	2
Pathology	6	3
Nematology	3	1
Horticulture	5	3
Botanist/Ecologist	6	1
Seed Testing	8	1
Animal Breeding*	8*	3
Animal Production/Systems	15	3
Animal Nutrition	5	2
Pastures	4	2
Veld & Range Management	3	1
Dairy	9	2
Statistics/Computer	6	1
Information Services	1	1
Total	138	-

+ excluding Directorate.

* including reproductive physiology.

6.2 Human Resource Requirements

Much has been achieved in rebuilding the professional and technical support cadres since Independence. However, given the central role that agricultural research must play in the transformation of the agricultural sector in Zimbabwe, it is imperative that the numbers of researchers and support staff in DR&SS be expanded considerably during the next 10-20 years. The exact size of this expansion needs to be carefully planned on the basis of the likely human resource requirements of each of the major research program activities during this period. One of the main objectives of a DR&SS research strategy would be to derive carefully reasoned estimates of this type. However, as noted earlier, the Team recommends that government financial support for DR&SS should increase in real terms by 5% per year, which is broadly in line with the target rate of growth of the agricultural sector as a whole. This would result in the following percentage increases in DR&SS's 1986/87 budget (measured in constant prices) during the next 20 years:

<u>Year</u>	<u>% increase</u>
1992	27.7
1997	62.8
2002	107.4
2007	165.3

Not all of these increases could be devoted to employing new research personnel however because allowance must be made for the increasing real costs of existing staff as a result of normal career progression. Taking this factor into account, and assuming the same breakdown of resources between emoluments and operational and capital expenditures as in 1986/87, it would be financially possible to approximately double the number of professional and technician staff during the next 15 years.

The average annual additions to professional and technical establishments during this period would probably need to be gradually increased, as shown in Table 25.

Table 25. Annual Additions to Professional and Technical Establishments, 1988-2007

<u>Period</u>	<u>1988-1993</u>	<u>1994-1998</u>	<u>1999-2003</u>	<u>2004-2007</u>
Professionals	5	7	8	8
Technicians	4	5	6	7

6.3 Human Resource Availability

The ability of DR&SS to achieve these increases in research and technical cadres during the next 20 years will clearly depend on the availability of recruits of the required quality. If the current annual rates of professional and technical attrition of 9% and 11%, respectively, continue to prevail throughout this period, then DR&SS will need to fulfill the annual recruitment targets presented in Table 26.

Table 26. Annual Recruitment Targets for Professional and Technical Staff, 1988-2008

Period	1988-1993	1994-1998	1999-2003	2004-2008
Professionals	20	25	29	33
Technicians	17	20	24	29

Projected annual outputs of university agricultural graduates from the University of Zimbabwe are likely to be between 90-100 during the next five years and for agricultural diplomates from Gwebi and Chibero agricultural colleges approximately 100. Detailed tracer studies of the employment of graduates from these institutions have not been undertaken, so we do not have a precise picture of the pattern of demand for their services. However, DR&SS should be able to meet the proposed recruitment targets, although the situation will need to be monitored closely in case any expansion in outputs may be warranted in the future.

6.4 Training Requirements

The availability of appropriate formal and on-the-job training will be a key factor influencing the degree to which the capacities of professional and technical staff in DR&SS are effectively developed and utilized. The Team recommends therefore that DR&SS continue to pursue its current training policies and provide detailed estimates of overall training requirements for at least the next 5-10 years. In very broad terms, approximately 15-25 researchers will need to embark on master's degree programs each year during this period. In addition, considerably more high-quality research, especially at the applied level, will need to be undertaken. Therefore probably between 3-6 researchers each year should also start Ph.D. degrees so that in 15-20 years time at least 25% of researchers in DR&SS will have received this level of training.

In order to minimize disruption to ongoing research programs and maximize the relevance and cost effectiveness of postgraduate degree training, DR&SS will need to collaborate closely with the Faculties of Agriculture and Biological Sciences at the University of Zimbabwe in the development of local training capacity at this level. For at least the next five years, however, DR&SS will continue to have to rely on overseas institutions, and efforts to attract medium- to long-term donor assistance to help meet the costs of this training should be given priority.

Until DR&SS has developed its own sizable group of experienced national researchers, the effective provision of high-quality on-the-job training and supervision for newly recruited graduates and diplomates will continue to be a major problem. The Team recommends therefore that, as an interim measure, DR&SS continue to employ a group of foreign researchers with the appropriate experience and attitudes whose primary role will be to provide assistance in these two critical areas of supervision and on-the-job training. While governments are understandably reluctant to employ more expatriate staff, the team is convinced that a carefully selected group with precise job descriptions are indispensable for the rapid development of DR&SS as a research and services institution during the next five to ten years. Thus, given the recommended growth in scientific and technical personnel, the Team recommends that the number of expatriate researchers should be maintained at its present level of 10-15% of the total research cadre. The department needs, at regular intervals, to critically evaluate the performance of these expatriate staff to ensure effectiveness and to review its requirements vis-a-vis its training output.

With regard to the training of research technicians, technical assistants, and agricultural assistants, the Department should continue with the current policies of encouraging research technicians who lack formal training to obtain full technical qualifications as quickly as possible. In addition, greater opportunities should be provided for research technicians to attend short courses both locally and overseas. The Department should consider specific short courses which lead to research or service-related qualifications which should be strongly recommended to the PSC for promotional purposes.

6.5 Conditions of Service

The ability of DR&SS to provide the necessary agricultural technologies in the future is dependent not only on the skills of researchers and their technical and administrative support staff but, equally important, their levels of commitment and overall motivation. It is essential therefore that DR&SS is able to develop an appropriate reward structure that will maximize the productivity of its staff.

At present, the grading and salary structures in DR&SS are based on rules and regulations issued by the Public Service Commission. In considering these conditions of service for staff in DR&SS, there are two sets of issues which must be addressed. (1) The system of grading and the corresponding remuneration structure and (2) the overall levels of remuneration. While these two sets of issues are closely interrelated it is necessary to treat them separately.

We shall limit our comments to the two most important groups of personnel in DR&SS, namely researchers and research technicians and agricultural assistants.

6.6 Grades, Promotion, and Salary Structure

Given the prevailing recruitment and advancement regulations laid down by the Public Service Commission (PSC), the likely career progressions and corresponding income profile of senior research staff in

DR&SS can be predicted with a reasonable degree of certainty. With regard to researchers, this exercise has been undertaken on the assumption that each research scientist fulfills all the advancement and promotion requirements in the minimum time periods stipulated in the PSC regulations. The resulting grade and salary levels during the research scientist's career with DR&SS are shown in Table 27 from which the following observations can be made:

Table 27. Existing and Proposed Grading and Salary Structures for Researchers, DR&SS 1986

Years Employed	Present Grade	Salary (Z\$)	Salary Index	Recommended Grade Entry Points
1	ARO	9576	100	
2		10056	105	
3		11496	120	
4		11976	125	
5	RO	13632	142	RO
6		14220	148	
7		16572	154	
8	SRO	16572	173	
9		17160	179	
10		17748	185	
11		18336	191	SRO
12		18924	198	
13		19476	203	
14	PRO	20028	209	
15		20580	215	
16	CRO	21132	221	
17		21684	226	PRO
18		22236	232	
19				
20				
21				
22				
23				CRO
24				
25				
26				
27				
28				

- While there are 11 annual salary increments in the research officer (RO) grade (up to and including the entry increment to senior research officer), the granting of up to six additional increments to assistant research officers (two for two years of initial service, two for obtaining an M.Sc. qualification, which is now expected, and two more for promotion from ARO to RO) means that the effective length of the research officer grade is reduced to just three years.
- The principal research officer (PRO) and chief research officer (CRO) grades are only two and three years, respectively.
- In theory, an able researcher progressing through the scale barriers as quickly as possible reaches the end of the CRO grade (and thus receives his maximum salary) after only 18 years of service with another 15-25 years of his/her career remaining.
- The overall income-years of service profile is S-shaped, with the highest percentage increases in salary typically awarded during the early stages of the researcher's career and very small percentage increases awarded in the middle or later stages of the career. The income-years of service index in Table 27 has been plotted diagrammatically in Figure 5. This can be compared with the actual median and upper quartile income-years of service values for DR&SS researchers employed in mid 1986. As expected, the potential maximum and actual upper quartile income-service curves are relatively close together.
- The grade and salary structures of research technicians are more complicated to analyze mainly because there are multiple entry points and the composition of this group generally more heterogeneous. Thus, our comments are confined to the core group of research technicians with formal agricultural diploma qualifications who comprise around 70% of all research technicians.
- Comparing tables 27 and 28, it can be seen that research technician salaries compare favorably with those of research scientists. The relatively attractive salaries paid to research technicians has, in the past, ensured that DR&SS has been able to attract and retain sufficient numbers of high-quality research support personnel.
- The senior research technician (SRT) and principal research technician (PRT) grades are only three and two years long, respectively.
- In theory, it is possible for an officer to reach the end of the PRT grade after 21 years of service with at least another 15-20 years of productive work before normal retirement. While, in practice, few technicians advance as rapidly as this, five PRTs employed by DR&SS in 1986 had been at the maximum scale level for some years.
- Agricultural and technical assistants are the other main technical support groups in DR&SS. Considerable concern has been expressed by DR&SS management about the poor career and salary prospects for these staff. The starting salary for agricultural assistants is Z\$ 5160

Figure 5 Income - years of service income profiles for DR&SS professional research officers 1986

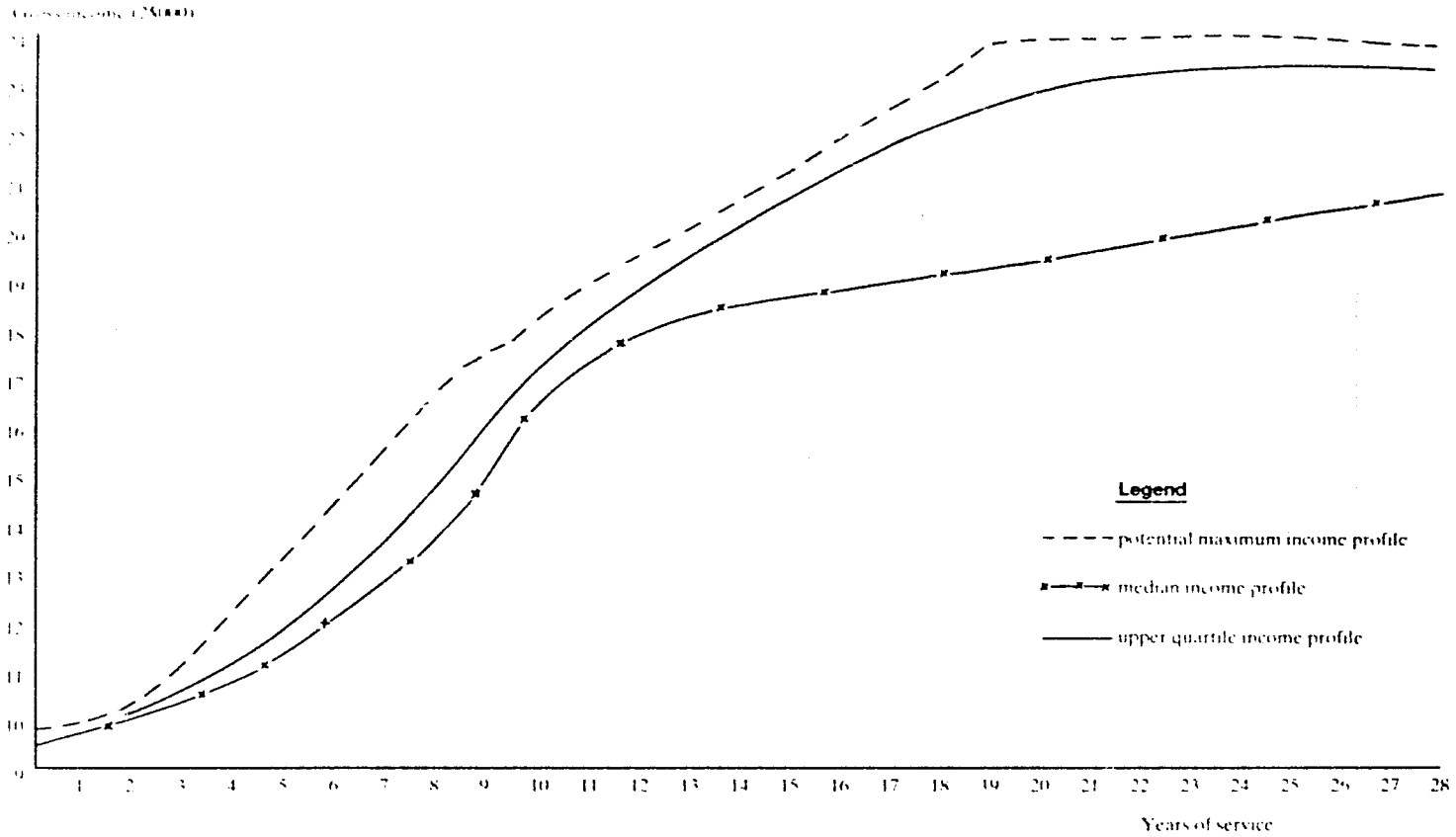


Table 28. Existing and Proposed Grading and Salary Structures for Research Technicians, DRSS 1986

Year Employed		Basic Salary (\$)	Salary Index 7636=100	Recommended Grades & Entry
1	RT	7656	100	RT points
2		8136	106	
3		9576	125	
4		10056	131	
5		10536	138	
6		11016	144	
7		11496	150	
8		11976	156	
9		12456	163	
SB				
10		13632	178	
11		14220	186	
12		14808	193	Senior RT
13		15396	201	
SB				
14		15984	209	
15		16572	216	
16		17160	224	
SB				
17	Senior RT	17748	232	
18		18336	239	
19		18924	247	
PC				
20	Principal RT	19476	254	
21		20028	262	
END				
22				
23				
24				Chief RT
25				
26				
27				
28				
29				
30				END

SB = Suitability Board
 PC = Promotion Committee

per annum, which appears reasonable given their formal training (after a two-year agricultural certificate course) but career advancement thereafter is very limited, with a maximum salary of only Z\$ 6540 per annum, with just seven increments.

6.7 Salary Levels

While salary levels in DR&SS are relatively high compared with other agricultural research organizations in developing countries, their value in real terms has fallen considerably in recent years. Nominal salary levels for researchers increased between 39-47% between 1982 and 1986 depending on the grade of the officer. However, the consumer price index for higher income urban households increased by about 70% during the same period so that as a result, DR&SS researchers are 25-35% worse off than four years ago. This situation is further exacerbated as a result of the much higher salaries paid to professional researchers and other agriculturalists in the private sector. No detailed salary surveys have been undertaken but typically this differential is now of the order of 50-100%.

6.8 Proposed Improvements

The team is fully aware of the severe financial and equity constraints faced by the Government. However, there are a number of significant improvements that could be made to the prevailing grade and salary structures for researchers and their technical support personnel which would provide more attractive and logical career structures but do not have major cost implications. In terms of the grade and salary progressions presented earlier, the Team recommends that for researchers, the starting points of the main grades should be designed so that the average researcher will normally be promoted after 5-6 years in each of the major grades (see Table 27). This will allow steady career progression for the researcher for at least 30-35 years. To achieve this, the salary scale will need to be extended considerably.

The research technician of average ability should normally be promoted to senior research technician after 10 years, principal research technician after 16 years, and to the proposed new grade of chief research technician after 22 years of service (see Table 28). There should not be any scale barriers within these grades nor should there be any restrictions on the overall numbers or proportions of officers employed in each grade as is the case at present.

With regard to the overall salary levels, the team strongly recommends that these be increased substantially for researchers and senior technical staff as soon as possible. Since the team was not able to carry out a comprehensive salary survey of professional and technical personnel employed in relevant public- and private-sector organizations in Zimbabwe, it is not possible to specify precisely what these increases should be. However, it is clear that basic salaries need to be raised by at least 30% in order to establish income parity between DR&SS and equivalent university professional and technical staffs. In addition,

Government should encourage utilization of staff expertise in local consultancies for which they should be accordingly recognized and remunerated. While it is unrealistic to expect that income parity could ever be achieved between agricultural research personnel employed in the public and private sectors, a salary increase of the magnitude suggested would help considerably in creating the stable staffing situation that is absolutely essential if DR&SS is to develop the agricultural technologies that Zimbabwe so urgently requires.

CHAPTER SEVEN

LINKAGES WITH EXTENSION AND CLIENT COMMUNITIES

Agricultural research has major responsibilities not only in the planning and execution of research in the priority commodities, systems, and factors of production, but also in ensuring that the outputs of research are made available to the client and user communities. The organization and management of research, as has been shown in previous chapters, require the careful translation of government policies and farmers' requirements into active and responsive research programs; the development of required physical infrastructure; the mobilization and effective utilization of human and financial resources; and the generation of appropriate research output and information that contribute to improved agricultural productivity. But the research process does not and should not end in the generation of outputs, since these outputs are not an end in themselves; they are a means to an end. The output must be made to flow to and influence extension workers, farmers, and other producers, private sector entrepreneurs, policymakers, the public, and any other group of clients that have direct or indirect contributions to make to the overall objective of growth and sustainability in agricultural production and productivity. The research service therefore needs to pay special and particular attention to its linkages.

Desired linkages for agricultural research broadly involve effective two-way communication with policy-makers, technology transfer systems (mainly extension), and technology-users (farmers and producers). Since research must generate and effectively deliver improved technologies specifically developed for the circumstances of a country, it needs to develop within the country effective linkages that involve these two-way communications. These linkages must provide a rational basis for the research priorities and programs selected and carried out, and generate feedback on the performance of the technologies in actual production situations. In addition, other linkages must permit access to relevant external knowledge sources that would further facilitate the effective utilization of available resources and information. In other words, research cannot internalize all aspects of its activities, it must learn to relate outside the system, nationally and internationally, in the process of planning and execution of its research and in the testing and evaluation of its products. Research must therefore be seen as an integral part of the technology development and transfer system, establishing appropriate survey and diagnostic methodologies, documenting research results in forms appropriate for its principal clients and users, and participating in interactive mechanisms to ensure the delivery and application of its outputs.

The review of agricultural research in Zimbabwe shows that DR&SS's principal clients and users can be grouped into six broad categories. These are:

- policymakers;
- extension and technical services;
- farmers and producers;
- scientific community;
- private sector/commercial companies;
- public.

The review tried to assess the existence and effectiveness of DR&SS's linkages to these six categories of clients and users. In analyzing these linkages, special attention was given to the nature of mechanisms, frequency and effects of communications, the needs and requirements of both parties, and the overall benefit of such linkages to agriculture in the country. Recommendations are based on the needs for improvement, taking into account the goals and objectives of the Government, the aspirations of the research service in meeting these objectives, and the desires of the end-users of research results in improving their productivity.

7.1 Policymakers

The category policymakers broadly covers senior public-sector officials charged with the responsibility for formulating Government agricultural and development policies. This group is responsible for crystallizing Government goals, objectives, and pronouncements into concrete policy guidelines for agricultural research. It is this group that produces the raw materials on which agricultural research bases or should base its translation of Government policies into scientific research programs.

DR&SS realizes that it needs to have an effective linkage with this group. The linkage with this group is essential:

- for a two-way communication on problems and opportunities in the agricultural sector;
- for transmitting information on the realistic requirements of research for resources;
- for transmitting information on what can be realistically expected from research and in what time frame;
- for transmission of information on previous and potential impact of government policies on agricultural research and production;
- for the transmission of analytical information on the impact of other government policies on the adoption and application of research results;
- for the sharing of knowledge and information on the actual and potential achievements and impact of research.

These reasons, among others, make it essential for DR&SS to develop and strengthen linkages with policymakers.

At present this linkage is informal and not fully developed between the Directorate of DR&SS and policymakers. This is due to the fact that DR&SS has no section that is specifically assigned responsibilities for research policy articulation, translation, and planning. The discussions with Government and other users on policy matters take place mainly at the level of Director, and even then, the system does not provide analytical information for the Director to participate more effectively in such dialogues. This situation reinforces the team's recommendation for the establishment of a Planning Unit in the Directorate (see Chapter 4).

Such a unit in addition to undertaking the necessary data analysis for research planning and programming should provide inputs into the Director's policy dialogue with government policymakers. It is essential that in doing so the Unit works in close collaboration with the Economics and Markets Branch of MLARR and the relevant analytical and statistical services inside and outside Government.

Dialogue with policymakers should be seen as a continual activity. It is important that research should in addition to periodic verbal dialogue generate written materials (publications) that concisely present information that would be useful to policymakers in articulating their policies and in presenting the case for research to the various echelons of government. Organization of periodic visits and exposure of policymakers and political leaders to research activities in practical situations would also go a long way in maintaining the dialogue and in sustaining policy interest in research.

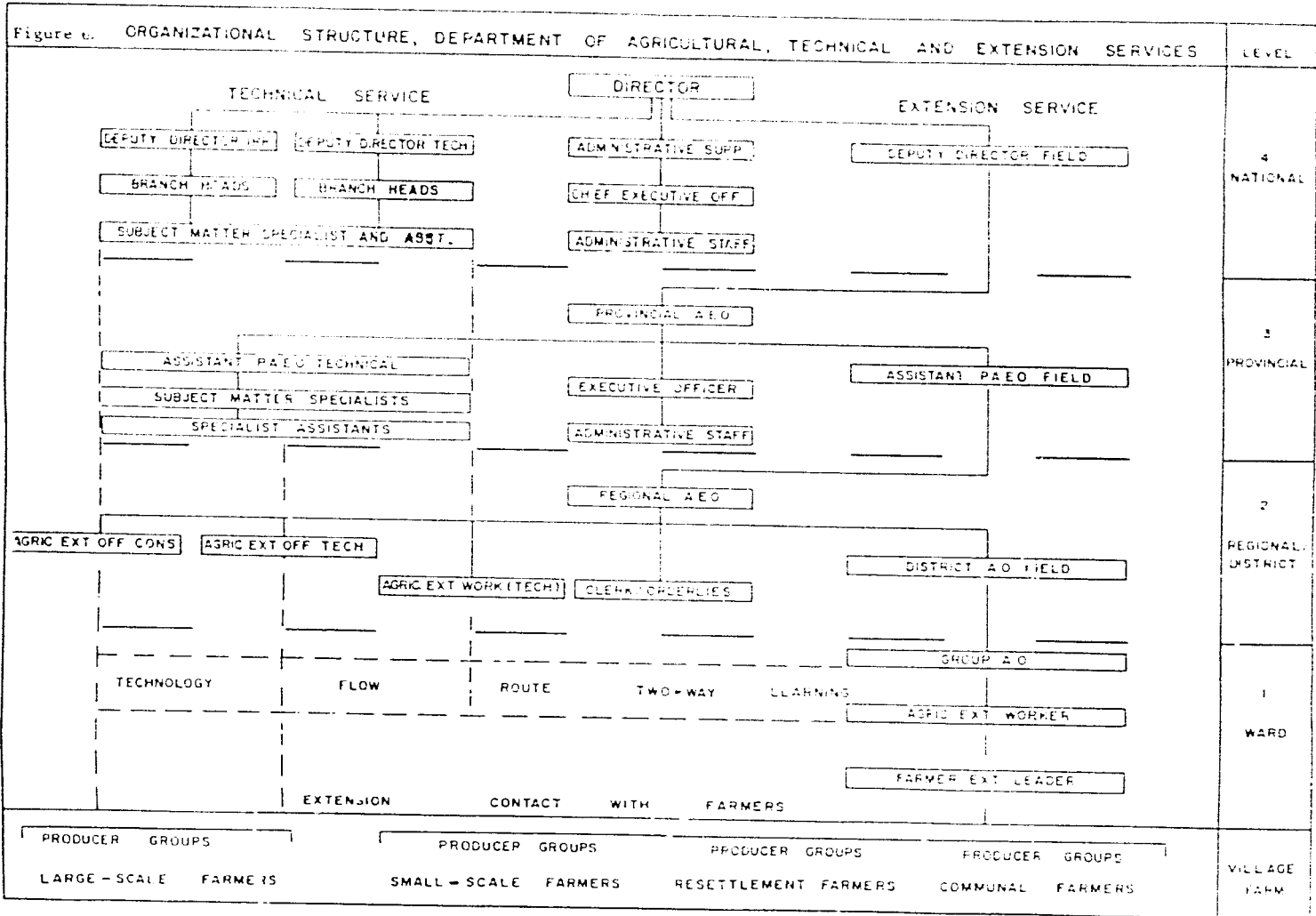
7.2 Extension and Technical Services

By far the most important category that should benefit directly from the output of research and which assists research in the testing, dissemination, and application of its results are the extension and technical services. These services constitute the most important client category because they possess a countrywide network of officers and agents and are in direct contact with farmers and producers. The Department of Agricultural Technical Services and Extension (AGRITEX) plays this important role in Zimbabwe.

AGRITEX is the Department in MLARR charged with the responsibility for providing extension and technical services to farmers and producers in the communal, small-scale, and large-scale commercial sectors of agriculture. With its headquarters in Harare, it is organized into two major divisions of Technical Services and Extension Services, supported by an administrative division comprising administrative and executive officers at headquarters and in the provinces. The Director is assisted by three Deputy Directors: Deputy Director (Field), Deputy Director (Technical), and Deputy Director (Irrigation), and by Branch Heads and Subject Matter Specialists (SMS) and their assistants. AGRITEX has an extensive national network of field and technical services which is organized on a provincial, regional and district basis (see Figure 6). In total about 2000 extension workers provide field and technical services to farmers and producers through this network.

AGRITEX depends on its Technical Services Division to synthesize, distill, and disseminate research results for the use of the field staff in the technical and field services. It would therefore seem appropriate that this Division should be the one to be more directly linked through communication and training with DR&SS, although linkages and interactions with the Field Services in testing of technologies and training would be equally important.

DR&SS recognizes that effective linkage with AGRITEX is fundamental to the delivery of its research output to the users of technology and the primary producers in Zimbabwe agriculture. Until a few years ago there



was very close liaison between both departments with some AGRITEX staff, especially in the Technical Services Division (the SMSs and their assistants) being based at the Harare Research Center. This offered the opportunity for DR&SS research staff to develop close personal relationships with their extension counterparts in commodity and subject areas, and for both formal and informal transmission of information to take place fairly smoothly. Extension was able to link directly into the research process, to become involved in the design and testing of technologies, and to be in a position to continually update its messages for field extension personnel and farmers. That arrangement was discontinued a few years ago and since then there have been spasmodic attempts to bridge the gap between research and extension that was created as a result. The claim that AGRITEX obtains its new inputs into technologies extended to farmers from the annual reports and other scientific publications of DR&SS may not be well founded and seems unsatisfactory. First, annual reports are often very out of date, and most of what is published in them and in other scientific articles published by DR&SS is not in a form suitable for translation, even with the greatest effort, into technology packages and extension messages. These reports are intended for a different audience.

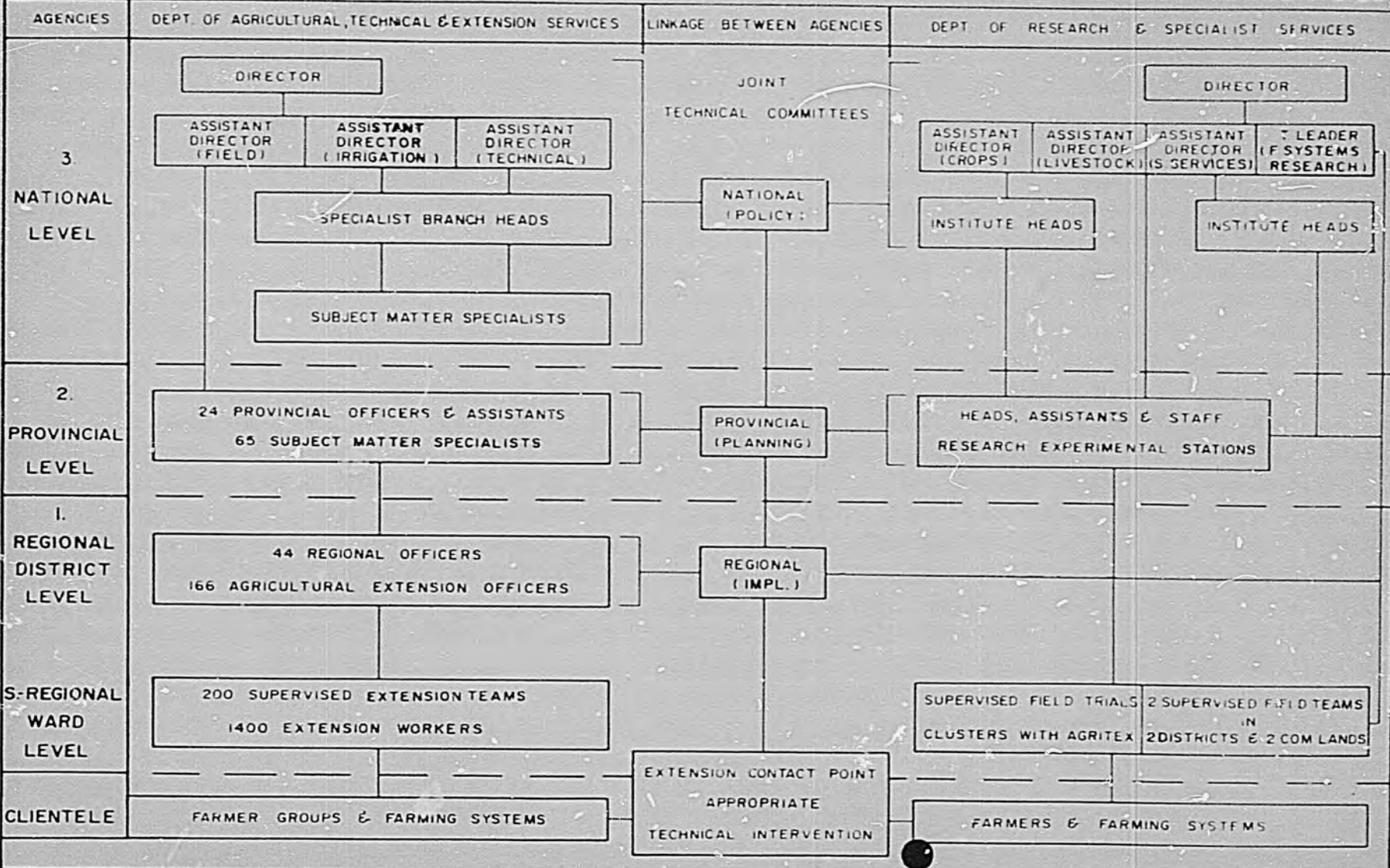
During the process of developing a capacity to undertake research in communal area farming systems, many informal linkages were established between AGRITEX and DR&SS. All institutes in DR&SS undertaking on-farm research have operated through the AGRITEX district network and have used AGRITEX officers to assist with identification of farmer participants, administration of surveys, management of on-farm trials, and organization of field-days and visits. On the other hand, AGRITEX makes use of DR&SS expertise in its training and extension programs.

While these informal links have had problems at times, they have contributed significantly to the development of a model of research-extension linkage and are still very important to both organizations. They promote understanding and respect for the work of each department and develop considerable goodwill on which a more formal base is being built.

In 1985, efforts were made by both departments to enter into dialogue to design a program that would bring about a two-way flow of information on new production technologies. The current World Bank-IFAD Agricultural Extension and Research Project has also focused on this interface between research and extension in its evaluation. In 1986, the Deputy Director (Field) was designated as AGRITEX coordinator on research-extension linkage, and both departments have identified the need for a close, dynamic, and interactive relationship based on formal and informal links. Figure 7 represents an approach which has been suggested by AGRITEX for interaction at the national level through joint technical committees, at the provincial level through provincial planning committees, and at the regional level through regional implementation committees. This is designed to promote the permeation of research results to the extension contact point leading to appropriate technical interventions at the farm level. While the setting up of these formal arrangements may be useful, and indeed essential, for strengthening

Figure 7.

MODEL OUTLINE OF PROPOSED INTERRELATIONSHIPS & LINKAGE TO ACHIEVE AN INTEGRATED RESEARCH-EXTENSION SERVICE SYSTEM



research-extension linkages by planning and offering official support for interactions, there is greater need in research for an even more formal, institutional, and permanent basis for interaction, training, and communication.

The Team noted that the efforts indicated above have in recent times led to closer liaison between DR&SS and AGRITEX. This has developed through the establishment of a joint Committee on On-farm Research and Extension (COFRE). This committee has been given the responsibility for reviewing all proposals for on-farm research, verification, and demonstration trials and for recommending them for approval. The joint participation of DR&SS and AGRITEX personnel in the planning, review, and evaluation of these activities has greatly facilitated cooperation between the two departments in the verification and promotion of improved technologies. In addition several institutes and units of DR&SS have provided inputs into AGRITEX training of its field and extension staff.

COFRE collects research and demonstration project proposals each year from all sources in DR&SS and AGRITEX and compiles a directory. Proposals are then divided on a commodity basis and submitted to the subcommittees for evaluation and recommendation for approval, changes, or discontinuation.

Meetings between DR&SS researchers and AGRITEX staff in each province are organized to discuss the research and extension programs and the subcommittees' comments. Subcommittees are then required to derive or modify technical recommendations from recent research results and in the process identify and prioritize topics for extension or research programs. COFRE organizes monitoring questionnaires and tours of trial and demonstration sites to make recommendations for management and direction. In addition, COFRE organizes joint AGRITEX-DR&SS workshops to program on-farm research and demonstrations according to identified farming problems, national priorities, and departmental capabilities.

COFRE has more recently moved into the areas of formally putting improved technologies together (technology design with inputs from the various Institutes, Services, Units and from AGRITEX). Arrangements are being made to have these technologies verified widely through the AGRITEX network covering the various provinces, districts, and agroecological zones as appropriate throughout the country. The first of such improved technologies to be tested will be that for maize production.

Future Development of Research-Extension Linkages

The Committee for On-farm Research and Extension has proved to be the beginning of a successful model for research-extension linkage. The two key developments in its evolution which have contributed most to its success are:

- a) the penetration of the committee right down to the field workers in AGRITEX which is achieved by having provincial staff on commodity subcommittees;
- b) the focus on real products of agricultural research which was achieved by requiring commodity subcommittees to draw up and modify

production recommendations. The activity is designed to ensure a frank exchange of ideas between the two services and to provide concrete subjects for testing, evaluation, and demonstration.

Future developments should incorporate these two aspects and broaden the scope of research extension linkages beyond on-farm research so as to address the larger issues of clear program objectives and the development of appropriate products and technologies for both research and technology transfer systems. Thus, research-extension linkages would be incorporated into the programming mechanisms in the two departments.

It would seem desirable that the DR&SS should build its intensive and more formal liaison with the extension services on this foundation. It is proposed in Chapter 3 that COFRE will continue these activities until the TAC is set up and becomes fully operational. When TAC is established, COFRE, including its AGRITEX members, would be reconstituted as a subcommittee of TAC and charged with the responsibility for research-extension linkages (Research Extension Liaison Subcommittee - RELSCO). In reconstituting the subcommittee the role of the research stations located in the various natural regions will be taken into account and their participation encouraged, since they are expected to be directly involved in problem diagnosis, technology design, technology adaptation, and technology testing in the natural regions in which they are located. These research stations will also play a principal role in field liaison with AGRITEX field staff and in assisting with the training of agricultural extension officers and agricultural extension workers. Apart from research, technical, and extension services representation, it will also be important to have expertise in the areas of research/extension communication and education, socioeconomics, and publications represented on the subcommittee.

The subcommittee's (RELSCO's) major responsibilities will be as follows:

- a) to serve as a forum for the joint planning and supervision of the design, testing, verification, and demonstration of technologies.
- b) to organize joint workshops, seminars and informal discussions for researchers, senior extension staff and other senior staff in agricultural development;
- c) to assist in the organization, by AGRITEX, of periodic training programs and courses in improved technologies for field extension workers, both at headquarters and at the research stations in the natural regions, and to ensure the inputs of DR&SS into such training;
- d) to coordinate and collate research results from the different Institutes and Units of DR&SS and present these in forms suitable for testing, verification, and dissemination as appropriate through the established organs and mechanisms of AGRITEX;
- e) in collaboration with research stations and AGRITEX, to organize and monitor the demonstration of improved technologies and provide feedback into technology development and technology adaptation research.

The first few years should clearly indicate the nature and quantity of resource requirements for the subcommittee to fully fulfill these responsibilities, and thereby provide a basis for further planning. If necessary, both departments should seek external assistance to strengthen research-extension linkages and communication along these lines. The team feels that this area must be regarded as a priority area in any research development in the immediate future, irrespective of scale of adoption of the comprehensive reorganization recommended in this report.

7.3 Farmers

Prior to Independence, DR&SS had maintained very close and productive relationships with farmers and producers in the large-scale commercial sector. This linkage has continued but does not appear to be as strong as it used to be. DR&SS is developing useful linkages with communal, small-scale commercial, and resettlement farmers mainly through the Communal Area Research Trials, the FSR unit, and some collaborative work with AGRITEX. However, there is need for DR&SS to increase its inputs into programs for training of farmers and producers on a regular basis. The types of training would vary according to the requirement and sophistication of each group, but such training could have a major impact on technology transfer and on feedback to research.

Training of farmers is generally the responsibility of the extension service. While it is not being suggested that this responsibility should now be taken over by the research service, it is nevertheless important that the DR&SS stay in close, direct contact with farmers. Participation in farmer training provides an excellent opportunity for this. In general, DR&SS should become more involved in the continuum of the testing, verification, and dissemination of new technologies to farmers. DR&SS will need to collaborate closely with AGRITEX in these technology transfer processes.

Training for farmers and producers should be supported by suitable published information and demonstration materials, which would serve the purpose of constantly updating the farmers on new and improved production technologies.

DR&SS must recognize this group as one of its most important client groups and constantly review and strengthen its linkage with it.

7.4 The Scientific Community

A research organization as part of the national and international scientific community must pay special attention to its relationship with that scientific community. Again this is for a two-way flow of concepts, information, and materials.

DR&SS is well linked to the scientific community through its annual reports, its scientific publications, and other activities such as conferences, workshops, symposia, seminars, etc., at both the national and international levels. It would seem that DR&SS has addressed itself more satisfactorily to the scientific community than it has to most of its other clients; this is commendable and should be further strengthened. The team recommends that greater opportunities be provided for research personnel to interact more widely with the international scientific

community in order to become more familiar with, and to benefit from, the rapid developments in science and technology elsewhere.

Especially important is the need for DR&SS to strengthen its links with the University of Zimbabwe. The present informal exchanges and interactions need to be formalized with significant potential benefits to DR&SS in postgraduate training, research collaboration (via joint projects), research planning, on-the-job training for potential research scientists, reciprocal teaching and research supervision arrangements, etc. DR&SS should recognize the Faculty of Agriculture at the University of Zimbabwe as an integral part of the national agricultural research system and collaborate closely with it in addressing the major research problems of the country. Some tentative areas in which DR&SS could benefit immediately from close collaboration with the Faculty are agricultural economics, farming systems, pasture science, and horticulture. Together, both should be able to build national capacities in these and other areas for the benefit of Zimbabwe agriculture.

Another important need for the DR&SS to develop closer contacts with the University of Zimbabwe arises in relation to the future availability of highly qualified scientists with a deep and direct insight into the problems of African agriculture. In general, the faculties of agriculture in the Sub-Saharan African countries are organized along academic lines with little direct involvement with the country's agriculture. Few of them have evolved the research and service culture and philosophy characteristic of the Colleges of Agriculture in the United States. These colleges, with their commitment to practical work in relation to problems of agricultural production, help to create a reservoir of scientific manpower -- highly relevant, committed, and well informed -- to run the country's future programs of agricultural research and development. This is the kind of scientific manpower which would be increasingly needed and it is in the interest of DR&SS to help the University to produce this type of scientific manpower. The Faculty of Agriculture in Zimbabwe has already shown a great desire to be involved in programs of agricultural research, and with further encouragement from DR&SS, it can be developed into a pioneer African institution of a specially relevant kind.

7.5 Private-Sector Research

Zimbabwe, unlike most other developing countries in Africa, has the great advantage of well-organized private-sector research in the form of the Agricultural Research Trust, seed companies, and agribusiness units of various kinds. This is fortunate because as agriculture evolves, a significant part of the research responsibility is normally taken over by the private sector. This has been the history of agricultural research in the developed countries with excellent results. In these countries, the private sector not only provides a wide range of services and does a great deal of extension work, it also undertakes a large part of the adaptive research and commissions and supports some strategic research. One important result of this is that the public-sector research is able to concentrate on technology-generating research of the applied and strategic kind. Zimbabwe must obviously take full advantage of its unique position. The DR&SS should further strengthen its cooperative research programs in selected areas with the Agricultural Research Trust

and other units. This would help to maximize the spillover benefits in the communal areas from the private sector research. As the agronomic environment in the communal areas improves with the intensification of research in the field of soil and water management, some of the technologies developed for the more favorable areas would begin to find application in the drier lands.

7.6 Department of Veterinary Services

At present DR&SS linkage with Veterinary Services is largely informal despite the strong collaboration that exists between Veterinary Services and DR&SS livestock research stations, dairy services, the farming system research unit, and the chemistry and soils research institute. This collaboration should be formalized and strengthened by having Veterinary Services personnel participating in all the relevant DR&SS programs and in the RELSCO.

7.7 The Public

In general, DR&SS's public image is good. This is probably due to the general health of the food and agriculture situation in the country. However, DR&SS needs to interact more with the public, in particular via the media, in order to present its latest findings and its contributions to the agricultural sector in simple and more concrete terms. The upgraded Information Management Unit would need to pay particular attention to this aspect of linkage and periodically produce and publish materials that would sustain public interest, support, and goodwill. DR&SS already has a strong tradition of holding or participating in field days and other public events at its research stations and institutes. It is important that this tradition be maintained in the future.

CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

- 1) DR&SS has made considerable progress in adjusting its research effort to meet the needs of the communal farming areas, but the technologies that are needed to transform these areas are still not fully available. To achieve the increase in agricultural research capacity that is urgently needed, the Department's budget should be increased (in real terms) by 5% per year for at least the next 10-15 years. It should be pointed out that this is the same rate of growth as has been targeted for the agricultural sector as a whole during the present Five Year National Development Plan 1986-1990.
- 2) There are several arguments that can be advanced in support of the creation of an autonomous or semi-autonomous agricultural research organization. However, at the present time we do not believe that there is a sufficiently strong case for the establishment of this type of agricultural research organization in Zimbabwe. It is, however, true that there are a number of administrative regulations and procedures which are particularly restrictive for an organization like DR&SS which needs to have considerable flexibility in its operations. Therefore, the management of DR&SS, with backing from its parent Ministry, should make concerted attempts to modify those regulations which are particularly onerous, on the basis of submissions and representations to the appropriate government bodies.
- 3) On the basis of a detailed examination of a wide range of possible organizational changes, it is proposed that the reorganization of DR&SS should comprise three major components: the rationalization of a network of research institutes and stations that will directly serve the natural regions through applied systems and adaptive research, the phased introduction of national research programs and changes in the functions and responsibilities of the directorate. The main responsibilities of the proposed nine research institutes would be to generate and test improved technologies for key commodities, factors of production, and production systems for the country as a whole and undertake specialized service and advisory functions. They should, therefore, be mainly engaged in applied research activities. The role of research stations in Natural Regions I to IV would be in the area of adaptive and on-farm research. They will identify in collaboration with the research institutes, the key research priority areas in each of the agroecological zones in which they are located and to adapt technologies for direct use by farmers. This will require close interaction with extension service personnel and farmers themselves in on-farm research and testing of improved technologies.

The research stations should be established or strengthened at Nyanga and Chipinge for Natural Region I, Grasslands and Henderson for Natural Region II, Makoholi for Natural Region III, Matopos for Natural Region IV, and Chiredzi for Natural Region V. In addition,

the Harare Research Center will provide specialized research and services and a focal point for interaction of programs, institutes, and stations. The present experiment station at Makoholi is, in fact, located in Natural Region IV but is well placed to serve Natural Region III. The establishment of a research station in a more central location in Natural Region III, probably at Kwe Kwe should be considered.

- 4) A more effective organizational arrangement for the Directorate would be to comprehensively redefine the responsibilities of the assistant directors and to establish an Assistant Directorate for Regional Research. More specifically, there would be the following three assistant director positions:

Assistant Director (Crops and Soils)

Assistant Director (Livestock and Pastures)

Assistant Director (Regional Research)

Assistant Director (Research Services)

The Director and the four assistant directors would have overall responsibility for research policy, planning and evaluation of all research and service activities within DR&SS.

A viable alternative to this organizational arrangement would be to have three assistant directorates, one for crops and soils, one for livestock and pastures, one for regional research, and a senior research administrator in charge of research services and operations. Although this alternative involves some decentralization for program organization and scientific leadership and provides for clear reporting relationships, emphasis in senior management would still be research policy, planning, evaluation, and scientific leadership.

- 5) DR&SS should develop eight national research programs, as indicated in the Report, comprising multidisciplinary teams of researchers which focus on specific commodities (or groups of commodities), factors of production, and production systems. The nationally coordinated programs are recommended as an instrument to mobilize the country's limited scientific resources for a selected number of priority problems of agricultural production and to find technical solutions to them through collaborative research. They should help to generate interinstitutional and interdisciplinary linkages both in planning of the experiments and in their execution and they should provide a mechanism for joint evaluation of new technologies through a common set of multilocal trials leading to agreed-upon recommendations for the new technologies. Each program will be headed by a Program Coordinator who will have overall technical responsibility for the elaboration of program priorities and objectives, the delineation of researchable problem areas, and the implementation of the research projects which make up the program.
- 6) DR&SS should take immediate steps to introduce a comprehensive system of resource management designed specifically to meet the needs of the

proposed national research programs. The basis of the necessary resource management system is a set of data sheets which when completed provide detailed information about research objectives, anticipated impacts, and estimates of human, physical, and financial resource inputs. All data are coded and computerized, which enables research management to undertake rapid and precise analysis of the allocation of resources to all types of activities.

- 7) DR&SS needs to develop a systematic framework for assessing past and proposed research activities. A number of relatively sophisticated cost-benefit methodologies have been developed to address these questions. However, in the Zimbabwe context they are likely to have only a limited application, mainly because of insufficient data. Nevertheless, other simpler techniques and methodologies could be used which would enable DR&SS to more objectively assess future research needs and priorities.
- 8) A Technical Advisory Committee (TAC) should be established in DR&SS which should meet at least every six months in order to review research programs and other research and service activities so as to ensure that the Department's overall objectives are being fulfilled as effectively as possible. Membership of the TAC would include the Director, Assistant Directors, the Head of the Planning Unit (see below), some senior researchers, some program coordinators, and the Director or senior representative of AGRITEX. The Agricultural Research Council should continue to play its important advisory role concerning agricultural research activities in Zimbabwe as a whole.
- 9) DR&SS urgently needs to develop a medium-term strategy which clearly sets out its main research priorities and objectives and corresponding resource requirements and allocations. This strategy statement is required not just for internal technical/scientific purposes but, equally important, to demonstrate to government and its clientele that the Department has a clear sense of direction and thus it will serve as a powerful tool in generating both political and financial support.
- 10) The strategy should be based on careful assessment of the correct balance between applied and adaptive research activities. There is a danger that undue emphasis may be given to adaptive research especially as DR&SS comes under increasing pressure from government and farmers to produce research results that can be adopted as soon as possible. While this pressure is healthy, it must be recognized that most of the technological advances that are required in the communal farming areas (in particular those in the low-potential regions) can only be achieved by sustained, long-term applied research. Given the need to build up the capacity of the research stations in the natural regions (where the bulk of adaptive research will be conducted) as quickly as possible, probably around 35-40% of all research scientists in DR&SS should be working at these centers by 1995, with the remainder engaged mainly, but not exclusively, in applied research activities at the other research institutes. This has been proposed on the assumption that (a) with a 5% per annum real increase in expenditure, DR&SS will be able to employ about 195 professional staff by 1992; (b) approximately one-third of professional staff time will be devoted to advisory and

service activities, leaving 135 person-years available for research activities.

- 11) In aggregate terms, the Team recommends that at least 70% of all livestock research in DR&SS should be oriented explicitly to improving livestock production systems in the communal farming areas. This will require a significant increase in the numbers of livestock researchers working at research stations in or near the communal farming areas.
- 12) A national farming systems research program should be established as soon as possible. The program should be divided into five subprograms which would undertake systems research in each of the main natural regions in Zimbabwe. With the establishment of these decentralized regionally based teams, the present FSR Unit should be reorganized. In view of the importance of the national farming system program, the Team recommends that a full-time program coordinator be appointed.
- 13) DR&SS should, through an upgraded Human Resources Development and Management Unit, continue to pursue its current training policies and provide detailed estimates of overall training requirements for at least the next 5-10 years. In very broad terms, approximately 15-25 researchers will need to embark on master's degree programs each year during this period. In addition, considerably more high-quality research, especially at the applied level, will need to be undertaken. Probably between 3-6 researchers each year should also start Ph.D. degrees so that in 15-20 years' time, at least 25% of researchers in DR&SS will have received this level of training. DR&SS should continue to employ a group of foreign researchers with the appropriate experience and attitudes whose primary role will be to provide assistance in the two critical areas of supervision and on-the-job training.
- 14) For researchers, the starting points of the main grades should be designed so that the average researcher will normally be promoted after 5-6 years in each of the major grades. This will allow steady career progression for the researcher for at least 30-35 years. The research technician of average ability should normally be promoted to senior research technician after 10 years, principal research technician after 16 years, and to the proposed new grade of chief research technician after 22 years of service.
- 15) There is a general need for DR&SS to strengthen its linkages with clients and sources of research. In particular, there is a compelling need for the strengthening of the existing linkages with technology transfer systems and the establishment of formal linkages with AGRITEX. This is to provide a strong mechanism for the collation, generation, development, and transformation of research results into improved technologies, for constant interaction with extension personnel through communication and training, for the planning and coordination of joint testing of technologies, and for the imbibition and transmission of feedback from extension and farmers on technologies being applied and promoted for adoption.

The team noted the progress made in this regard through DR&SS and AGRITFX collaboration in the joint Committee on On-farm Research and Extension (COFRE) and recommends the formal establishment, under TAC, of a broad-based Research Extension Liaison subcommittee (RELSCO) with more comprehensive terms of reference to address the larger issues of appropriate program objectives and development of appropriate products and technologies for the research and technology transfer system. Such a subcommittee would be built on the successful experiences and characteristics of COFRE and would become an integral part of the programming mechanism in both Departments. An essential Unit which will support the development and functioning of these and other linkages is the Information Management Unit which is recommended for upgrading.

16. There is need for DR&SS to strengthen its inputs into the training of extension personnel and farmers. Participation in training provides an excellent opportunity for the essential interaction with these groups of clients.
17. DR&SS should provide greater opportunities for its research personnel to interact more widely with the national and international scientific community in order to become more familiar with, and to benefit from, the rapid developments in science and technology elsewhere. Especially important is the need for DR&SS to strengthen its links with the University of Zimbabwe and the Agricultural Research Trust. The present informal exchanges and interactions need to be formalized, with significant potential benefits to DR&SS in postgraduate training, research collaboration (via joint projects), research planning, on-the-job training for potential research scientists, reciprocal teaching and research supervision arrangements, etc.
18. The recommendations in this Report represent a vision of the evolution of the Department in the medium to long term in response to the needs and challenges of Zimbabwe. Their adoption may be phased over a period of time so as to create a balanced major element of an effective and efficient national research system.

ANNEX A (November 16 - December 5, 1986)

Sunday 16 November: Arrival of the ISSAR Team.

Monday 17 November: am Meetings with the Director and Chairman of the Task Force.
pm Meeting with the Task Force.

Tuesday 18 November: am Meetings with the Task Force.
pm Task Force -- Analysis of questionnaires.

Wednesday 19 November: am Meetings -- Task Force.
Visit to Henderson Research Station.

Thursday 20 November: Meetings -- Task Force.
Visits to Research Institutes, Harare.

Friday 21 November: Visit to Grasslands Research Station, Marondera.

Saturday 22 November: Review of progress with the Director of DR&SS and Meeting of the ISSAR Team.

Monday 24 November: Visits to Research Institutes and Services.
Visit to AGRITEX.

Tuesday 25 November: am Visit to University of Zimbabwe.
pm Meetings -- Task Force.

Wednesday 26 November: am Visit -- Minister of Agriculture, Lands and Rural Resettlement.
Visit -- Department of Veterinary Services.
Visit -- Information Services DR&SS.
pm Meetings-Task Force.

Thursday 27 November: am Visit to AID Agencies.
Meeting with the Deputy Secretary.
pm Meetings -- Task Force.

Friday 28 November: Visit to Makoholi Research Station.

Saturday 29 November: Review of reports and progress.

Monday 1 December: Visit to Matopos Research Station (P.O'D).
Visits to Research Institutes, Harare.

Tuesday 2 December: Visit to Henderson Research Station.
Visit to Research Institutes and Services.

Wednesday 3 December: am Visit to Research Institutes and Services.
Review of Task Force Reports.
pm Visits to ODA and EEC.

Thursday 4 December: am Visit to Magwende Communal Area.
pm Visit to Institute of Agricultural Engineering.
Meetings -- Task Force.

Friday 5 December: Depart from Harare.

OPERATION DATA SHEET

Provisional identification

Project Sheet no. _____

Operation sheet no. _____

Page no. 1 of _____

1. IDENTIFICATION

Coding

Operation established _____ 19____
month year

Operation Code _____

Title _____

In charge of Operation : _____

Project Leader : _____

Calendar Start _____ 19____ End _____ 19____
month year month year

2. OBJECTIVES

2.1 Operation Objectives : _____

3. GEOGRAPHIC LOCATIONS :

3.1 Stations & experimental sites : _____

3.2 Provinces : _____

3.3 Agricultural regions : _____

SPECIAL COMMENTS

PERSONAL TIME ALLOCATION DATA SHEET

1. IDENTIFICATION

1.1 Name-S : _____
 1.2 Adm. unit : _____
 1.3 Location : _____
 1.4 Year : _____

Coding

 19 _____

2. PROJECT TIME ALLOCATION

Time in m/m

Project Codes

	Time in m/m	Project Codes
2.1	_____	_____0000
2.2	_____	_____0000
2.3	_____	_____0000
2.4	_____	_____0000
2.5	_____	_____0000
2.6	_____	_____0000

3. OTHER ACTIVITIES

3.1 Fellowship-Training	: _____	_____
3.2 Study Tour	: _____	_____
3.3 Meeting abroad-	: _____	_____
3.4 Sabbatical leave	: _____	_____
3.5 Leave without pay	: _____	_____
3.6 Teaching-education	: _____	_____
3.7 Program management	: _____	_____
3.8 Administration	: _____	_____
3.9 Others	: _____	_____

Total m/m _____

4. COMMENTS _____

5. Chief of Department
 Name : _____
 Date : _____
 Signature : _____

6. Staff
 Name : _____
 Date : _____
 Signature : _____

ANNEX C

Production, Consumption, and Foreign Trade Data for Main Agricultural Commodities in Zimbabwe.

Table C.1. Production of Crops, Large-Scale Commercial Sector.
('000 tons)

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Cereals							
Maize	705	887	1713	1121	576	817	1180
Wheat		154	191	200	110	88	199
Sorghum	19	16	24	17	7	17	51
Barley	24	33	33	13			
Oilseeds							
Soyabean	89	58	88	86	91	80	
Groundnuts	11	19	16	8	6	3	
Sunflower	1.4	0.8	1.0	0.7	2	1	
Cotton	145	88	92	105	143	170	
Coffee		5	6	8			
Tea		10	11	10			

Sources: Statistical Yearbook 1985. Central Statistical Office, Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the Agricultural Industry in Zimbabwe, 1984. AMA, Harare, September 1985.

Table C.2. Production of Crops, Small-Scale Commercial Sector
('000 tons)

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Cereals							
Maize	35	38	97	70	23	12	68
Wheat		38	97	70	23	12	68
Sorghum	1.2	0.9	0.8	0.4	0.3	0.5	1.2
Oilseeds							
Soyabean		0.4	0.3	0.3	0.3	0.3	
Groundnuts	7	9	4	1	1	2	
Sunflowers		1	0.7	0.5	1	1	
Cotton		7	3	2	6	10	

Sources: Statistical Yearbook 1985. Central Statistical Office,
Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the
Agricultural Industry in Zimbabwe, 1984. AMA, Harare,
September 1985.

Table C.3. Production of Main Crops, Communal Farming Areas

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Cereals							
Maize	420	700	957	595	285	454	1712
Wheat*	9	9	12	7	11	16	
Sorghum	30	66	100	50	47	37	81
millet							
Rice							
Oilseeds							
Soyabean	n.a.	2	1	2	3	7	
Groundnuts	67	100	95	22	19	46	
Sunflower			7	2	6	15	
Cotton		150	27	26	70	110	

* includes small commercial sector

Sources: Statistical Yearbook 1985. Central Statistical Office, Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the Agricultural Industry in Zimbabwe, 1984. AMA, Harare, September 1985.

Table C.4. Area in Hectares ('000) of Main Crops by Sector 1984/85

Commodity	Ha	LSCS		SSCS/ARDA			CA			Total		
		Ha	%	Rank	Ha	%	Rank	Ha	%	Rank	Ha	%
Maize	200	52.6	1	40	63.5	1	1018	63.5	1	1258	61.5	1
Wheat	21*	5.5	4	"	0.0	"	"	0.0	"	21	1.0	8
Rice	n.a.	0.0	13	1	1.0	6	n.a.	n.a.	"	1	0.05	14
Sorghum	17	4.5	5	2	3.1	4	211	13.2	2	230	11.2	2
millet	17	0.0	13	2	0.0	"	93	5.8	5	93	4.5	7
Barley	3*	0.8	9	1*	1.6	6	0	0.0	"	4	0.2	10
Groundnut	2	0.5	11	5	7.9	3	118	7.4	4	125	6.1	4
Soyabean	41	10.7	3	1	1.6	6	2	0.1	7	44	2.1	5
Sunflower	12	0.5	11	2	3.2	4	30	1.9	6	34	1.7	6
Cotton	75	19.7	2	10	15.9	2	130	12.3	3	215	10.5	3
Vegetables	4*	1.0	8	1*	1.6	6	n.a.	n.a.	n.a.	5	0.25	11
Fruit	3*	0.8	9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3	0.15	13
Coffee	7*	1.8	6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7	0.35	9
Tea	5*	1.3	7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5	0.25	11
Totals	380	100.0	-	63	100.0	-	1602	100.0	-	2045	100.0	-

* 1982/83.

Sources: Statistical Yearbook 1985. Central Statistical Office, Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the Agricultural Industry in Zimbabwe, 1984. AMA, Harare, September 1985.

Table C.5. Exports of Major Agricultural Commodities (\$Z million)

Commodity	1980-83	1984
Maize	30.6	-
Barley	3.4	3.6
Animal feeds	4.3	6.8
Tea	7.1	25.5
Coffee	12.6	29.8
Cotton (lint & raw)	61.6	115.4
Groundnuts & oil	2.2	0.8
Maize seed	2.4	2.2
Meat	13.0	37.9
Cattle hides	4.5	11.6
Tobacco	193.6	287.3
Sugar	51.6	56.0

Sources: Statistical Yearbook 1985. Central Statistical Office, Government Printer, Harare.
 Agricultural Marketing Authority. Economic Review of the Agricultural Industry in Zimbabwe, 1984. AMA, Harare, September 1985.

Table C.6. Imports of Principal Agricultural Commodities
(Z\$ million current prices)

Commodity	1980-83	1984
Rice	2.2	4.4
Wheat	1.3	14.3
Milk & Cream	13.2	59.9
Rubber	3.8	5.3

Sources: Statistical Yearbook 1985. Central Statistical Office,
Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the
Agricultural Industry in Zimbabwe, 1984. AMA, Harare,
September 1985.

Table C.7. Projected Domestic Demand* for Major Crops, 2005
('000 tons)

	1985	2005	% increase
Cereals			
Wheat	258.0	699.0	171
Rice	9.8	28.5	191
Maize	1969.2	3942.7	100
Barley	9.8	16.1	64
Millet	203.9	409.1	101
Sorghum	95.1	189.3	99
Other	3.0	5.4	80
Root Crops			
Potatoes	25.2	49.3	95
Cassava	64.4	129.2	101
Pulses	28.2	54.3	92
Vegetables			
Eggplant	157.3	306.1	95
Tomato	63.6	127.6	101
Fruits	8.7	15.9	83
Vegetable	92.8	174.3	81
Coffee			
Coffee	1.0	1.9	90
Tea	3.8	6.9	81
Fiber	0.0	0.1	
Rubber	4.2	6.2	48
Cotton			
Cotton	12.1	16.9	40
Fodder	52.0	102.4	97

* Based on intermediate projects used in SADCC Agricultural Study

Source: SADCC Agricultural. "Towards 2000". FAO, Rome, 1984.

Table C.8. Annual Diet Required to Sustain the Expected Population of
13.7 Million People in the Year 2000

Commodity	Million tons	Per Capita Requirement		
		Kgs/annum	cal/s/day	Protein grams/day
Maize	2.254	165	1587	32
Wheat	0.478	35	326	10
Other grain	0.109	8	73	3
Oil Seed	0.123	9	95	11
Pulses	0.068	5	44	3
Fruit/Vegetables	0.601	44	42	2
Vegetable Oil	0.027	2	48	-
Dairy Products	0.451	33	59	3
Meat	0.260	19	124	11
Total	4.371	320	2400	75

Source: P.T.W. Murphy. Population, Agricultural Development and Food Supply. Paper presented at the National Seminar on the Dissemination and Utilization of the 1982 Population Census Data for Development Planning, 21-24 January 1986, Harare, mimeo.

Table C.9. Projected Domestic Demand for Livestock Products, 2005

	1985	2005	% increase
Beef	69.5	131.1	89
Mutton	7.0	18.4	163
Pork	11.2	30.5	175
Poultry	11.1	28.9	160
Milk	307.1	530.0	73
Eggs	12.4	21.6	74

Sources: Statistical Yearbook 1985. Central Statistical Office, Government Printer, Harare.
Agricultural Marketing Authority. Economic Review of the Agricultural Industry in Zimbabwe, 1984. AMA, Harare, September 1985.