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The Agricultural Research System in Sri Lanka

Joint Review Group:
Agricultural Research Group, Sri Lanka
International Service for National Agricultural Research

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LIST OF ACRONYMS

ADA	Agricultural Development Agency
ADB	Asian Development Bank
APCC	Asian and Pacific Coconut Community
ARTI	Agrarian Research and Training Institute
AVRDC	Asian Vegetable Research and Development Centre
CARI	Central Agricultural Research Institute
CARP	Council for Agricultural Research Policy
CCB	Coconut Cultivation Board
CDA	Coconut Development Authority
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CIP	Centro Internacional de la Papa
CRB	Coconut Research Board
DA	Department of Agriculture
DAPH	Department of Animal Production and Health
DMEC	Department of Minor Export Crops
FAO	Food and Agriculture Organization of the United Nations
FD	Forest Department
IBRD	International Bank for Reconstruction and Development
ICAR	Indian Council for Agricultural Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IITA	International Institute of Tropical Agriculture
IRRI	International Rice Research Institute
ISTI	In-service Training Institute
JEDB	Janatha Estates Development Board
LUD	Land Use Division
MADR	Ministry of Agricultural Development and Research
MCI	Ministry of Coconut Industries
MF	Ministry of Fisheries
MFP	Ministry of Finance and Planning
MHE	Ministry of Higher Education
MLLD	Ministry of Lands and Land Development
MMD	Ministry for Mahaweli Development
MPI	Ministry of Plantation Industries
MPlan I	Ministry of Plan Implementation
MRD	Ministry for Regional Development
MRID	Ministry of Rural Industrial Development
MTS	Ministry for Trade and Shipping
NARA	National Aquatic Resources Agency
NARESA	Natural Resources, Energy, and Science Agency
NIPM	National Institute of Plantation Management
NLDB	National Livestock Development Board
PGIA	Postgraduate Institute of Agriculture, Peradeniya
RRC	Regional Research Centre
RRI	Rubber Research Institute
RTWG	Regional Technical Working Group
SPC	State Plantations Corporation
SRI	Sugarcane Research Institute
SRRP	Smallholders Rubber Replanting Project
TRI	Tea Research Institute
TSHDA	Tea Smallholders Development Agency
UGC	University Grants Commission
UNDP	United Nations Development Programme
UPFA	University of Peradeniya, Faculty of Agriculture
UPVMAS	University of Peradeniya, Faculty of Veterinary Medicine and Animal Science
USAID	United States Agency for International Development

CHAPTER 1: INTRODUCTION

The Government of Sri Lanka is undertaking a comprehensive review of the country's agricultural production and the food situation in order to develop a coherent framework of policies, programmes, and projects to achieve the objectives set for agriculture, food, and nutrition. At the National Agriculture Food and Nutrition Strategy workshop held at Kandy 19 to 21 April 1983, research workers were asked to contribute to this review. A meeting was arranged at the Ministry of Finance and Planning, and the Agricultural Research Group was instituted including representatives of all main agricultural research institutions (see Annex I), and the National Planning Division of the Ministry of Finance and Planning undertook secretarial duties. In this context, agricultural research includes all annual and perennial crops, livestock fisheries and forestry, and those elements of natural resources used by agriculture.

The group recognized the urgent need for a comprehensive review, analysis, and evaluation of the agricultural research system in Sri Lanka as an initial step to proposing measures for improvement. The Terms of Reference for the study were formulated and the subcommittee to implement it was selected from the members of the Agricultural Research Group (See Annex I).

The Terms of Reference consisted of two broad sections. The first called for a description of the current situation in all institutions including research structure; manpower resources and conditions of service; administrative and financial structure; and priority and policy guidelines. The second section called for an analysis of the wide range of linkages between research institutions and the national and international bodies; an assessment of how well national priorities are reflected in the research programmes of the various institutions; a comparison of alternative research structures and organizations; and finally, preliminary suggestions for projects to strengthen the agricultural research system in order to improve its role in the national development of agriculture.

It was agreed that the study should be carried out in three phases. Firstly, the subcommittee would design a questionnaire (see Annex I) to be sent to all research institutions. The responses to the questionnaires would be followed up by field visits by subcommittee members and a preliminary report would be presented to the Agricultural Research Group for comment. In the second phase, a team from ISNAR would be invited to join the subcommittee to consider especially the second section of the Terms of Reference; and to prepare a final joint report. The third phase would concentrate on the preparation of a project proposal to be submitted for funding to international or bilateral donor agencies.

Questionnaires were distributed in August 1983, and interviews at research centres were carried out by members of the subcommittee during September and October 1983. From the information obtained, the subcommittee prepared a preliminary report on the main issues and problems together with proposals for their resolution. On 8 November 1983, the Agricultural Research Group approved the preliminary report subject to a few amendments.

An invitation was sent to ISNAR on 18 August 1983 by the Director of Planning Division of the Ministry of Finance and Planning. Agreement by ISNAR to participate was indicated by the Director-General, Dr. W.K. Gamble, on 29 August 1983. Following the preliminary visit made by Dr. M. Lagg on 6 to 9 September 1983, the team from ISNAR arrived on 6 November 1983. (Members of the team members are given in Annex I).

The subcommittee's preliminary report was made available to the ISNAR team, together with copies of the reponses to the questionnaires. A detailed itinerary for the team to include meetings with officials from a wide range of ministries and agencies, either actively involved in research or in the application of research results, was planned with the subcommittee. Most of the main research institutions were included. The detailed itinerary is given in Annex I.

Discussions between the ISNAR team and the subcommittee sharpened the definition of the major issues, and a summary of main points was presented to the Director of the Planning Division of the Ministry of Finance and Planning prior to the departure of the ISNAR team on 30 November 1983. It was agreed that the ISNAR team would redraft the preliminary report, incorporating extra material and the agreed conclusions from their joint discussions. The draft report would then be considered by the subcommittee and the Agricultural Research Group.

The members of the joint review team would like to take this opportunity of thank all those in the ministries and agencies of the Sri Lankan Government who made them so welcome and gave their time so generously and helpfully. They are also grateful to the United States Agency for International Development for making available to the National Planning Division the valuable services of a consultant, Dr. R.J. Jiron. Special thanks are due to the Government of the Netherlands for financing the involvement of Sri Lankan staff in the exercise, and for the provision of transport in Sri Lanka. The excellent cooperation of Mr. S.W. Bruinsma of the Royal Netherlands Embassy was particularly appreciated.

This report begins with a general consideration of the role of agricultural research in development in Sri Lanka, followed by a review of the main features of the agricultural research system. The following section addresses issues on the determination of research priorities at national, institutional, and research station levels, and then factors involved in the implementation of the national research programme are considered. Finally, conclusions and recommendations are presented.

(Addendum. The joint report was presented to the Government of Sri Lanka in June 1984. It was used as the basis for a presentation of a Review of the Agricultural Research System to a Policy Level Workshop of National Agriculture,Food and Nutrition Strategy in February 1985, and subsequently in the preparation of a Sri Lanka Agricultural Research Project by the National Planning Division in October 1985 for consideration by the World Bank for financing. Clearance of the report by the Government of Sri Lanka for wider publication by ISNAR was given in September 1986.)

CHAPTER 2: THE ROLES OF RESEARCH IN AGRICULTURAL DEVELOPMENT

2.1 AGRICULTURE IN THE SRI LANKAN ECONOMY

Traditionally, agriculture has been the mainstay of the Sri Lankan economy and has remained so into the 1980s, maintaining its share of gross domestic product (GDP) at about 27% (see Table 1). Agriculture has also played a vital role in providing about 50% of employment in the period 1971 to 1982. The overall value of agricultural production grew encouragingly at about 4% per annum in the period 1978 to 1982 (see Annex VII, Table VII.1). This has been due to a rise in the contribution of commodities produced mainly for domestic consumption, because there has been a steady decline in the share of the traditional export crops. The particularly sharp rise in rice output of more than 5% per annum in the period 1977 to 1982 was due to the development of more irrigated land, and to the contribution of agricultural research to improved water management, and the breeding of new varieties which are quicker maturing, shorter stemmed, fertilizer-responsive, and disease resistant, and which have facilitated double-cropping and permitted higher yields. Consequently, Sri Lanka is now close to self-sufficiency in rice production.

Table 1. Agriculture - percentage shares in the economy

	1971	1976	1979	1980	1981	1982
GDP from agriculture	27	28	27	28	28	27
Agricultural employment	54	53	51	50	50	50
Agricultral exports	91	78	71	63	60	58

Note: This table has been taken in its entirety as published in Public Investment 1983-1987 by National Planning Division, Ministry of Finance and Planning, Colombo, Sri Lanka, 1983.

Although agriculture is still the main foreign exchange earner, its proportion of the total exports has declined from 71% in 1979 to 58% in 1982 (Table 1 and Annex VII, Table VII.2). This has been partly due to the increase in the value of industrial exports, and partly due to the disappointing production of the main tree crops. Until recently, the three main agricultural exports were tea, rubber, and coconuts, but in 1982, coconut was replaced in third place by a group of minor export crops, which includes cocoa, coffee, cashews, pepper, cloves, and various other spices, medicinal plants, and herbs.

In the constant competition for international markets, agricultural research has made an important contribution to the maintenance of export earnings. This is especially true of tea where research has allowed new markets to be developed to supplement the relatively inelastic traditional European markets. Improvements in production and processing techniques have also contributed to the expansion of rubber exports. Recently, more attention has been paid to the production of minor export crops. This is reflected in the rapid expansion of their export value, which has doubled since 1980 (Annex VII, Table VII.2).

The most disturbing aspect of the basically healthy Sri Lankan economy is the deteriorating balance of trade (Annex VII, Tables VII.2 and VII.3). Since 1978, the value of imports has grown faster than that of exports, mainly because of the growing gap between prices for essential imports and prices for exports, particularly agricultural commodities. Agricultural research has contributed and can continue to contribute to amelioration of the balance of trade deficit by improving production and processing of agricultural commodities, thus increasing their share of export markets, and by developing substitutes for imports.

In 1982, the value of agricultural imports was about Rs 4,000 million, constituting only about 10% of total imports. This is still a formidable amount, and represents a substantial target to be reduced by local production, to be backed up by well-directed research towards feasible improvements in productivity. This is especially the case with rice, sugar, and dairy products. While it would be imprudent to consider a reduction in the use of fertilizer, continuing research on more efficient water use, weed control, variety improvement, and multiple cropping, together with research on economic improvement of soil and plant nutrition, will lead to an increase in the efficiency of the use of fertilizer.

The 1983-1987 Public Investment Programme envisages agricultural research playing a vital role in improving productivity and market competitiveness of crops and livestock to achieve the target growth rate of 4% per annum for the agriculture sector as a whole.

2.2 ROLES OF RESEARCH IN AGRICULTURAL DEVELOPMENT

It is evident from the previous section that Sri Lanka must continue to improve its efficiency in agricultural production, not only to match international competition in overseas markets, but also to make local products attractive in comparison with possible imports, and to improve the standard of nutrition of those involved in non-market production.

It is widely recognized that research has an important role to play in giving the lead for agricultural improvements for development, but there is often failure to recognize how best the various types of research can contribute. In addition, the specific roles of research and the interactions between researchers and those who can benefit from the results of research are seldom considered. Discussion on these points is based on a series of questions:

* Why is research needed?
* What type of research needs to be done?
* How, by whom, and where is the work best carried out?
* What resources are required for effective action?

2.2.1 Why is Research Needed?

Agriculture involves the use of land to grow nonclimax vegetation. This means that certain measures are necessary to displace the natural vegetation in favour of those crops which man wants to grow and use. In a simple system with a limited resource base, output may be stabilized at a low level, with little risk. To increase the output from such a system, additional inputs are needed, thus changing the risk situation in the process.

In traditional systems of agriculture the rate of change was usually slow. Informal systems of research (trial and error) were adequate to support production of sufficient food and fibre for the community, and fuelwood was abundant in the areas not under cultivation. As the demand for agricultural produce began to increase, it became necessary to speed up the rate of change in various production systems. More inputs were needed and as a result more research was required to define these inputs and to find ways of using them effectively. Thus, the informal system at the production level became more formalized, involving specially trained staff working in specialized institutions. Research was needed to increase the rate of change in agricultural production systems, as well as to protect those systems which had already resulted in high levels of productivity. To these ends, advances in science and technology in a wide range of disciplines have been harnessed to improve efficiency and stability in agricultural production. Further progress will continue to depend on scientific research to improve the potential for development.

In established production systems, research has at least two components. One is the maintenance or protection of what already exists, and the other is the provision of the basis for changes in existing practices or systems to increase total output, to develop new products or to reduce the cost of producton. Research is, therefore, one component of the agricultural development process. Although research is essential because it provides the knowledge and materials which permit changes to take place, and it demonstrates the potential that can be achieved, research does not provide the whole framework within which increases in production can be achieved. Many other factors, such as, cost and availability of inputs, access to markets, and remunerative prices, must be in balance before research information and materials can be used effectively in agricultural production systems.

The basic philosophy behind research in agriculture, therefore, is the provision of continually changing technology as one of the essential components for agricultural development.

2.2.2 What Type of Research?

While the basic philosophy behind agricultural research may vary little from country to country, the strategies adopted to define specific objectives within the overall national goals will be influenced by many factors. The most important of these seems to be the significance of the agricultural sector in the general development of the country; the stage of development of the agricultural sector and the national agricultural research system; and the availability of information from outside the country.

In Sri Lanka, agriculture is recognized as having a dominant role in the economy, and agricultural research has a respected history. There are a number of mature research stations, and new institutions are being developed in anticipation of the constructive role they will play in furthering development. However, there are always competing demands for national resources available for development and research, and questions must always be raised about what type and quantity of agricultural research is appropriate in view of the enormous demand for new information to change and protect agricultural production systems.

Information is, indeed, the main product of the research system, even though expressed sometimes in special materials, for example, varieties, breeds, chemicals, and equipment. The major clients are the government, the farmers and fellow scientists, and the research system should be able to provide the following.

It should be able to make available to the government, in an appropriate form, some of the critical information which provides the basis for the agricultural development planning, for example:

* latest opportunities for successful development, but also warnings of potential dangers and limitations in technical details of proposed plans;
* medium- and long-term market forecasting, for both domestic and world export markets;
* the suitability of various agroclimatic zones for the production of the crops and livestock required in competition with other forms of land use;
* detailed technical information about storage, transport, and handling of produce to minimize postharvest losses;
* estimates of the national resources of land, capital, labour, and agronomic inputs needed to carry out the national plans while maintaining or improving the national land capital, especially productive capacity.

The research system should be able to make available to the farmers through appropriate channels, the detailed agronomic and economic information on which production of crops and livestock can be based. This includes the maintenance of existing production in the face of hazards, as well as possible changes in production based on new technology.

It should also be able to communicate its results and conclusions to the world community of scientists.

There is usually little problem in servicing fellow scientists. The identification of problems and opportunities at the farm level and the setting up of relevant research programmes to develop new technologies are well understood and generally accepted by most governments as essential functions of the agricultural research system. However, the role of providing major technical and economic inputs into national agricultural development plans or into the planning of individual projects is not as well understood.

The information needed can come from a variety of sources: direct research within the country on specific problems is essential in many cases, and survey research in all cases. In other cases, interpretation and application of world knowledge in light of physical and economic

circumstances in Sri Lanka are most appropriate, followed up by local testing as necessary. Another important role of the research system is to assess the extent to which research outside Sri Lanka can be adapted for use within the country, and to determine those investigations that can only be done within the country.

The climate in Sri Lanka is favourable to a wide range of crops, trees, and animals. The stated policy objectives emphasize increasing the volume of exports, decreasing imports, and becoming self-sufficient in as many foodstuffs as possible. Increased production of fuelwood, timber, and fish are also important national objectives. This presents a very wide range of researchable topics, not only in production and protection. For instance, what is the optimum combination of crops and livestock on individual farms, given such factors as, the compatibility of these commodities, relative prices and costs of production, and local micro-climatic variations? What are the likely trends in prices of individual farm commodities? What are the most economic sources of power for various groups of farmers: large or small tractor, buffalo or manpower? What is the likely impact on farmers' incentives and/or benefit from a proposed change in taxation? How can maximum benefit be derived from the total national quantity of fertilizer?

These few examples illustate that there are many types of research activities which can assist producers, policy makers, and other researchers. Clearly not all possible commodities can receive the depth of research that would be desirable. Within the national resources available, difficult choices must be made on research priorities and allocation of resources.

A recent analyses by Steppler (private communication) provides a convenient framework to consider which type of research is most appropriate for the range of crops and commodities of varying economic importance. Steppler divides the research spectrum, which is essentially continuous, into five stages or phrases:

* Phase 1, pre-release testing and evaluation in farmer's field;

* Phase 2, adaptation to specific local conditions;

* Phase 3, generation of technology prior to adaptive research;

* Phase 4, identification and assembly of individual disciplinary inputs and of appropriate research methodologies;

* Phase 5, development of disciplinary inputs, synthesis of new materials, collection and evaluation of new materials, and establishment of the understanding of basic organisms and functions.

The spectrum ranges from adaptive research in the farmer's field (Phase 1) to basic research (Phase 5) in specialized laboratories. All stages may need to be brought to bear on a particular problem, however, the main question is how and where the research should be carried out.

The phases have been deliberately numbered in the reverse order to that which might have been expected. This has been done to emphasize, firstly, that it is essential to convince farmers of the value to them of the change or practice proposed, as there is no increased production

without satisfied producers. Secondly, this has been done to emphasize that the first phase of the research is to define the problem at the production end, and to carry out on-site research using existing knowledge and materials. Further problems may be referred to other phases of the research process. This is not to imply that basic research is not necessary to solve farmers problems. Much basic research from all over the world has gone into generating the pool of existing knowledge and technologies. It is only when this fails that more general adaptive applied and basic research is necessary.

The sequence indicated has other important features. In general, the cost of individual research projects increases from Phase 1 to 5, because of the increasing complexity of the facilities and equipment needed. However, Phase 1 research is site-specific: widespread replication is prohibitively expensive. Phases 3 to 5 are increasingly less site-specific, and conclusions are of more widespread application and potentially have great impact, even if they cannot be used directly on farmers fields with confidence. Further, single season results may have immediate significance at Phase 1 level for a few local farmers, while conclusions at Phase 4 and 5 typically take several years to reach, but bring benefit to thousands.

A balance has to be reached depending on the subject and situation in hand: determining this balance is a difficult task for management.

For the main export crops (tea, rubber, and coconuts) and the major foods (rice, sugar, and fish) in Sri Lanka, it could be argued that research should be carried out in all five phases. While the balance may vary from time to time, the capacity to carry out research in all five phases should be available. For other crops and livestock, research need not be carried out in all phases at present. Phases 1 and 2 are location-specific and are essential for development of a commodity within the country. Phase 3 is desirable, but Phases 4 and 5 may not be possible, given current resources and the present apparent agricultural research priorities. However, mechanisms are needed by which these policy issues can be decided.

2.2.3 How, by Whom, and Where Can the Work Best be Done?

This issue has been partially covered in the previous section and will arise again later. Basic and much applied research (Phases 5 and 4) can be done more or less anywhere, but often requires specialized equipment. The generation of packages of component technologies for testing as production practices (Phase 3) usually needs to be done within the country or region of application, preferably by a substantial multidisciplinary group. All scientists need to be well trained in research methodology, with increasingly narrowing focus of specialized knowledge moving from Phase 3 to 5. More complications in staffing and concepts of training arise with respect to Phases 2 and 1.

Adaptive research and on-farm validation (Phases 1 and 2) need to be done at many sites and in on-farm situations. This means that an adequate number of trained staff must be available at this level to carry out the necessary trials. Their two main functions are to interpret and to test at the local level, methods, and materials derived from the other phases of research (done locally or overseas), and to identify and to refer to the appropriate unit those problems and opportunities which may

require further research. The performance of these tasks requires a thorough knowledge of the local farming situation and of production systems. The requirement in terms of professional skills is, therefore, wide and includes the social sciences as well as the more usually accepted biological sciences. Further, for research scientists to be able to interpret existing knowledge in the light of local needs, the ecological characteristics of each area need to be thoroughly documented and their significance understood.

The professional input required in Phases 1 and 2, therefore, can be divided into two: interpretative and deductive on the one hand, and the performance of large numbers of simple trials on the other. All the research scientists need to be well trained in research methodology, as above, but with more accent on interactions between disciplines, rather than excessive depth in single disciplines or special methodologies. The conduct of many single trials is essentially a task for skilled technicians and well-trained observers. It is not a full-time task for research officers, even though research officers may manage and supervise a group of experiments and be heavily involved in planning trials and interpreting results. The research officers at the field level should have strong technical support, and close association with extention staff in the field to ensure appropriate networks of trials. The interpretive and deductive activity of Phase 1 merges into the other phases and also from field stations to central laboratories. It is a continuous operation; each scientist adding his or her special contribution, whether from in-depth disciplinary penetration or from broad interdisciplinary appreciation.

2.2.4 What Resources Are Needed?

Once the research programme has been defined, it is self-evident that adequate resources of trained manpower, materials and equipment, land and buildings, and assured continuity of funding are necessary to carry it out effectively. The type and quantity of resources should be considered in the wider context of planning for implementation of national agricultural research. The overall process is represented diagramatically in Figure 1. As already stated, research priorities are defined with reference to the needs of the main clients and research programmes are formulated on the basis of these priorities. The staff, facilities, and institutions should match the programme as closely as possible, and the programme should be trimmed realistically to match the resources likely to be available. The conclusions from the completed programme must be interpreted and fed back to the clients in a form readily understood and appreciated.

Since a permanent institutional framework is inevitable in most situations, this must have sufficient flexibility in operation to accommodate with maximum economy the continuously changing programmes. Some of the salient features and needs of the research system in Sri Lanka are discussed in Chapter 3. In essence, however, there is no single pattern of resources which is appropriate for all situations. In some instances, strong well-equipped central units with multidisciplinary staff are appropriate. In others, wide dispersion of research, with strong central back-up services, is necessary so that research can be carried out as near to the production situation as possible. The needs of the programmes should determine the resources to be deployed and where, subject to prior decisions on general policy, priorities, and the total resources available.

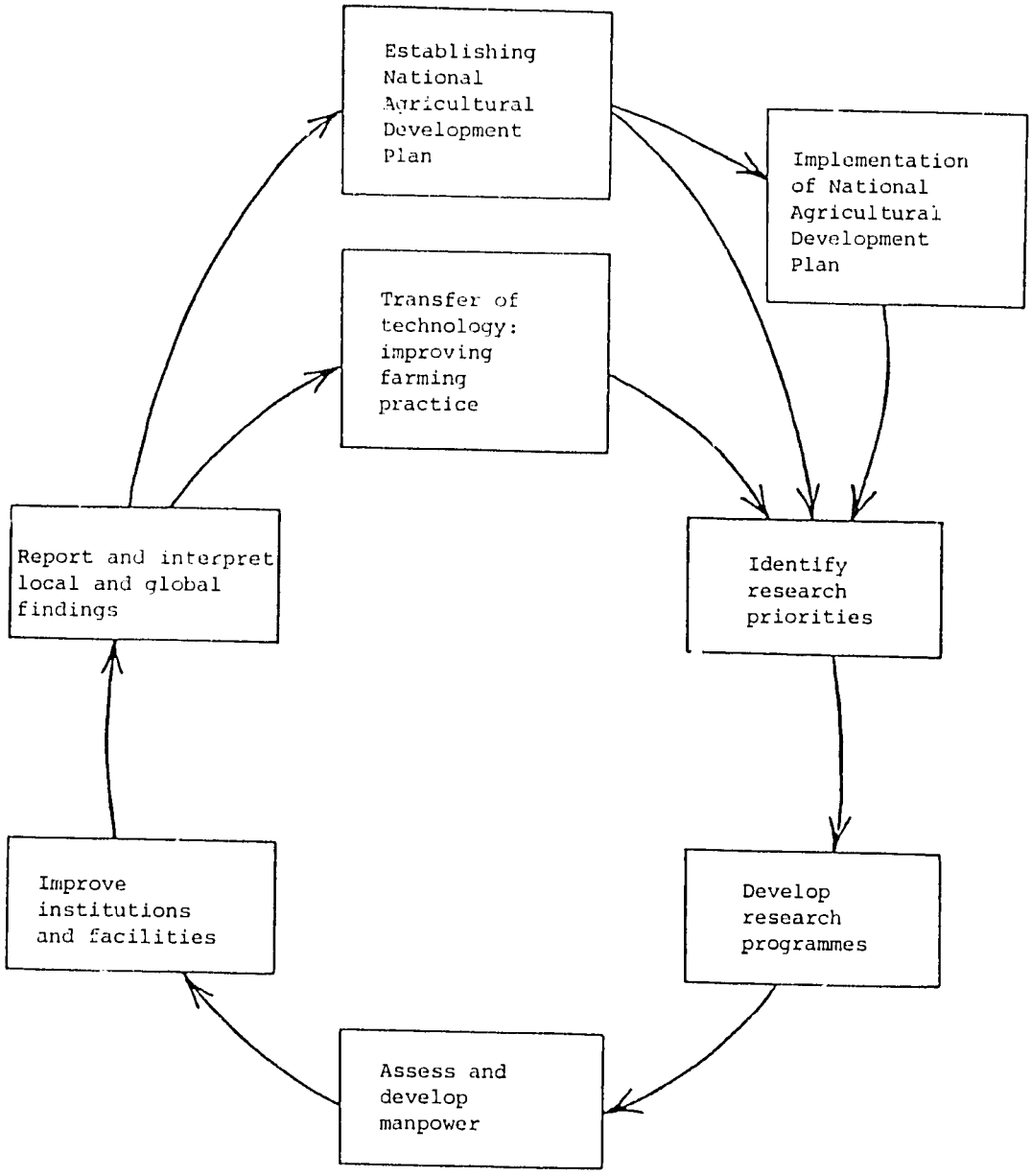

Figure 1. Planning for implementation of national agricultural research

Emphasis should be placed on a good supply of staff trained in research methodology and the provision of a congenial environment in which to work unimpeded by unnecessary bureaucratic controls.

Sri Lanka already has reasonably good physical facilities for research on most of the important crops, and these facilities are well distributed throughout the country. However, research on livestock and forestry are not as well served. There is a substantial number of staff with good basic training, and a reasonable and increasing number have received training in research methodology. Continuous up-grading of the skills of the staff in all research units is essential.

The reward structure for research workers needs to reflect their high level of training and skills, and to sustain their enthusiasm and motivation. It is essential that they have reasonable salary levels, good working conditions, and recognition of the role they play in agricultural development.

In the research units which are controlled by statutory boards and strongly supported from cesses, security of funding for agreed programmes is assured, but in the line ministries, the procedures for the funding of recurrent costs often impede progress. Assured continuity and flexibility of funding for recurrent expenditure is an essential resource in the context of this section.

The total quantity of resources to be applied to research is a national policy issue. Whatever the level, resources need to be applied in such a way as to ensure that research units are of appropriate size, with the appropriate numbers of well-trained staff and provided with adequate facilities so that work can proceed unimpeded on agreed programmes, even if the number of programmes has to be restricted. The temptation to spread resources too thinly needs to be firmly resisted.

CHAPTER 3: FEATURES OF THE AGRICULTURAL RESEARCH COMPLEX IN SRI LANKA

In Sri Lanka, agricultural research is carried out in at least 15 separate research institutes and departments which function under seven ministries and the Office of the President. In this chapter the agricultural research complex is briefly outlined and the salient features discussed (for further information, see Annex II).

3.1 PRESENT ORGANIZATION

Research institutions in Sri Lanka can be divided into two groups: those within departments of individual line ministries and; those which are statutory bodies set up by Acts of Parliament and governed by boards. The latter are semi-autonomous units operating within ministries but operational details differ amongst ministries.

3.1.1 Ministry of Agricultural Development and Research (MADR)

MARD has responsibility for research and development for all crops except for rubber, tea, coconuts, and cashews. Within the ministry, research is carried out by 330 graduate staff in four separate units:

* Department of Agriculture (DA);
* Department of Minor Export Crops (DMEC);
* Agrarian Research and Training Institute (ARTI);
* Sugarcane Research Institute (SRI).

The Director of DA and the Director of DMEC report to the Secretary of MADR; the Director of ARTI reports to a governing board (nominated by the Minister) of which the Secretary of MADR is the Chairman. The Director of SRI also reports to a governing board, but the Chairman of SRI reports directly to the Minister.

3.1.2 Ministry of Lands and Land Development (MLLD)

The main responsibilities of MLLD are land use and settlement, especially in the large irrigation schemes. The large Irrigation Research Division is mainly concerned with engineering aspects of irrigation, but two departments within MLLD have small research programmes directly concerned with agricultural production:

* Forest Department: Research Division;
* Irrigation Department: Land Use Division (LUD).

Forestry research, which is mainly concerned with silviculture and timber utilization, currently has only one Research Officer out of a cadre of four. LUD is responsible for the National Soil Survey of Sri Lanka and for land use capability surveys of special development areas. The division is also involved in water management studies in irrigation, and at present has one Land Use Research Officer out of a cadre of four, seven graduate assistant chemists, and about 45 soil surveyors at technician level.

3.1.3 Ministry of Rural Industrial Development (MRID)

The Department of Animal Production and Health (DAPH) within this ministry carries out research mainly on animal health but some work is also done on pastures, and on the feeding of various types of livestock. DAPH, which has a professional staff of about 260, has a Research and Investigation Division with a professional staff of about 30, most of whom are veterinary scientists. There are, however, components in other divisions in DAPH and in livestock development projects which can properly be regarded as carrying out adaptive research. The research component of these projects cannot be quantified readily.

3.1.4 Ministry of Plantation Industries (MPI)

Two major research institutes come under MPI :

* Tea Research Institute (TRI);
* Rubber Research Institute (RRI).

These institutes are statutory bodies controlled by the Tea Board and the Rubber Research Board, respectively. Both institutes are financed out of cesses on exports and have a greater degree of flexibility in their budgetary arrangements than research units operating within line ministries under Public Service Regulations. Each institute has about 30 graduate research officers.

3.1.5 Ministry of Coconut Industries (MCI)

The Coconut Development Authority (CDA) which comes under MCI operates through the Coconut Development Board and the Coconut Research Board (CRB). This board is responsible for research on the production of the crop and on processing of kernel and non-kernel products. There are about 37 graduate research workers in Coconut Research Institute (CRI) which is the main centre for production research.

3.1.6 Ministry of Fisheries (MF)

In MF, the National Aquatic Resources Agency (NARA) is a statutory body with responsibility for research and development of marine and freshwater resources. This unit with about 30 research officers focuses on fish technology and development of freshwater fisheries. It has one main station in Colombo and three substations in course of development.

3.1.7 Ministry of Higher Education (MHE)

There are three main units within the university system which carry out research in agricultural and veterinary sciences:

* Faculties of Agriculture in the University of Peradeniya (UPFA), and in the University College of Ruhuna and of Batticaloa;
* Faculty of Veterinary Medicine and Animal Science, University of Peradeniya (UPFVMAS);
* Postgraduate Institute of Agriculture, Peradeniya (PGIA).

These units represent a substantial resource of trained staff (in excess of 100 in UPFA, 26 at Ruhuna, 23 at Batticoloa, and 25 in UPFVS) but receive very little core funding for research from MHE. Project funding is received from several sources and is used mainly in the postgraduate training programme in which the staff of UPFA and UPFVS are involved. The Deans of the two university faculties, and the Director of PGIA report to the Vice-Chancellor and through him to the University Grants Commission (UGC).

3.1.8 The Office of the President

The Natural Resources, Energy, and Science Authority (NARESA) was established in 1981. While carrying out the functions of the former National Science Council, it endeavours to play an active role in coordinating the activities of various departments and other government institutions involved in research on natural resources, development, and energy. One way in which NARESA supports agricultural research is through grants to individual scientists in the public sector for research on topics of high national priority. The Director General of NARESA reports directly to the President.

3.2 SALIENT FEATURES OF THE AGRICULTURAL RESEARCH COMPLEX

Agricultural research in Sri Lanka has developed in response to identified needs for information on improved production and processing to meet the needs of producers and the objectives of the government. The nature of the country, its agricultural economy, and its political history have all contributed to the way in which the agricultural research system has developed and is currently organized and operated.

Two main groups of research institutions may be distinguished in the agricultural research complex. Firstly, there are three single-crop institutes which service the three main export crops. These institutes are large enough to be self-contained. Secondly, within various ministries there are a number of research units which are concerned with a large number of crops, different types of livestock, and a range of land use situations.

3.2.1 Commodity Institutes

The long-established commodity research institutes for tea, rubber, and coconuts were set up by the planting community to support the production of these crops for export. These institutes are governed by boards, and the director of each institute is assisted by a research committee. The costs are now met by cesses levied on exports in the case of rubber and tea, and by allocation from MCI in the case of coconuts. In the past, the financial operating procedures established by the boards were designed to service the research institutes rather than to control them, except by regular audits. In contrast, financial procedures in line ministries are designed to control expenditure largely in development and administration and have hindered rather than promoted research. Unfortunately, these procedures are being gradually imposed on the research institutes. This trend can only lead to loss of flexibility in the use of funds, delays in making essential purchases, and adverse effects on the research work itself. The trend needs to be reversed.

The area under cultivation of each of these crops is large enough to support a multidisciplinary research group. One of the greatest strengths of these research institutes initially was the close working relations between the users of research findings and the researchers themselves. This relationship has been weakened by changes which have taken place in the last decade, but steps are now being taken to restore this important linkage.

In Sri Lanka, rubber and tea are grown as monocultures; intercropping is not practicable in tea, and although feasible in rubber, the practice is not recommended. Intercropping of coconuts with shallow-rooted species is widespread in other countries and has been shown to be successful in the wetter parts of the coconut growing area in Sri Lanka. The National Livestock Development Board (NLDB) has a large area of land in coconuts under which pastures have been developed for cattle production, but at present little research is being carried out on this important interaction.

3.2.2 Research in Other Ministries

Climate, soils, topography, and the availability of ample supplies of irrigation water in many areas, combine to make it technically feasible to grow a large number of crops in Sri Lanka. Although many different crops can be grown, some have specific requirements and can be grown only on relatively small areas, and others have limited markets. Government policy is to achieve self-sufficiency in as many foods as possible, while at the same time increasing the range of agricultural commodities produced for home consumption and for export. The major commodity research institutes and the group working on rice may be considered to be mature research units of adequate size to meet the changing needs of their respective industries, but other research units have been set-up recently in different ministries and these have increased in size quite rapidly over the last few years. These relatively immature institutions are faced with the formidable tasks of selecting appropriate research topics and of setting up suitable organizations and operational procedures to carry out the research.

In the Research Division of the Department of Agriculture (DA) in MADR, research is concentrated in regional research centres (RRC). At each centre there is a regional technical working group (RTWG) including both research and extension staff, and also trainers from the In-Service Training Institute (ISTI). This ensures that there are close linkages between farmers, extension workers, and research workers. Individual RRCs have been designated as lead stations for specific crops, and all programmes are backed up by research staff at the Central Agricultural Research Institute at Gannoruwa.

The Agrarian Research and Training Institute (ARTI) which is also under MADR, has the main group of social scientists available for research in agricultural development. However, unfortunately, the work of these scientists has not yet been fully integrated into the research of the ministry as a whole.

The Department of Minor Export Crops in MADR works largely independently of the Research Division of DA, but has established links with the commodity institutes and with the universities. There are good linkages between researchers, seed and plant production agencies, and growers in estates.

Apart from specific targets for the production of rice and sugar, researchers in MADR have received little guidance on the market potential of the range of crops which can be grown in Sri Lanka and on which they may be required to do the necessary research. This makes it difficult to set realistic research priorities.

The lack of effective interaction between researchers in MADR and those in CRI, and between those working on crop and on livestock production in a range of farm situations is an unsatisfactory feature of the present organization.

There is only a small research programme in forestry but this is being expanded to include research on watershed protection and fuelwood production. The research programmes on fish technology and on increasing production of fish from inland waters are important features of the overall agricultural research programme. While these programmes can be carried out independently of other agricultural research, interaction may be necessary at a later stage, especially if pond culture of fish is to become a part of the farming system in some areas.

3.2.3 Research in University Faculties

The Faculties of Agriculture, and Veterinary Medicine and Animal Science in the University of Peradeniya have totally inadequate core budgets for systematic research. Both faculties depend on grants from a number of sources for staff training and for the postgraduate training programme under PGIA. While this contractual type of relationship has some advantages, the short-term nature and discontinuity of funding is inimical to the development of strong research programmes and to making full use of the large group of well-trained scientists in the university.

3.3 DISCUSSION OF MAIN ISSUES

The discussion is confined to a few general issues which arise from the nature and operation of the current agricultural research complex.

3.3.1 The Multiplicity of Research Units

Agricultural research is carried out by at least 15 different agencies which have varying degrees of responsibility and authority, and which are located in seven different ministries and the Office of the President. At the operational level, there may be several advantages for this apparent fragmentation of research. One such advantage is that research and development can be closely linked, and this may well account for the success of single-commodity research institutes in a number of countries, including Sri Lanka. The strong linkages between researchers, extension workers, and producers developed in MADR for crops are also of great value.

The multiplicity of agencies, however, complicates research planning at the national level and may lead to an imbalance in the overall research programme and also to the relative neglect of research in some areas, for example, farming systems research which requires involvement of more than one unit or agency.

3.3.2 Single-Crop Versus Multi-Crop Research Units

Both single-crop and multi-crop research units are used to advantage in Sri Lanka. Single-crop research institutes can concentrate resources on a narrower range of problems. When constituted as statutory bodies, they have greater control over funds and consequently over their research programmes. Such institutes are most useful for research on perennial monocrops, especially when the area under cultivation is large enough to support a multidisciplinary research unit.

Multi-crop research organizations, however, can make more efficient use of specialist staff because their talents can be applied to a range of problems arising in a number of crops. In addition, multi-crop institutes are better equipped to carry out preliminary research on potential crops. This is particularly important where the research unit is called upon to work on a range of crops each of which may be important in a small area or production system.

3.3.3 Centralization Versus Dispersion of Research Staff

One requirement for productive agricultural research is a minimum critical mass of highly qualified researchers in a range of disciplines at one location. Thus, where only a few qualified researchers are available, it is often better to group them together in one or a few places, rather than to disperse them widely in different research stations. On the other hand, it is only possible to conduct productive agronomic research under circumstances similar to those where the research results will be used by farmers (soils, moisture, temperature, topography, etc.). This suggests that researchers should be spread out more thinly, instead of being concentrated at only a few locations.

Both types of organization of research staff are used in Sri Lanka. The three single commodity institutes have concentrated most of their staff at their main research stations with a few members of staff (with support from the main stations) at substations in particular areas. MADR, which deals with a wider range of crops and agroclimatological situations, has chosen to decentralize its research and extension programmes in eight regions. Thus, for the time being, until more researchers have been trained at the doctoral level (Ph.D.) there are too few well-trained researchers for each regional station of DA to be fully effective. Initially much of the adaptive research at RRCs can be carried out satisfactorily by those with less specialized training, provided that experienced researchers are available to design programmes and supervise the work. This presupposes that central research services are available for this purpose. Such central services are essential for the development of innovative or opportunity-taking research, in addition to the adaptive and problem solving work which may dominate RRC activities at least in the early stages of development of these stations.

Some programmes requiring specialized equipment or resources are best located at central points to facilitate service and maintenance, for example, HRI chemistry laboratory located in Colombo. Such specialized facilities require skilled technicians and a case can be made for strengthening such facilities so that services could be extended to other research institutes.

3.3.4 Formulation and Control of Research Programmes

The ways in which research programmes are formulated and controlled is to a large extent dependent on whether research staff are concentrated in one main station or a number of substations. Given good policy guidelines, central control is likely to be appropriate in an institute carrying out research on one particular crop confined to a few agroecological zones. For research institutes dealing with several crops and zones, the formulation and control of research programmes may not be as straight forward. Central programme control may be a response to having only a few well-trained researchers at the main centre to oversee and direct the activities of less trained staff at regional centres. In addition, central direction is appropriate for individual programmes which may need to cover many parts of the country.

The primary argument for regional autonomy in formulating and controlling research programmes is that researchers at regional centres are likely to be more aware of the main problems in their regions than those at a distance. Moreover, since local circumstances, and hence cropping patterns and livestock production, vary from region to region, the range of research activities should reflect these regional differences. Regional autonomy can help to make appropriate adjustments in general research programmes.

The Department of Agriculture has centralized control in the series of Integrated Crop Improvement Programmes in which research is carried out at a number of stations in several districts but conforming to a pattern determined by DA. For all other research carried by the DA, there is regional autonomy.

3.3.5 Financial Management

There are major differences in budgetary procedures between some statutory authorities and line ministries which must follow public service procedures. In the statutory authorities, once the budget has been agreed and allocated, the director of the institute or unit has responsibility for its disbursement against agreed programmes, subject to normal accounting safeguards. There is sufficient flexibility to meet contingencies which always arise in research. The director has regular and rapid access to the board on urgent financial matters so that delays are minimized and the agreed research work can continue without interruption. This is very satisfactory in many ways.

For research carried out in line ministries following public service procedures, there are two main problems. Firstly, funds allocated to a given ministry against a research heading are maximum amounts which may be spent. There is no obligation on the recipient ministry to use these funds for the specified research purposes. This is clearly unsatisfactory for long-term research planning. Secondly, when funds have been allocated, the director or deputy director of the research programme does not have sufficient financial authority to use the fund and the resources provided efficiently. Substantial delays are common. In 1983, this resulted in major underspending on capital projects by two institutes, even though the funds were available.

Most agricultural research involves experiments with crops or livestock. These are living entities that will be stunted or die if not fed regularly. A research programme interrupted because of lack of funds is not postponed, it is ended. This dependence on a regular and timely flow of budgeted funds for research is essential, and little can be done to improve agricultural research unless the flow and accessibility of funds can be guaranteed.

3.3.6 Mechanisms for Setting Research Priorities

The setting of research priorities must be considered at different levels. In the broader national context, research priorities need to be set in terms of agricultural development and the macro-economic implications for individual industries or ministries.

Within those industries served by separate research institutes, the boards of these institutes themselves need to set development priorities from which research priorities can flow. There should be a research input into the determination of development priorities, but decisions on these are not the responsibility of researchers. Once broad guidelines have been established, the research director assisted by his staff, extension workers, and users of research results can establish research programmes with clear objectives and within the resources available. The implementation of research programmes is the concern of the research staff. To work effectively, they need support and encouragement, but should not need control in the normal usage of the word as far as the programme is concerned.

With few exceptions, mechanisms for the establishment of priorities at these different levels are generally weak or non-existent. However, it is most important that research programmes are carefully selected so that the limited number of research staff are used to the best advantage.

3.3.7 Interactions between Policy-Makers, Researchers, and Extension Workers

On the whole, the interaction between researchers and extension workers is good. There are, however, weaknesses in the linkages between research and extension when regulatory schemes absorb most of the time of extension staff, as for example, in some tree crops. In some places measures are being taken to improve the linkages between research and extension staff.

Interaction between technical staff (research and extension) and policy-makers is less satisfactory, and there is no effective forum for such interaction to take place. Frequent interaction is not needed, provided that periodic reviews and decisions are subsequently supported by the provision of adequate resources for their implementation.

CHAPTER 4: DETERMINATION OF PRIORITIES AND FORMULATION OF PROGRAMME FOR AGRICULTURAL RESEARCH

A good match between national objectives, research programme formulation, and application of resources in implementation is necessary for an efficient agricultural research system. This chapter deals with aspects of research programme formulation, and its implementation is dealt with in the following chapter. Thus in terms of Figure 1, which shows the overall functions of a national agricultural research system, this chapter is concerned with the first three phases: the definition of clients' needs; identification of areas of high priority for research; and formulation of research programmes in respect of these areas.

There are three main groups of clients for agricultural research: the planners and policy makers at the government level; the producers and processors; and the scientific community. It is essential for a research institution to maintain good linkages with all these groups. The flow of research information and resources in a typical ministry, as described in Chapter 3, is presented schematically in Figure 2. The following points need to be emphasized:

* The information flows are two-way, and quite different from the one-way line of financial and administrative control.

* Of the three crucial linkage points, indicated as L1, L2, and L3 in Figure 2, only L2 is within the domain of financial and administrative control by the ministry.

* The domain for determining the institutional research programme is different from and is greater than that covered by ministerial administrative control. Some guidelines and criteria for the institutional research programme come from outside the ministry and therefore, there should be formal mechanisms to allow them full expression.

* Research target guidelines are transmitted from above to the staff at the research station. Proposals for experiments must also take into account information regarding the farmers' needs. The final national research programme is the aggregation of many individual choices of experiment.

* Policy decisions and plans depend on a reliable flow of information from the research institution, since research has a significant contribution to make.

4.1 LINKAGES

The review team enquired closely about linkages important to the establishment of research priorities at four levels; international, national, institutional, and research station. The detailed responses are reviewed in Annex III.

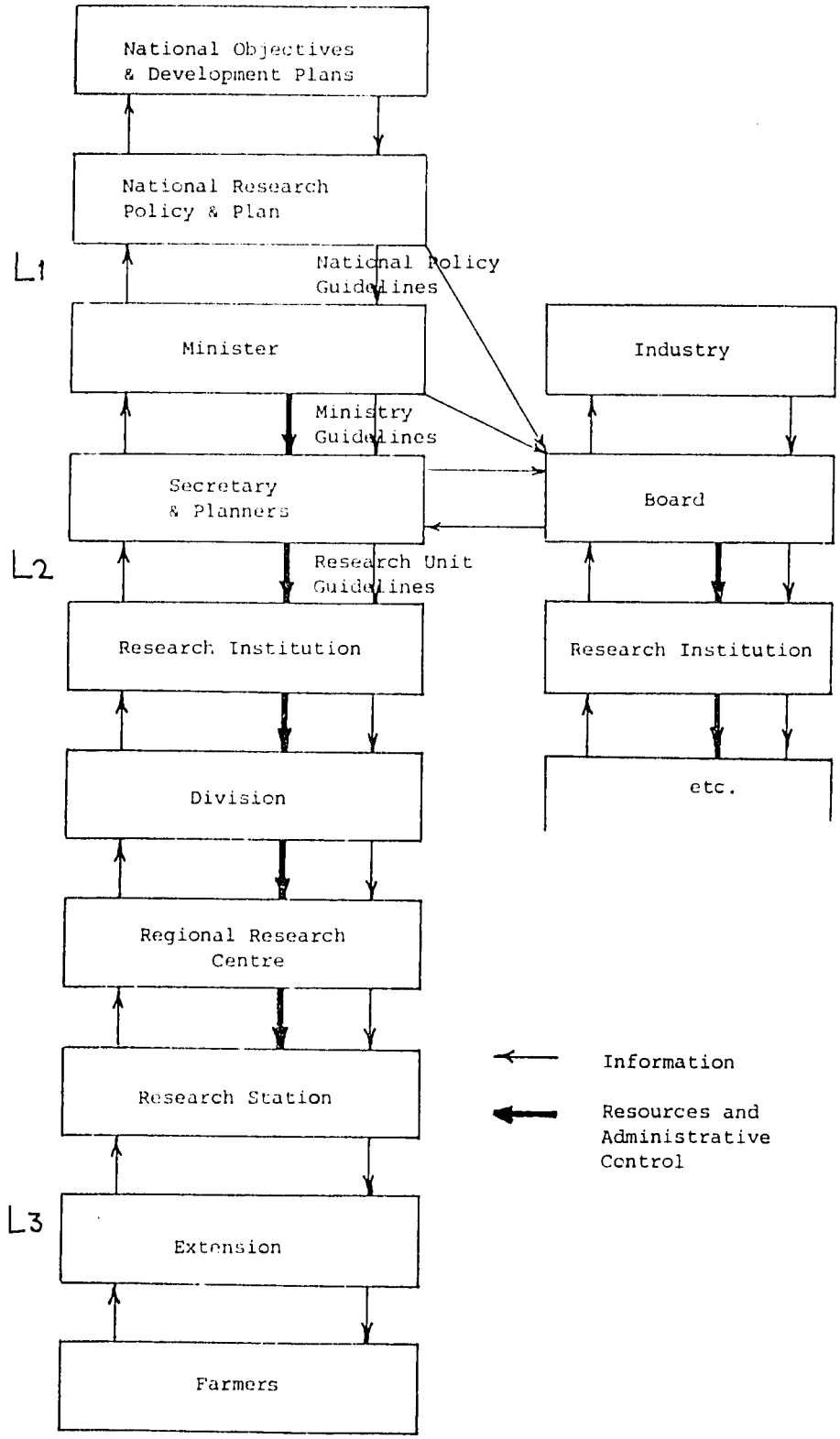

Figure 2. Flow of information and resources in determining the research programme

In general, linkages at the international level were found to be good, but there is room for improvement, especially in library facilities at regional and substations, and in conference attendances, etc. However, other linkages showed areas of weakness. Many scientists deplored the absence of a recognized coordinating body to consider and advise on national research policy, and they urged that mechanisms for better communication between research institutions be established. It was also recognized that relevant research information already available was not being used by the National Planning Division of the Ministry of Finance and Planning. This was ascribed to poor mechanisms for communication with those involved in national policy making, and also to poor presentation of research information by the institutions in a form which can be used for policy and programme development.

This latter point was also strongly stressed at the institutional level: in almost all of the research institutions, communication between the research group and the planners and policy makers about research policy and objectives was considered to be inadequate. At the research station level, inflow of information from extension which could influence the choice of experiments was reportedly very variable among institutions. Few institutions had formal studies of the producers' farming systems.

4.2 DETERMINATION OF AGRICULTURAL RESEARCH PRIORITIES AT THE INSTITUTIONAL LEVEL

Research institutions were in general agreement that most of the interaction between the Secretary of the Ministry and the Director of Research Institution was concerned with financial and administrative matters, and little time was spent on issues of research priorities and programmes. Most institutions recognized the need to improve substantially two-way dialogue on research priority and planning.

It is the responsibility of the research group to provide the Secretary of the Ministry (and/or the Board of the Research Institution) and planners with appropriate information on which to base decisions on realistic development and research priorities. Some of the information required will be technical, referring to development opportunities and constraints as revealed by previous research, but much will necessarily relate to economics, referring to producers' benefits, prices, marketing opportunities, elasticity, incomes, employment, etc., aspects which at present are receiving inadequate research attention. In turn, the policy makers and planners must give firm guidelines to the director of research on major priorities for future research.

The review team considered improvement of communications between the Secretary and planners and the Director of Research to be the most important step in strengthening the national agricultural research service, and that to achieve this an effective linkage mechanism at a high executive level in the ministry is required. It is suggested that an Additional Secretary (Technical Liaison) be appointed with the responsibility of keeping the Secretary and ministerial planning group well informed on the progress and capabilities of the research groups and programmes within the ministry. Working closely with the research institutions, he would be responsible for collecting and interpreting

research information in a form readily comprehended by planners and policy makers. He would have an equivalent role to interpret new development needs in terms of research requirements, and to channel this information to the research division.

The review team considered that the Additional Secretary (Technical Liaison) would need to be assisted by a Technical Cell consisting of, at the least, an economist and a technical scientist. The Additional Secretary (Technical Liaison) would have the authority to call in extra short-term assistance from research, extension, and planning divisions as occasion demanded.

The Additional Secretary (Technical Liaison) would also ensure that input of research information is made to the National Planning Division so that a valid contribution from national agricultural research can be introduced into overall national planning, to enable realistic technical opportunities and obstacles to be more clearly defined. The Additional Secretary (Technical Liaison) would inevitably be involved in servicing the Council for Agricultural Research Policy, or whatever body is deemed appropriate to formulate national agricultural research policy and to supervise certain national rather than ministerial agricultural research.

The creation of such a cell in each ministry with clearly defined responsibilities would go a long way to ensure the relevance of research planning and programming in the achievement of development objectives.

4.3 DETERMINATION OF AGRICULTURAL RESEARCH PRIORITIES AT THE NATIONAL LEVEL: A COUNCIL FOR AGRICULTURAL RESEARCH POLICY

Figure 2 shows only one research institution in one ministry (or Board). However, in Sri Lanka there are several ministries and boards which operate research institutions, within the limited mandate of their own ministerial responsibilities. To show all of these ministries and institutions, the diagram would have to be three dimensional with ministries radiating from a central hub. A body or forum to determine national agricultural research priorities and to provide policy guidelines to the ministries could be at this hub, as suggested in Figure 2.

However, no such forum exists at present. Scientists in all research institutions maintain that a coordinating body should be established to provide a national perspective for agricultural research that is wider than might be expected in individual ministries and boards.

Research and extension staff have also pointed out conspicuous gaps in some research areas which are important to farmers, but which fall between the jurisdictions of the various research institutions, and thus do not receive due attention from any of them. Well-known examples are the intercropping of coconuts with annual crops, minor export crops, or livestock; and the interdependence of livestock and crops. A coordinating body at a higher level could ensure that such fringe areas received appropriate research effort by directing funds to these problems.

The review team considered at length several alternative forms of such a body, taking into account the particular circumstances in Sri Lanka and the functions of such a body. Some of the options considered are discussed in Annex IV.

4.3.1 Agricultural Research Authority

At one extreme (option 1 in Annex IV), all jurisdiction for agricultural research in the country could be vested in an independent Agricultural Research Authority that contributes research information and services to all ministries but is not part of, or controlled by, any particular ministry. This option has many attractive features. It offers a clearly defined structure for controlling and directing agricultural research, with direct and relatively uncomplicated funding procedures. It would provide an excellent opportunity to develop truly national agricultural research programmes. Such an authority could deal well with inter-institutional research problems; and could ensure uniform and appropriate terms of service and operational procedures throughout the agricultural research system.

Currently, agricultural research is spread amongst many ministries, the distribution of which has been determined by strategic allocation of responsibilities for development activities, not the research component. There seems little likelihood in the near future of the unification of these development ministries in agriculture. The establishment of such a comprehensive Agricultural Research Authority would, therefore, require maximum changes in the present ministerial organization, and a long period of readjustment. Moreover, this would also carry a very real danger of dislocating research even further from ministerial development activities and extension, which is already considered to be the weakest linkage in the national agricultural research process. The review team reluctantly concluded that the dangers of reduced development/research linkages outweighed the undoubted appreciable benefits from closer national coordination of research through such an authority. The review team, therefore, recommends that agricultural research should continue to be a tactical element within each development ministry, rather than become a strategic element of development, a junior ministry in itself, in parallel position to other ministries.

It was confidently hoped that most of the essential benefits from close national research coordination could be achieved through less drastic organizational rearrangements but no less dramatic changes in function.

4.3.2 Council for Agricultural Research Policy

Accordingly, two options (options 2 and 3 in Annex IV) were considered which left research within the parent development ministries and boards with core support funding under direct ministry or board control, and required the establishment of a Council for Agricultural Research Policy (CARP). The Council would be responsible for developing national agricultural research policy, and for some allocation of incremental funding to research projects of high priority. A major issue is how much of the incremental funding the Council should control to make an impact strong enough to encourage ready collaboration between institutes.

At the lower limit, (option 3) the Council would be s rictly advisory, influencing incremental allocation to ministries through recommendations of high priority programmes to ministries and to the Ministry of Finance and Planning. Given a high measure of goodwill and cooperation between ministries with operational research units, such an

arrangement could perhaps be effective. However, the review team considered it to be unrealistic to expect effective cooperation unless the Council had a measure of independent financial strength (option 2). The question remains as to how much strength would be appropriate. Later, it is proposed that the Council should at least control funding for inter-institutional research projects and for a systematic postgraduate training programme.

4.3.3 Agricultural Research Policy Planning Committee

A fourth option which has the advantage of invoking the least change to the existing ministerial organization would be the incorporation of the Additional Secretaries (Technical Liaison) into an Agricultural Research Policy Planning Committee to advise the government on research issues of high priority. An extension of this (option 5) could involve the group of seven Secretaries themselves meeting occasionally as a Council, and serviced by the group of Additional Secretaries (Technical Liaison) which would meet more frequently. However, it was considered that such a group, in that setting, would not be sufficiently independent, and each member would be too committed to his own ministry line.

4.3.4 Membership of a Council for Agricultural Research Policy

The review team concluded, therefore, that membership of an appropriate national coordinating body should be broadly representative of all groups concerned with the contribution of research to agricultural development. This body should have significant authority to determine national agricultural research priorities, and have authority over the distribution of some funding for agricultural research, but essentially within the existing ministerial organization. A Council for Agricultural Research Policy is therefore proposed. Such a Council, consisting of representatives of the major research, planning, and production (user) communities, would be complementary to existing research organizations within the ministries. It would participate in the allocation of incremental funds for research to different institutions and high priority inter-institutional projects.

The Council should be numerically as small as possible, consistent with the appropriate breadth of representation indicated above. Minimum composition could be:

* one Secretary of a development ministry;
* one representative of Ministry of Finance and Planning;
* one representative from NARESA;
* three directors of research institutions; one for perennial crops, one for annual crops, and one for livestock, fisheries, and forestry;
* three representatives of producers and processors; one from JEDB/SPC, one from Chamber of Commerce, and one for smallholder interests to be nominated by the President;
* one representative from the universities;
* one senior scientist of distinction in research or management.

The precise mode of selection of representatives must await Government consideration of the status of the Council. However, it is suggested that, for continuity of service with the Council, appointments should be by name for a fixed period (such as, three years, with one-third retiring each year).

The Council would need the services of a competent secretariat linked closely with the directors of research and the ministries.

In addition to its main strategic tasks to formulate national research policy and to arrange for interinstitutional research projects, the Council would also carry out other functions, such as, improvement of linkages between agricultural research organizations and scientists; maintenance of a comprehensive national register of scientific manpower engaged in agricultural research; supervision of a systematic postgraduate training programme for agricultural research staff; facilitating access to certain specialized central services; development of common methods to evaluate research progress; and provision of coherent articulation of national agricultural research contributions and capacity to planners and policy makers.

It is recommended that, in addition to channelling incremental funds to research institutions, the Council should have an independent role in funding interinstitutional research projects, in implementing a systematic programme for agricultural research scientists, and in other activities as may be prescribed.

4.4 DETERMINING PRIORITIES AT THE RESEARCH STATION LEVEL

Referring again to Figure 2, and assuming well-defined national research priorities from a National Council (L1) and good linkages (L2) between Secretary of the Ministry and Director of research, clearly defined research target guidelines can be passed down the sequence from director to the research stations. The guidelines will become more specific and technical as they descend to the lower levels of the structure, but, nevertheless within the guidelines, there is still a wide choice of experiments and studies open to the research officer at the lowest level.

It is here that the bottom-up process of programme formulation begins. Proposals for experiments from individuals and research stations are steadily aggregated to produce station, regional, and national agricultural research programmes, after such proposals have passed through various reviewing committees. The reviewing process within the various research institutions was found to be quite thorough and efficient. However, the quality and relevance of the final programme depends on the choice of experiments by the research officer at the research station level, and on the criteria used to determine priorities at that point. The needs of farmers should be high on the list of criteria, and therefore, the linkage (L3) between researcher and farmer is critical.

It is imperative that the researcher understands the constraints and opportunities the farmer faces in his total farming enterprise, including crop components, the availability of land and labour, range of social objectives, etc. Many aspects have bearing on the possible value and

application of research results. It is important that research should be focussed on the urgent problems of the farmers, rather than time and energy be wasted on second-order peripheral issues.

Where farms are large and farmers articulate, the flow of information to researchers, both directly and via extension staff, is often adequate. But with smaller farmers, who are not articulate about their technical needs, communication is usually not clear even when research/extension contacts are good. Well-trained professional research teams, which should include at least an economist and agronomist, are needed to analyse and diagnose farming systems requiring improvement.

There seems to be little tradition of such research in most research institutions. The absence of diagnostic socio-economic research at the producer level is a serious weakness in the definition of priorities when formulating research programmes. There are no economists on the staff of many research institutions; and those economists recently posted to Regional Research Centres in the Department of Agriculture, are more concerned with collecting farm records than with diagnostic survey of farmers' constraints. There is an urgent need for more research to clarify and quantify farmers' contracts. The main strength of socio-economic expertise in agricultural research at present is at ARTI, and these researchers could well provide a lead in collaborating more closely with scientists at other research stations in diagnostic studies on small farm management.

CHAPTER 5: IMPLEMENTATION OF THE RESEARCH PROGRAGRAMME

Once the research programme has been formulated on the basis of research priorities, the implementation of the programme involves the organization of the manpower necessary to carry out the programme, and the provision of facilities and funds to enable them to function efficiently. Both factors are inextricably linked with the determination of research priorities and programmes, as the research programmes must also be determined in relation to the manpower likely to be available, and the whole system is constrained by overall national funding for research support for agricultural development. This chapter examines the resources allocated to national agricultural research and the various research institutions. It also reviews the research manpower available, conditions of service, and the facilities available; and considers future needs and the organization of research in the system.

5.1 INVESTMENT IN RESEARCH AND ALLOCATION OF RESOURCES

From the completed questionnaires it has been possible to review the allocation of funds to the various research institutions, and to examine the overall allocation of resources to research* in relation to the contribution of agriculture to the economy.

5.1.1 Allocation by Commodity

Recurrent research expenditures on major agricultural commodities in 1983 in relation to their value production in 1982-1983 are given in Table 2. The share of resources for food crop research is about 8% higher than the share of food crops in overall value of production; thus it is reasonably in balance. The export crops receive appreciably (45%) more for research than their share of production value alone would justify. Of the export crops, tea and rubber are especially well supported, but the allocation of resources for research on minor export crops is low in comparison with their production value. The most serious imbalances are, however, in allocation of research funds to livestock, fisheries, and forestry, which seem to be considerably underfunded in relation to their value of production. While production value is by no means the only criterion for allocation of research funds, the very large comparative deficit does suggest that the level of support for research in these important production areas should be closely examined.

The figures do not suggest that rubber and tea research are over funded; in fact, the actual cost per scientist (Table 3) and low level of support staff show there is room for improvement. As already stated, these are mature tree crops worthy of multidisciplinary research teams to protect and enhance the massive investment already made. Other crops may not yet merit such extensive research teams, but their stature and potential must always be kept in review. Rubber, tea, coconut, and rice are the only crops currently with substantial multidisciplinary teams.

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* It was not possible to gain a clear picture of the contributions made by donors outside the prescribed budgets of the institutions. Most contributions to recurrent funding, at least, are included in the analysis. A more comprehensive review should be undertaken to provide a time series of all donor allocations to show any distorting effects in resource allocation to research.

Table 2: Recurrent expenditure on research on major commodities in relation to production value in 1982-1983

	Production value (million Rs)[A]	Percentage of total production value	Research[B] expenditure (thousand Rs)	Percentage of total research expenditure	Congruence Ratio[C]	Research expenditure per thousand Rs production value (Rs)
Food crops research						
Paddy	5,482	23.3	26,547	20.6	0.88	4.84
Other food crops	2,409[D]	10.3	3,032	2.4	0.23	1.26
Sugarcane	1,299	5.5	9,455	7.3	1.33	7.28
Resource management[E]			2,749	2.1		
Socio-economic[F]			13,821	10.7		
Total food crops	9,190	39.1	55,604	43.1	1.10	6.05
Export crops research						
Coconut	3,283	14.0	21,833	16.9	1.21	6.65
Tea	2,302	9.7	21,399	16.6	1.71	9.30
Rubber	1,024	4.4	11,962	9.3	2.11	11.68
Minor export crops	1,645	7.0	3,177	2.5	0.36	1.93
Other grants[G]			6,000	4.7		
Total export crops	8,254	35.1	64,371	49.9	1.42	7.80
Total all crops	17,444	74.2	119,975	93.1	1.25	6.88
Livestock[H]	1,455	6.2	3,826	3.0	0.48	2.15
Fisheries	2,903	12.3	4,000	3.1	0.25	1.38
Forestry	1,710	7.3	1,104	0.9	0.12	0.65
Total all commodities	23,512	100.0	128,905	100.0	1.00	5.48

NOTES:

A) Values in 1983 constant prices. Source of most data, Department of Agricultural Economics, MADR.

B) Research expenditure based on recurrent costs only. Capital costs add at least Rs 50 million, to the total Rs 130 million recurrent costs. The total expenditure for agricultural research would thus be about Rs 180 million or about US$ 7.5 million. This is 0.77% of gross production value.

C) The congruence ratio is the ratio of the percentage of research expenditure on a commodity of the total research budget to the percentage of the production value of that commodity of the total value of agricultural production. A perfect match of research expenditure to production value is 1.00.

D) Value estimated.

E) Land and Water Management, MLLD.

F) Includes economic research at ARTI, and Irrigation/Survey Research.

G) Includes cashew, silk, and also some university grants.

H) Value of livestock production includes sales of meat, milk, eggs, hides and skins, and estimated value animal draft, and manure.

5.1.2 Allocation by Research Institution : Support per Research Scientist

Table 3 shows a breakdown of agricultural research allocation for 1983 to major research institutes based on the responses to the questionnaire. The wide variation in costs at the various institutions demonstrates how difficult it is to use any common yardstick for comparison of research expenditure. Throughout the world, monocrop research stations are found to be more costly per scientist than multicrop research stations, especially when extensive tree-crop estates have to be maintained and where expensive processing research and laboratory activities are concerned. Thus, each research station needs to be treated on its own merits in relation to its mandate. Nevertheless, it is possible to make a few generalizations. In 1983, the estimated overall cost per research scientist was Rs 351,000 per annum (US$14,600 per annum). This parameter or module of support is obtained by dividing the total funds allocated for research by the number of research officers. The module includes the salaries of the research officer and support staff, and a proportion of administrative costs, operating expenses, and annual capital expenditure. This estimated cost per research scientist is remarkably low compared with figures for elsewhere in the developing world. Table 4 shows that there were only two countries out of 67 where the cost per scientist was as low as for Sri Lanka in 1980. This reflects the low level of salaries and support staff per scientist, the average number of technical support staff per scientist being only 1.3 (see also Table 7).

5.1.3 Ratio of Salaries to Operational Funds

In spite of the low level of support staff, the proportion of the total funding for salaries is dangerously high compared with the proportion of expenditure for operating costs, being on average 51% and 49%, respectively. While scales for salaries are a national issue, operating costs usually have international components, for example, transport, chemicals, equipment, and machinery. As a rough estimate, therefore, operating costs for a particular type of commodity research may be expected to be similar in absolute terms in a number of countries. In developed countries where salaries are high, a good balance of funding for research is about 67% for salaries and 33% for operating costs. Where salaries are considerably lower, as in Sri Lanka, but some operating costs must still be high, the proportion of funding for salaries should be very much lower than 67% for equivalent efficiency of research operation and use of well-trained scientists. When the number of support staff per scientist is also lower than optimum, this should be reflected in a still lower proportion of expenditure on salaries. Even a figure of 30% of funding for salaries (and 70% for operating costs) would still be somewhat high for effective research.

It is, therfore, alarming to note that for the Research Division of Department of Agriculture, 69% of funding goes on salaries, and for Minor Export Crops Research Division, 61% goes on salaries. For other institutions, the proportion of funding spent on salaries is even higher. Even the Tea Research Institute, which spends only 32% of resources on salaries, cannot be considered to be well funded for operating costs because of its heavy overheads.

Table 3: Agricultural research allocation by institute and major programme in 1983 (at 1983 values)

Item	Total	MARR				MCI	MPI		MRID	MLD			MF	MHE
		DA[a]	SRI[b]	DMFC Research Division	ARTI[c]	CRI	THI	PPI	VRI[d]	Forestry	Irrigation[e]		NARA	Universities[f]
ALLOCATED CAPITAL EXPENDITURE (thousand Rs)														
Buildings, land, construction	Not complete	9,785		4,985			1,524	419						
Vehicles and machinery	"	1,866											1,000	
Equipment and tools	"	4,635					4	42						
Other (office equipm., books)	"	602		792	75		1,327	431			1,500		1,960	
Total capital expenditure	53,752	16,891	3,045	5,777	75	11,492	611	73	4,921	620		1,500	2,040	
							3,466	965					5,000	
ALLOCATED RECURRENT EXPENDITURE (thousand Rs)														
Personal emoluments	63,617	22,044	3,881	1,921	5,113	10,720	4,738	5,271	2,870	951	2,210		1,888	1,500
Travelling expenses	7,893	1,541	369	128	982	1,940	1,661	1,644	53	35	44		506	100
Supplies and requisites	16,336	5,306	1,585	168	500	4,005	2,202	1,503	363	64	265		375	250
Repair and maintenance	10,301	660	915	66	771	1,152	4,607	1,500	80		50		300	50
Transport, utilities services	19,257	1,399	2,445	94	4,556	3,661	3,437	2,138	460	46	180		841	250
Miscellaneous (grants other)	5,736	829	260	800	640	395	2,754	6		2			90	100
Total recurrent expenditure	124,640	31,979	9,455	3,177	12,562	21,833	21,399	11,962	3,826	1,104	2,749		4,000	2,250
Total expenditure	177,792	48,870	12,500	8,954	12,637	33,325	24,865	12,927	8,747	1,724	4,249		9,000	2,250
Total expenditure 000 US$[g]	7,408	2,036	521	373	526	1,388	1,036	539	364	72	177		375	81
BUDGET ANALYSIS														
Percentage of														
capital/total cost	30.0	34.7	24.4	64.5	6.0	34.5	14.4	7.5	56.2	36.0	35.2		55.5	-
recurrent/total cost	70.0	65.3	75.6	35.5	94.0	65.5	86.1	92.5	43.8	64.0	64.8		44.5	100.0
emoluments/recurrent cost	51.3	69.0	41.0	60.5	40.7	49.1	21.5	44.1	74.9	86.6	80.4		47.2	66.7
operating cost/recurrent cost	48.7	31.0	59.0	39.5	59.3	50.9	68.5	55.9	25.1	13.4	NA		52.8	33.3
estimated non-consolidated fund funding/total cost	40.0	32.5	0	58.7	74.6	71.0	9.0	99.0	8.0	36.0	NA		NA	NA
COST PER SCIENTIST														
Number of scientists	506	258	11	23	37	37	33	31	30	3	10		33	30
Total cost (Rs)	351,000	190,000	1,136,000	382,000	341,500	900,700	753,500	417,000	291,600	5 5,000	425,000		273,000	75,000
Recurrent cost (Rs)	245,000	124,000	860,000	138,100	338,000	590,100	648,500	386,000	127,500	3 6,000	275,000		121,000	75,000
Total cost (US$)	14,600	7,900	47,300	16,200	14,200	37,530	31,400	17,400	9,700	4,000	17,700		7,400	3,100
Recurrent cost (US$)	10,200	5,170	36,000	5,755	14,000	24,100	27,000	16,100	5,300	1 ,300	11,500		5,100	3,100
Personal emolument	125,700	86,000	353,000	83,500	138,200	289,700	204,500	170,000	95,700	31,000	221,000		57,200	50,000
Operating cost	119,300	38,000	507,000	54,500	201,000	300,400	444,000	216,000	31,800	43,000	NA		61,800	25,000

NOTES:

a) Includes Research Division, Adaptive Research, Agricultural Economics, and Agricultural Engineering.
b) Breakdown of capital between research and development not clearly specified. Use of foreign funds not clear, partly for capital and partly for recurrent expenditure.
c) A high proportion of ARTI's recurrent funding comes from a Swedish grant of Rs 3.2 million and commissioned research on special projects.
d) Vaccine research is included under costs of veterinary research. Capital pro-rated from total shown in estimates for all animal work in same proportion as recurrent expenditure.
e) Estimated from estimates of the revenue of the GSL, 1983.
f) Illustrative only; not included in analysis. Assumes approximately 30 scientist-year equivalents devoted to agricultural research at universities at average level of Rs 35,000 per annum (Research Officer Grade 1). Other recurrent costs pro-rated on salaries.
g) Exchange rate in 1983 Rs 24 = US$ 1.

There seems to be a clear prima facie case that research scientists are seriously constrained in their work by inadequate funds for operation: the average operational recurrent funding per scientist, (not including salaries), is currently only Rs 119,000 per annum (US$4,900).

5.1.4 Overall Level of Investment in Agricultural Research

When capital allocations are added to recurrent expenditure for agricultural research, the total investment for all institutions covered is Rs 180 million (US$7.5 million) for 1983. This is approximately 0.77% of Agricultural Gross Domestic Product (AGDP) in 1982. Compared with many developing countries, this represents a better than average level of investment in agricultural research, especially when the lower salary rates are taken into account (see Table 4). However, it does include a large proportion of relatively costly monocrop research, and it is far short of the 2% of AGDP suggested by the World Bank as a suitable target to be reached by 1995.

There is certainly scope for more investment in agricultural research, and in view of the sound manpower base for development of research capacity, there is a good case for increasing the level of investment in agricultural research. However, in light of the previous discussion on the need to increase the proportion of operating costs and number of support staff, the first priority for additional funding should be to improve the conditions for research performance of existing staff, rather than increasing numbers of research staff. This implies an emphasis or balance: current vacancies for research staff need to be filled, and there are some areas of research and some disciplines that need to be strengthened.

5.1.5 Funding for University Research

As data were not available on allocation of research funds to the Faculties of Agriculture and Veterinary Medicine and Animal Science, they could not be included in the overall analysis presented in Table 3. However, with a combined strength of 180 scientists, this research capacity should be drawn into the national agricultural research programme by allocation of reliable core funds for research to facilitate long-term collaborative research work with national research institutions on high priority problems.

5.1.6 Stability of Funding

Many institutions expressed concern about the threat of irregularity in funding to the continuity of research projects. Stability and reliability of funding are as important in research as the actual level of funding. Intermittent funding from donors can also have a destabilizing effect, and every effort should be made to ensure there are no disruptions to or distortions of major research programmes as a result of changes in donor funding. A coordinating body for national agricultural research could help focus attention on this issue.

5.2 MANPOWER

The strength of the agricultural research system depends on the quality of the research staff, and Sri Lanka is fortunate in having established a sound basis for growth in its research manpower.

Table 4: 67 developing market economy countries classified in order of 1980 expenditure on agricultural research as a percentage of their agricultural GDP

Country	GNP per capita (US$)[A]	Agricultural research expenditure 1980		Average annual growth rate of agricultural GDP 1970 - 1980 (%)	No. of scientists	Average cost per scientist (US$)[B]
		Thousand US$	Percentage of agricultural GDP			
Expenditure over 1% of agricultural GDP						
Panama	1,730	3,200	5.33	1.9	64	50,000
Zimbabwe	630	10,560	2.42	-0.5	201	52,537
Guyana	570	2,428	1.85	1.0	35	69,371
Argentina	2,390	166,340	1.64	2.6	1,064	156,335
Mexico	2,090	172,402	1.36	2.3	1,950	88,411
Barbados	1,620	767	1.35	0.0	23	33,348
Venezuela	3,630	39,172	1.32	3.8	360	108,811
Mali	190	7,354	1.24	4.4	68	108,147
Senegal	450	9,797	1.21	3.7	105	93,304
Kenya	420	24,052	1.19	5.4	400	60,130
Brazil	2,050	245,000	1.15	4.9	2,957	82,854
Cyprus	1,520	2,411	1.12	1.1	55	43,836
Total		663,483			7,282	93,860
Expenditure between 0.5 and 1% of agricultural GDP						
Fiji	1,150	2,349	0.88	N.A.	22	106,773
Malaysia	1,620	46,334	0.82	5.1	822	56,367
Chile	2,150	10,353	0.81	2.3	281	36,843
Burundi	200	3,610	0.81	1.8	41	88,049
Zambia	560	5,205	0.80	1.8	109	47,752
Ivory Coast	1,150	24,370	0.78	3.4	212	176,594
Togo	410	1,892	0.76	0.8	49	38,612
Malawi	230	4,562	0.75	4.1	276	16,529
Nigeria	1,010	134,964	0.74	0.8	1,084	124,505
Colombia	1,180	38,572	0.64	4.9	333	115,832
Morocco	900	19,981	0.62	0.8	686	29,127
Lesotho	420	465	0.60	2.9	14	33,214
Papua New Guinea	780	5,052	0.59	N.A.	110	45,927
Benin	310	2,403	0.59	N.A.	19	126,474
Uruguay	2,810	4,174	0.59	0.2	222	18,802
Sudan	410	14,636	0.57	2.6	164	89,244
Chad	120	1,602	0.56	-0.3	42	38,143
Tunisia	1,310	6,764	0.55	4.9	285	23,733
El Salvador	660	4,974	0.50	2.8	116	42,879
Total		332,262			4,887	67,990

Country	GNP per capita (US$)[A]	Agricultural research expenditure 1980		Average annual growth rate of agricultural GDP 1970 - 1980 (%)	No. of scientists	Average cost per scientist (US$)[B]
		Thousand US$	Percentage of agricultural GDP			
Expenditure between 0.25 and 0.49% of agricultural GDP						
Bangladesh	130	26,616	0.48	2.2	1,642	16,210
Egypt	580	23,717	0.45	2.7	2,724	8,707
Jordan	1,420	850	0.44	N.A.	35	24,286
Libya	8,640	2,793	0.44	11.1	123	22,707
Pakistan	300	25,277	0.41	2.3	2,834	8,919
Sri Lanka**	270	4,342	0.41	2.8	422	10,289
Guatemala	1,080	4,700	0.39	4.6	158	29,747
Madagascar	350	4,801	0.39	0.1	68	71,779
Tanzania	280	7,219	0.35	4.9	256	28,199
Ecuador	1,270	6,436	0.35	2.4	276	23,319
Bolivia	570	2,808	0.34	3.1	114	24,632
India	240	154,781	0.33	1.9	7,103	21,791
Peru	930	8,912	0.33	N.A.	269	33,310
Turkey	1,470	34,426	0.28	3.4	937	36,741
Upper Volta[C]	274	1,105	0.28	1.2	123	20,463
Paraguay	1,300	3,100	0.28	6.9	63	49,206
Nicaragua	740	1,999	0.27	3.1	63	31,730
Thailand	670	23,276	0.26	4.7	1,525	15,263
Indonesia	430	44,485	0.26	3.8	1,473	30,200
Total		381,743			20,208	18,890
Expenditure under 0.25% of agricultural GDP						
Costa Rica	1,730	2,082	0.24	2.5	75	27,760
Syria	1,340	5,293	0.24	8.2	172	30,773
Korea (Rep)	1,520	29,031	0.23	3.2	960	30,241
Jamaica	1,040	772	0.23	0.7	40	19,300
Mauritana	440	284	0.22	1.1	8	35,500
Sierra Leone	280	698	0.21	2.2	35	19,943
Nepal	141	2,797	0.20	0.5	226	12,376
Cameroon	670	3,786	0.20	3.8	106	35,736
Dominican Rep.	1,160	2,515	0.20	3.1	99	25,404
Philippines	690	16,254	0.20	4.9	1,050	15,480
Zaire	220	5,098	0.20	1.2	97	52,557
Rwanda	200	945	0.18	N.A.	24	39,375
Ethiopia	140	3,400	0.18	0.7	155	21,935
Ghana	420	10,095	0.17	-1.2	352	28,679
Honduras	560	978	0.16	1.5	60	16,300
Liberia	530	394	0.11	4.7	20	19,700
Uganda	300	7,452	0.08	-0.9	175	42,583
Total		91,876			3,654	25,144

SOURCE: Oram and Bindlish, IFPRI Research Report in publication.

A) GNP per capita, agricultural GDP derived from national or World Bank data and growth rates of agricultural GDP (World Development Report 1982).
B) Costs per scientist includes salary and all research expenditure.
C) Excludes costs of expatriate scientists.

5.2.1 Distribution

From the responses to the questionnaire, it was possible to determine the distribution of research officers in each research institution according to level of qualification, B.Sc., M.Sc., and Ph.D. (see Table 5). The research scientists were categorized according to 26 disciplinary groups or research areas. A rough breakdown of the length of service of research officers in the various institutions is also given, although data covered only 87% of research staff.

In total, there are approximately 500 research scientists in the ten institutions reviewed, with about half in the Research Division of the Department of Agriculture. The returns on vacancies were not complete but suggested that there are about 140 unfilled research officer positions of a total establishment of about 640. There are a further 180 well-trained university staff in the Faculties of Agriculture and Veterinary Medicine and Animal Science, who can contribute some of their time to research.

Of the 500 scientists in post, almost half (46%) have either an M.Sc. or Ph.D. degree. This is a substantially better than average level of training for agricultural research staff than in most Third World countries. In the Faculty of Agriculture at the University of Peradeniya the proportion is higher, being 64%.

Moreover, most institutions have an adequate core of scientists with more than five years research experience. However, in the newer institutions, such as, the Research Division of DMEC and some of the RRCs of the Department of Agriculture, the average length of service is less.

Spread of disciplines

Overall, there is a commendably wide spread of disciplines with a reasonable balance. However, there are alarming gaps or weaknesses in certain disciplines, including: pastures and fodders; animal husbandry and nutrition; plant physiology (especially in DA); agrometeorology and resource management, especially in tree crops; social sciences, especially in tree crops; marketing; and forestry. Not so obvious are shortages in expertise in soil microbiology, nematology, and weed science.

Many of the experienced social scientists are in ARTI and the University, and they could make a large contribution to the other institutions in collaborative research efforts. Most research officers in the category "Farming Systems/Adaptive Research" (Table 5) are in fact concerned with adaptive research and not farming systems. This area is not receiving much attention at present, as mentioned earlier with respect to determining priorities at research station level.

Emerging research fields

Science continues to advance at an accelerating pace and major new fields of application in agricultural research are continually unfolding. This is especially true today in biotechnology where potentially very significant advances seem imminent. Massive investments in research in this area are being made in anticipation of massive benefits accruing. With a total of 680 scientists concerned with

Table 5: Number of research officers, level of training and length of service in research institutions and major research programmes in 1983[a]

Discipline or type of research	Total				MADR												MCI				MPI								MRID				ML Forestry & Irrigation				MF				MHE[b]		
					DA				SRI				UHEC				ARTI				CRI				TRI				RRI				VRI								NARA						
	Total	PhD	MS	BS	PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS		PhD	MS	BS
Direction	26	19	7	–	11	5	–		1				1				1	1			1				1	1			1				1											
Genetics and plant breeding	31	6	6	19	3	3	16						2								1		3		1				1	1														
Plant physiology	7	2	2	3			1						1									1			2		2																
Biochemistry and microbiology	14	6	4	4	1	3	1						1	1							1				3		1		1		1										5	8	2
Plant pathology	29	6	7	16	4	3	11						3								1	1	1			1	1		1	2													
Entomology & nematology	25	3	10	12	1	7	9						2								1	1	1		1	1																	
Botany and weed science	12	1	4	7	1	1	5				2											1								2				1								
Agricultural engineering	11	1	2	8			3																			1												1	1			
Climatology, resource management	5	1	3	1		2																											1	1	1						1	3	7
Water management, hydrology	18	–	9	9		5	5		1								2	3																1	1								
Soils and plant nutrition	34	7	15	19	5	9	9						2								6					2			1													
Agronomy and plant science	80	4	33	43	2	20	29		1	5			3	1			3	2			1	3	2		2	4			1	1												
Horticulture	13	–	4	9		4	9																																		3	4	7
Pastures and fodders	2	1	1	–																									1	1												
Animal husbandry and nutrition	3	1	1	1																									1	1	1											
Animal health	17	7	4	6																									7	4	6										4	4	6
Farming systems/adaptive research	15	–	3	12		2	12																																			
Sociology, anthropology, geography	6	1	3	2													1	3	2																							
Economics/agricultural economics	29	4	11	14	1	5	8						1				2	3	6										1	2											5	5	3
Statistics and biometrics	15	–	6	9		1	2				1			1	2		1				1	2			1	1				1												
Technology, chemistry, processing	29	4	6	19		4	2							2								4		1		2		3	2	9									1	1		
Commerce and marketing	3	–	–	3															3																							4	3	3
Fish technology	13	2	4	7																																	2	4	7				
Inland aquatic resources	8	1	2	5																																	1	2	5				
Marine biology	8	1	2	5																																	1	2	5				
Extension/estate management/other	46	–	4	42			28[c]								2			2	2			4				4							2	1			1						30[c]
Total number of staff	506	78	153	275	29	74	155		1	2	8		1	8	14		4	15	18		6	14	17		9	7	15		10	10	11		11	10	9		2	3	10		5	10	18	22	27	28[d]
Percentage of staff by level of training	100	16	30	54	11	29	60		9	18	73		4	35	61		11	40	49		16	38	46		20	23	48		32	32	36		37	33	30		13	20	67		15	30	55	29	35	36[d]
Total number of posts filled				506	258				11				23				37				37				31				31				30				15				33			77 (+4)[d]		
Percentage of unfilled posts					NA				62				30				10				17				28				6				30				35				44			27		
Percentage with length of service (average length of service in years)																																													
5 years or less					44 (2.6)				45 (2.8)				86 (2.1)				71 (2.5)				54 (1.5)				N.A.				46 (2.0)				0				N.A.				N.A.			N.A.		
6 – 10 years					21 (7.7)				55 (8.3)				14 (9.3)				26 (7.3)				23 (6.4)								13 (7.7)				0													
11 years or more					35 (18.2)				0	–			0	–			3 (11.0)				23 (16.4)								39 (17.8)			10 (21.6)													
Sample size as percentage of total and average length of service (years)	87	(6.4)			77	(9.1)			100	(5.3)			96	(3.0)			92	(4.0)			95	(6.5)			N.A.				100	(8.7)			33	(21.6)			N.A.				N.A.			N.A.		

Notes:

a) Source of data, mainly from replies to questionnaire sent to research institutions by Subcommittee.
b) Staff of MHE in university faculties not included in total for all institutes as the time spent on research is not recorded.
c) On training (unspecified).
d) Faculty of Agriculture, University of Peradeniya only. In addition, there are 25 graduates at the Faculty of Veterinary Medicine and Animal Science, University of Peradeniya, 26 in the Faculty of Agriculture at Rahuna, and 23 at Batticaloa; and 30 graduates in training overseas. Total number of research scientists in university faculties is 181.

agricultural research, there is scope for a small proportion of them to develop a high degree of specialization in the most modern, less traditional fields of research, so that Sri Lankan agricultural research can keep abreast of the latest opportunities for progress that might arise. It might prove difficult to convince scientific administrators in any one institution that such positions are justified, but a national body responsible for coordinating the whole sector of agricultural research could have a more strategic viewpoint, and recommend appointing and developing specialized staff to particular institutions for the benefit of the country as a whole.

Distribution of research staff by commodities

At this stage, it was not possible to construct a table to show the distribution of research man-years to various crops and commodities. This should be done as soon as data become available, as such a table would be a valuable planning tool for initial assessment of the rate of progress which may be expected from research on the various crops. However, it was possible to examine the allocation of research staff to the nine major groups of commodities in relation to their value of production. This information is presented in Table 6, which is analogous to Table 2 on recurrent expenditure on research on the major commodities.

The value of production of the three main tree crops is sufficient to justify the interdisciplinary research teams working on these crops (although there are insufficient economists). There is also a reasonably strong team of scientists working on rice research throughout the country, but it is difficult to quantify exactly because only 14 scientists are listed specifically for rice research. The distribution of research staff to other food crops, and the consequent expression of priority, is not clear.

Comparison of the proportion of research staff allocated to a particular commodity with the proportional value of production of that commodity, indicates that many food crops of relatively low value of production have a disproportionately large number of research staff (see congruence ratio, Table 6). Fisheries and forestry still reflect a relatively low level of attention, although the number of staff for livestock research seems to be more in balance with the value of livestock products than is its allocation of financial resources (Table 2).

5.2.2 Training

With a targeted output of about 240 graduates* from the Faculty of Agriculture, and 40 from the Faculty of Veterinary Medicine and Animal Science, not to mention graduates from other faculties, the higher education system ensures an adequate supply of recruits for the research service. Curricula and facilities in higher education are continually being improved to enhance the quality of graduates, and closer interaction between faculties and the national research programmes would be beneficial in this process. In the present context, the main concern is, therefore, with postgraduate training.

* Based on 1977 survey of requirements in graduates in agriculture. A more up-to-date survey may change this figure.

Table 6: Scientific staff (research officers) allocated to major commodities as at 1983 in relation to commodity production value in 1982-1983[A]

	Production value (million Rs)[B]	Percentage of total production value	No. of scientific staff	Percentage of total scientific staff	Congruence ratio[C]	No. of scientists per thousand million Rs production value[D]
Food crops						
Paddy rice and other Food crops[E]	7891	33.6	306	59.9	1.78	38
Sugarcane	1299	5.5	11	2.2	0.40	9
Total	9190	39.1	310	62.1	1.59	34
Export crops						
Coconut	3283	14.0	37	7.5	0.54	13
Tea	2302	9.7	31	6.2	0.64	13
Rubber	1024	4.4	31	6.2	1.41	30
Minor export crops	1645	7.0	23	4.6	0.66	14
Total	8254	35.1	122	24.5	0.70	15
Total food and export crops	17444	74.2	432	86.6	1.17	25
Livestock	1455	6.2	30	6.0	0.97	21
Fisheries	2903	12.3	33	6.6	0.54	11
Forestry[F]	1710	7.3	4	0.8	0.11	3
Total non-crops	6068	25.8	67	13.4	0.52	11
Total all commodities	23512	100.0	506	100.0	1.00	21

A) Not including staff of university faculties and International Dambala Institute.
B) For source of value data, see Table 2: For source of data on Scientific staff see Table 8.
C) The congruence ratio is the ratio of the percentage of research staff allocated to a commodity of the total research staff to the percentage of the production value of that commodity of the total value of agricultural production. A perfect match of research staff to production value is 1.00.
D) Exchange rate in 1983; Rs 24: US$ 1.
E) Including Department of Agriculture, Adaptive Research, Land and Water Management, and Economic Research Staff at MADR and ARTI.
F) Forestry excludes 11 staff members shown under "resource management" in Table 2. Their work is related more to water and food crops than to forestry.

All the various schemes in the research establishments now require formal postgraduate qualifications for the advancement of research staff. Most postgraduate training to date has depended rather haphazardly on donor fellowships for study and research at a variety of foreign institutions. This has been successful enough to have permitted about 50% of all research staff to gain postgraduate degrees. With the present emphasis on postgraduate specialization and familiarity in research methods as a prerequisite for all research staff, advanced training needs to be organized more systematically, to enable scientific officers (honour graduates) to become research officers. Standardized procedures and centralized supervision of postgraduate training is required if national research priorities are to be served. The proposed Council for Agricultural Research Policy can play a supervisory role and systematically channel donor funds for postgraduate training to specializations in which shortages occur in order to achieve balanced development of research manpower.

Training requirements

From the review of the number and level of qualification of existing research staff, it is possible to draw up an approximate numerical requirement for training on the basis of a set of assumptions. These are, for the ten research institutions and the Faculties of Agriculture and Veterinary Medicine and Animal Science, that after ten years these targets will be attained:

* most research officers will have been trained at least to the M.Sc. level; including all new recruits, but excluding about 50% of older staff with B.Sc. qualifications, (about 100);

* two-thirds of new postgraduates will have been trained to M.Phil. level and one-third to M.Sc. level;

* 35% of staff in all institutions will have a Ph.D. degree (currently 16%);

* 60% of faculty staff will have a Ph.D. degree (currently about 30%);

* current vacancies in research officer cadre are filled but there is no growth beyond that;

* replacement rates of 10% per annum at M.Sc. level, and 15% per annum at Ph.D. level.

To achieve these targets, 90 M.Sc. or M.Phil and 25 Ph.D. per annum would be required over the period of ten years. The replacement rate alone, after the backlog is cleared, would be about 80 M.Sc. or M.Phil per annum.

PGIA has made a good start to develop local postgraduate training and expects to be able to produce up to 80 M.Sc., M.Phil, and Ph.D. graduates per annum by 1985. Even though it expects to accept candidates from other institutions, PGIA should be able to deal with all M.Sc. students from the research institutions and about half the M.Phil and Ph.D. students. The remainder would have to attend universities overseas, which is much more costly but which would allow for a wider range of specializations and schools of thought than is possible in one postgraduate training institute.

The total requirement for support of these trainees at an estimated US$ 3,000 per annum at PGIA and US$ 20,000 per annum overseas, is about US$ 2.1 million per annum.

Training for management

It was reported that senior research officers have often been thrust into responsible managerial positions with very little preparation for the complexities to be mastered, other than general experience accumulated as a research officer. Just as formal training in research methodology is beneficial, so formal training in management can greatly improve the efficiency of scientists placed in responsible managerial positions. Selected research officers who show promise of having managerial qualities should be sent for short-term training courses in management, preferably research management, at a relatively early stage in their careers. As noted in Section 5.4.1, not all good research workers will make good managers, and promotion to the highest level should not depend on assuming managerial responsibilities.

5.2.3 Technical Support Staff

Well-trained research officers are usually more productive when supported by good technical staff. Table 7 shows the number of technical support staff in most of the research institutions excluding administrative support staff and labourers. Support staff have been divided into five categories, and because job titles vary considerably between institutes, the ranges of titles are given in the footnotes.

The lowest average number of support staff per scientist is 0.6 in the Veterinary Medicine Research Institute and the highest is 2.4 in the Rubber Research Institute; the overall average is 1.3 per scientist, which is very low. Two support staff per scientist is probably the minimum required to prevent highly trained scientists having to spend a wasteful proportion of their time on routine tasks, which could be done adequately by junior technical staff. Even three support staff per scientists, for example, 1 experimental officer, 1 field assistant, and 1 experimental assistant, is not excessive. Older research scientists recalled that earlier there were approximately three support staff to each scientist. They thought that the number of support staff had not risen proportionally with the numbers of research officers.

The mature tree crops research institutes are best served with the number of technical staff per scientist in the range of 1.7 to 2.4. In all other institutions, the number is below 1.2, except the new Sugar Research Institute where at present there is a large proportion of vacancies for research staff. For the whole complex the number of vacancies in the technical support staff cadre is roughly in balance with the number of research staff vacancies, so that the overall ratio would not change greatly if all positions were filled.

A feature of the technical support staff in the Department of Agriculture is the relatively high proportion of experimental officers (EOs), many at the graduate level. Although the number of support staff per scientist is only 1.1, the quality of the staff may be higher than the national average. However, the length of service of many EOs is short, and as was pointed out, career prospects do not encourage long service at EO grades.

Table 7: Technical support staff in research institutions and major research programmes as at 1983[A]

Category	DA	SRI	DMEC	ARTI	CRI	TRI	RRI	VRI	FD	NARA	Total
Senior supervisor[B]	-	-	2	3	1	3	3	-	-	-	12
Experimental officer or equivalent[C]	109	-	1	1	8	8	11	1	-	-	140
Senior technical or field asst.[D]	62	15	6	8	16	15	9	18	1	23	173
Technical officer or field asst.[E]	111	15	14	8	35	29	39		3		254
Laboratory technician/experimental assistant[F]				11	3	1	11			16	42
Total	282	30	23	31	63	56	74	19	4	39	621
Research officers	258	11	23	37	37	31	31	30	4	33	495
Ratio technicians to scientists	1.1	2.7	1.0	0.8	1.7	1.8	2.4	0.6	1.0	1.2	1.3
Percentage of vacancies	N.A.	33	30	N.A.	15	14	10	57	67	30	
Percentage of academically qualified technicians	39	0	13	13	14	20	19	3	0	0	

A) Source of data: replies to questionnaire sent to research institutions. University faculties not included.
B) Including estate managers, senior librarians, managers of data bank, systems analysts, and works engineers. These may not necessarily be graduates.
C) Usually B.Sc (pass degree) or equivalent level of training.
D) Usually not graduates; including library assistants, documentation, and publications officers, senior foremen, programmers, data development officer, and forest rangers. These are not usually graduates.
E) Not graduates; including similar but lower graded staff to the above category (D); statisticians, field experimental staff, senior laboratory workers.
F) Not graduates; including library and statistical assistants, laboratory technicians, and instrument mechanics.

The shortage of technical support staff is a weakness in many research institutions that deserves early and sustained attention in order to strengthen the research system.

Only to fill vacancies in technical support staff, in total about 200, and to raise the average level of technical support from 1.3 to a modest 2.0 assistants per scientist would require recruiting and training an extra 650 technical staff. Training of recruits for field assistants and experimental officers has in the past been done by institutes, colleges, and university (pass degree). The review team did not look closely into the capacity of the system to generate more middle-level staff, but this would be necessary, if it were decided to increase the numbers. The training of laboratory technicians is an accute problem because suitable courses are not available in the Polytechnical Institutes.

5.2.4 Conditions of Service

The agricultural research service already has a fair proportion of competent and well-trained research scientists. They deserve good conditions for research: adequate operating funds; moderate facilities and support staff; opportunities for national and international interaction; competitive salaries with equivalent scientists in the country; and reasonable living conditions.

Perceived morale varied considerably from station to station. Complaints about inadequate housing and recreational facilities, poor education and medical facilities, and the lack of communal transport were widespread. To ensure adequate education for children, many scientists operate split homes. These factors are not conducive to conscientious research work. However, such inadequacies did not seem to lower morale or dampen enthusiasm unduly at stations where there was a clear research programme, reasonable facilities, good opportunity to carry out research, and frequent contacts with peer scientists, for example, at the Rice Breeding Research Centre at Batalagoda. The review team, therefore, is very concerned to emphasize the need to improve conditions to enable scientists to carry out research, and wishes to stress that living conditions are also very important, especially for those at postings remote from large centres. Capital investment in adequate housing, modest recreational facilities, communal transport, etc. is often as necessary as, and less costly than, capital investment in training to ensure excellent research performance from diligent scientists.

5.3 FACILITIES

The physical facilities for agricultural research are good at several long-established stations, and very basic at some of the newer research stations. There has been a recent expansion in research stations in the Department of Agriculture, mainly aimed to intensify adaptive research. Improvement of these stations would be required, if more sophisiticated trials and supporting laboratory tests are to be incorporated. Indeed in several cases, decisions about future research programmes are closely related to the availability and improvement of physical facilities. For instance, if it is decided to intensify research on lowland tea, then field research facilities at Ratnapura will have to be expanded substantially. Similarly, a decision to intensify research on alternative methods of tea processing would require the acquisition of a

new estate and use of a factory. These are major decisions that would greatly affect proposals and priorities for development of better facilities. Specific proposals for improving facilities must await more detailed analysis of specific situations than was possible in this initial review.

a) Communications Centre. With many research institutions in many ministries, a profusion of specialized libraries has developed, together with a range of contacts with outside agencies. It has long been felt that there should be a unified communications and documentation centre for agricultural research that would serve the whole community more efficiently. To this end, a Documentation Centre has been established in NARESA. It is suggested that this centre be upgraded to a Communications Centre to take full advantage of the excellent data banks and information communications networks that exist today. A fairly comprehensive computerized documentation programme has been developed by IDRC for use with certain computer hardware. Such an installation should be made available with staff to operate it. Efficient duplicating facilities would also be required to fulfill a service function to research centres within the country. Such a centre would require a full-time Documentation Officer and two Research Officers to operate the service and work toward better coordination of publication and dissemination services of established institutions.

b) Specialized laboratories. There is a general consensus that the country cannot afford to duplicate very specialized laboratories, but that all research agencies should have access to the services of specialist laboratories that have been developed and are currently housed in particular institutions. These laboratories are often geared to service their own institution only. It is recommended that the facilities and staff be expanded to enable them to carry out analytical and other services for a wider range of users under the guidance of CARP. These specialized laboratories include:

Central Biological Control Unit
Pesticide Residue Laboratory
Soils Analytical Laboratory
Electronic Equipment Servicing and Maintenance Unit.

There may well be need for new specialized laboratories that can offer services to several research institutions. In the absence of a comprehensive agricultural research authority, it would be desirable to set up such new facilities under the auspices of a Council for Agricultural Research Policy. If necessary, they could be established as separate and independent institutions, but preferably they would be attached to, and come under the jurisdiction of, the research institution considered to be the most suitable base in the balanced judgement of CARP.

c) The role of the Central Agricultural Research Institute at Gannoruwa in the Department of Agriculture is discussed in the following section. However, if it is agreed that it should become the main laboratory facility and testing centre for the whole network of food crops research, (in addition to providing central guidance on research design and coordinator of regional activities), then both its field and laboratory facilties will need to be improved.

d) Work at many research stations, especially those in the Department of Agriculture, would be greatly facilitated by the addition of a reliable green house and screen house.

e) The new programme at the Minor Exports Crops Research Institute has made a good start with external support. However, if it is to continue, the physical infrastructure will have to be improved with more laboratory space, insectary and green house, pilot plant for processing, etc.

f) Livestock and forestry research have undoubtedly been neglected in relation to the value of their production. If it is agreed that research in these areas be intensified, then improved field facilities will be required.

g) Research on the three major tree crops is in urgent need of up-to-date baseline data on areas under tree crops, and on age, composition, and stand. This would require a major study based on aerial photography checked by ground samples. The resultant data base would be a very valuable development planning facility.

5.4 ORGANIZATION WITHIN RESEARCH INSTITUTIONS

It is extremely difficult to discuss briefly the strengths and weaknesses in the diversity of organizations encountered in the research institutions. The strengths are such that, if the best features from several were incorporated in all institutions, there could be a great improvement in research operations without introducing anything new from outside the system. There are, however, several points which are worthy of mention.

5.4.1 Management

Within a research institution there are two separate lines of control:

* administrative and financial;
* research policy and programme.

The first is usually handled under a hierarchal structure where authoritative directions are handed down from above. The second is best handled by a collegiate "first among equals" approach, as the lowest research officer makes direct and original contributions to the research programme. Both controls are essential for efficient research operation, but it must be stressed that the main purpose of the institution is the research programme, and the administrative and financial control must serve the research programme.

The director of a research institution is usually selected for his competence to develop an efficient research programme from policy guidelines given from a higher level. He should be supported by experienced and senior assistants on administrative matters on which he does not necessarily have expertise.

The board or senior authority above the director should lay down policy guidelines, review and approve plans and progress, etc. The Board should leave development and operation of the research programme to the Director who can be assisted by advisory committees, as necessary. Directors of some research institutions do not seem to be receiving adequate policy guidelines for research planning, due again, in some cases, to an inadequate flow to the board of relevant information on which to base policy decisions.

The structures and composition of the boards of research institutions were found to vary widely. As bodies mainly concerned with research policy, these boards should have a balanced membership of scientists and clients, with the balance generally in favour of the clients, including government policy makers, producers, and processors.

5.4.2 Budgetting

Agricultural research is by no means as predictable in its course as is a development exercise which has clearly demarcated steps to be accomplished. However, agricultural research planning and control, especially at research station level, can benefit from the application of principles of programme budgetting worked out for more predictable systems in industry and commerce. Each research project proposed at sectional and station level should be carefully assessed in terms of professional and supportive manpower (man months), physical facilities, and financial requirements. Station research managers can then begin to plan a programme based on matching realistic limiting resources and reflecting quantitatively determined priorities for research. The programme budget derived from such an analysis provides a very useful base for assessment of priorities, a framework for making unavoidable cuts, a basis for future monitoring and evaluation, and a first indication of the effects of restriction of resources on the research programme.

5.4.3 Administrative and Financial Controls

Most administrative and financial control procedures in development ministries have been adopted to prevent misuse of public funds, especially in development projects involving large sums of money. However, meticulous checking procedures mean delays in decisions. In agricultural research, the amounts of money to be controlled are small but timing is often critical, even a short delay can mean abandoning a season's trials. Thus, firm financial control should be combined with flexibility and an understanding of the primary research function of the organization. There is a wide diversity of administrative and financial controls in operation, even within individual ministries. But there are examples of very good features and mechanisms in some institutions that are very helpful to research operations, (and there are also examples that are unhelpful). An effort should be made to compare processes and adopt the best features in all institutions as far as possible. The best overall model is probably the RRI.

5.4.4 Central Agricultural Research Institute (CARI)

The relationship between central and regional research stations has already been discussed in Chapter 3. Historically, it was probably necessary to move the weight of decision making from the main centre to the RRCs to emphasize the need for adaptive research to serve the farmer directly. However, the pendulum has perhaps swung too far, leaving CARI in an ambiguous position. The CARI is the strongest station in the Department of Agriculture, with almost 60 research scientists and with a higher proportion of experienced staff and postgraduates than most other institutes. It must play a larger role than its present role of RRC for the mid-country wet zone. Its responsibility for regional and other outlying research stations is not clearly defined, although it does perform some specialist services for other research stations.

The review team was concerned that some RRCs seemed to be dominated by adaptive research programmes, indeed, some have no funding for anything else, with little scope for strategic research, exploring new opportunities for change. The experienced staff of CARI could play a formative role in such research, and provide guidance on experimental choice and design for the newer recruits at RRCs, in addition to being the specialized centre for most laboratory analysis and identification service . This coordinating and advisory role should be recognized formally, while in no way implying that it should have absolute control of research programmes in the regions.

5.4.5 Faculties of Agriculture, and Veterinary Medicine and Animal Science

The potential contribution of university staff to national agricultural research has already been emphasized. A contribution of 50 man-years per year does not seem unreasonable from 180 faculty staff members and about 100 postgraduate students in PGIA. Funding to support such work should be made available. It is suggested that about half of such funding be allocated to a core research fund to enable departments within these faculties to develop in some depth and to permit continuity of research programmes. The other 50% of funding should be channelled through development ministries or boards, on the advice of research management committees, in close consultation with faculty staff. University staff should be invited to participate in research programme formulation at an early, grassroots stage, to enable them to identify the role they have to play in the institution's research programme. It would not be sufficient for heads of university departments to attend high level reviews of research programmes.

5.4.6 ARTI

A similar arrangement as suggested for university faculties may be necessary to bring ARTI into the main stream of the national research programme. At present, the research programme depends heavily on the preferences of donor groups. As ARTI is the main repository of socio-economic expertise, it is essential that its research programme be closely linked with, at least, that of the Research Division of the Department of Agriculture.

5.4.7 Schemes of Service

Salary scales for research staff do not differ greatly between institutions. Service regulations vary within similar guidelines. Most institutions have an encouraging attitude towards schemes of service which reward research performance, and opportunities exist for promotion to career expectancy levels within ore specialized research position. All research institutions should move towards the establishment of promotion committees composed of peer scientists, outside scientists, and administrators, and towards the development of criteria that reflect research performance and not traditional administrative responsibilities.

5.5 COLLABORATION WITH INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

All fruitful collaboration with International Agricultural Research Centres involves some national investment in time and resources (see Annex V). The return is usually quite high and merits generous budget allocations for visits of scientists and for other means of interaction. The expectations of benefits from research programmes must be higher from international research institutions established within Sri Lanka than if they were established overseas. It is, therefore, well worth a more substantial national investment than would be made for collaboration with external institutions. It is proposed that contributions are made to both capital and recurrent expenditure of the International Irrigation Management Institute (IIMI) and the International Dambala Institute to facilitate close interaction with the national research programme. In particular, the large-scale irrigation fieldwork of IIMI will require considerable collaborative effort from both the national services for irrigation and for agricultural research.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS: FINANCIAL IMPLICATIONS

The national agricultural research service has many strengths and compares favourably with research services in many developing countries. Nevertheless, there is much room for improvement. The dispersed state of agricultural research in Sri Lanka is very conspicuous, and since linkages between institutions are not strong, it can really only be called a research complex, not a system. However, all research organizations inevitably are divided into sections. In Sri Lanka, there is a rational division of agricultural research into major export crops, minor export crops, foodcrops, livestock, fisheries, and forestry with little overlap of responsibilities. However, several important research areas are not covered where interinstitutional collaborative team work is necessary and urgent, if the needs of producers are to be best served.

Achievements, especially in research on tree crops, major food crops, and vegetables as well as in natural resource inventories, are evidence that appropriate research priorities have been chosen in the past.

At present, a total of 506 research scientists work in ten research institutions, and a further 180 in the Faculties of Agriculture and of Veterinary Medicine and Animal Science. About 50% of these have postgraduate degrees (but this has been a very haphazard, and unsystematic process). The rate of supply of graduates from the university system is sufficient to maintain the present strength of the research service. A postgraduate training system has now been developed. A sound basis for research growth and development has been established, and unlike many developing countries, the possibility of strengthening the research system is not severely constrained by shortage of senior manpower. Nevertheless, there are gaps in the distribution and range of research disciplines that need to be remedied on a national scale. It is time to consolidate the research manpower base and to plan systematically for the future.

The situation with respect to support staff is not as encouraging. The average ratio of support staff to research officer is very low, 1.3:1. Training for laboratory technicians in particular is poor.

While in general, the physical facilities for research are reasonably good and there are opportunities to carry out productive work at many research stations, there is considerable variation from station to station. Each institution has special needs, but almost universal is the need for more staff housing at relatively remote research stations. Improved transport and travelling allowances are essential if research officers are to get out into the farmers' fields and to interact with other research stations, and not be confined to a home research site.

The overall level of funding for agricultural research at Rs 180 million (US$7.5 million) is 0.77% of AGDP and is better than average compared with many other developing countries, but it is still well below World Bank recommended rates of investment in research of 2% AGDP. On the other hand, the average level of funding per research officer is in

the lowest three of 67 developing countries and is grossly inadequate. (This parameter, or module of support is obtained by dividing the total funds allocated for research by the number of research officers.) There is again wide variation among institutions, but even in the best funded institution, the level is no better than reasonable.

The system of administrative and financial control can have either a stimulating or a stultifying effect on research performance. The system used for control of development operations is not suitable for research operations but seems to be the mode imposed in many cases. Nevertheless, within the various research institutions, there are examples of flexible financial and administrative arrangements which could serve as models for beneficial changes in others. Similarly, there are good models of schemes of service to follow.

Linkages and communications between components of the research system vary greatly in effectiveness, but on the whole they require a great deal of improvement. The major deficiency is in the two-way linkage between research and development planning, both within ministries and at the national level. Mechanisms for interaction between research institutions within different ministries are also notably lacking. However, linkages are generally good between research organizations and international research bodies, especially the IARCs, and appropriate advantage has been taken of these contacts. Linkages between research and extension vary considerably; the formal and informal collaboration between extension services and RRCs in the Department of Agriculture, which have been fostered by the Extension and Adaptive Research Project, is an example of good cooperation. Vigorous adaptive research programmes are formulated at Regional Technical Working Groups held at the RRCs where participants come from research, extension, and other regional agencies. Staff from other research institutions are now beginning to attend these meetings.

Thus, while there are many shortcomings in the agricultural research complex, there are also many satisfactory elements. Moreover, in a number of cases, where procedures or arrangements are not satisfactory in some institutions, there are current examples of better procedures in several other institutions that could serve as models for improvement. The good examples also serve to highlight the areas in other institutions where mechanisms need to be strengthened in order to function more effectively.

There are shortcomings that seem to extend across the whole system, particularly concerning the linkage between different groups and hence, the determination of research programmes to be carried out. These form the basis of the first group of recommendations. The second group concerns the implementation of the research programme.

6.1 DETERMINING THE RESEARCH PROGRAMME

6.1.1 At the Institutional Level

The most serious shortcoming in linkages is between research groups and ministry policy makers and planners. It is recommended that each ministry carrying out agricultural research should appoint an Additional Secretary (Technical Liaison) together with a small Technical Cell to ensure two-way transfer of information, so that research can make its

best contribution to highlighting development opportunities, and solving key development problems. The Additional Secretary (Technical Liaison) would also be the main channel on research to the National Planning Division. The financial requirement for support of one Additional Secretary and two Research Officers in seven ministries for five years would be US$1.5 million.

6.1.2 At the National Level

At present, there is no national forum at which national research priorities and perspectives can be developed, and linkages between research institutions are poor.

It is recommended that a Council for Agricultural Research Policy be established to fulfil such a role, with a broad membership to include policy makers and planners, producers, processors, and scientists. The Council would have special responsibility for organizing interinstitutional research projects and for supervising a systematic postgraduate training programme for agricultural research officers. The financial requirement for support of the Secretariat consisting of four research officers and supporting staff, for five years would be US$0.55 million. Funds for interinstitutional research for five years would be US$2.0 million.

6.1.3 At the Research Station Level

For programme formulation at the research station level, there should be reliable information about the main problems of farmers. Thus, it is recommended that a number of teams of economists and agronomists be established to survey and to analyse farming enterprises operated by small farmers. The financial requirement for the support of eight teams each of two research officers and support staff for five years would be US$1.3 million.

6.2 IMPLEMENTING THE RESEARCH PROGRAMME

The research service has built up a good research staff, but at present, they are not being given good opportunities to carry out worthy research programmes. The rate of funding per scientist is one of the lowest in the world and the number of support staff per scientist is too low for efficient operation of well-trained researchers. University research capacity is not being fully used.

Conditions of service leave some scientists unsettled. As postgraduate training is now obligatory for advancement, a systematic and comprehensive postgraduate training programme is necessary for reasonable career development.

6.2.1 Allocation of Funds

a) Since operating funds per scientist are extremely low, it is recommended that they be increased from an average of Rs 119,000 (US$4,900) to Rs 200,000 (US$8,300) per scientist.
(Financial requirement: 500 to 640 scientists over five years, US$10.5 million)

b) It is recommended that investment in commodity sectors now underfunded in research in relation to present value of production, be increased. These sectors include livestock, US$0.4 million; forestry, US$0.2 million; fisheries, US$0.6 million; and minor export crops, US$0.4 million.
(Financial requirement: for five years, US$1.6 million)

c) To bring the substantial research capacity of 180 scientists in the Faculties of Agriculture and of Veterinary Medicine and Animal Science to bear more strongly on the national agricultural research programme, it is recommended that reliable funding be made available to support a research effort of 50 man-years per year.
(Financial requirement: operating funds at US$8,000 per man-year over five years; US$2.0 million)

6.2.2 Manpower

a) It is recommended that a systematic programme for providing postgraduate fellowships for training be instituted to produce 90 graduates per year at the M.Sc. and M.Phil. level, and 25 graduates at the Ph.D. level. This should raise within ten years all agricultural research staff to the M.Sc. level, 35% of research staff to the Ph.D. level, and 50% of staff in the Faculties of Agriculture and of Veterinary Medicine and Animal Science to the Ph.D. level.
(Financial requirement over five years: US$10.6 million)

b) With a core research staff of over 600 scientists, it is recommended that the agricultural research service sponsor more specialized research scientists in new research areas of high promise. It is suggested that in the first five years provision be made for training ten such scientists and for the acquisition of specialized equipment.
(Financial requirement: US$1.2 million)

c) It is recommended that selected scientists be given training in research management at a relatively early stage in their career.
(Financial requirement: 20 scientists on short courses, US$0.4 million)

d) It is recommended that the number of technical support staff per scientist be raised from the low national average of 1.3 to at least 2.0 per scientist; and that appropriate training courses be developed.
(Financial requirement: 450 support staff for five years, US$1.0 million)

e) Research scientists and support staff deserve reasonable living conditions and recreational facilities at stations remote from large centres. It is recommended that provision be made for an additional 150 houses for Research Officers and 400 houses for support staff, and for improved recreational facilities.
(Financial requirement: US$7.75 million)

6.2.3 Facilities

Scientists need adequate facilities for approved research programmes. It is difficult to make specific recommendations for facilities when some, which would have high priority, depend on policy and development programme decisions not yet taken. The following recommendations are made:

* a modern fully equipped communications centre be developed for the benefit of the whole system (US$0.5 million);

* facilities at the Central Agricultural Research Institute be upgraded to provide an improved central laboratory service for RRCs (US$0.4 million);

* the capacity of certain specialized laboratories in some institutions be improved to serve the whole agricultural research system (US$1.0 million);

* screen and green houses be provided for research stations (US$0.5 million);

* research facilities in underfunded areas of livestock, forestry, and minor export crops be improved (US$1.5 million).

* aerial baseline survey of tree crops be carried out, and substations in tea and rubber research be upgraded (US$3.8 million).

6.2.4 Organization within Research Institutions

There are many patterns of research organization within the agricultural research complex in Sri Lanka. All have good and undesirable features from the viewpoint of research efficiency. However, there are sufficient acceptable features for good organization, and the general recommendation is made for the discontinuance of unfavourable procedures in some institutions and the adoption of the good examples existing in others.

Within a research organization there are two lines of control. While the control of administrative and financial matters can, and perhaps should be hierarchal in structure, it is recommended that the control of research policy and programme formulation be on a collegiate, first amongst equals basis; and the two should not be confused.

The structure and composition of boards governing research institutes vary widely. It is suggested that the balance in membership of boards determining policy to be pursued by the research director be reviewed. The development and operation of the research programme should then be left to the director.

It is strongly recommended that reward and promotion procedures in all schemes of service for research staff reflect performance in research and not merely seniority and administrative responsibility.

6.2.5 Collaboration with International Agricultural Research Centres

It is recommended that investment in collaboration with established international agricultural research centres be continued vigorously, and that a higher level of investment be made in the international centres recently established within Sri Lanka.
(Financial requirement over five years: US$2.6 million).

ANNEX I

ARRANGEMENTS FOR THE REVIEW OF THE AGRICULTURAL RESEARCH SYSTEM IN SRI LANKA

I.1 Membership of the Agricultural Research Group and Subcommittee

Dr. R.L. Wickremasinghe*	Chairman	Sugar Research Institute
Dr. W.S. Alles	Assistant Director	Minor Export Crops Research Station
Dr. S.B. Dhanapala	Director	Dept. of Animal Production and Health
Prof. S.T. Fernando	Dean	Faculty of Veterinary Medicine and Animal Science
Dr. G.W.E. Fernando	Director	Dept. of Agriculture
Prof. H.P.M. Gunasena	Dean	Faculty of Agriculture
Dr. S.D.I. Gunawardena	Deputy Director	Research Division, Dept. of Agriculture
Prof. W. Herath	Deputy Director-General	International Dambala Institute
Mr. E.H.V. Jayasekera*	Consultant	Ministry of Agricultural Research and Development
Dr. R.P. Jayawardene	Director-General	Natural Resources, Energy and Science Authority
Dr. R.J. Jiron	Consultant	Ministry of Finance and Planning
Prof. T. Jogaratnam	Director	Postgraduate Institute of Agriculture
Dr. S.T.W. Kirinde	Director	Dept. of Minor Export Crops
Dr. S. Kulasekaran	Deputy Director (Research)	Tea Research Institute
Mr. M.F. Mohideen*	Deputy Director	National Planning Division
Dr. C.R. Panabokke*	Consultant	Ministry of Agricultural Research and Development
Dr. O.S. Peries*	Director	Rubber Research Institute
Dr. O. Perera	Director-General	National Aquatic Resources Authority
Dr. J.A. de S. Siriwardane	Deputy-Director	Veterinary Research Institute
Dr. P. Sivapalan	Director	Tea Research Institute
Dr. B. Subasinghe	Director	Institute of Fish Technology, NARA
Dr. T.B. Subsinghe	Director	Agrarian Research and Training Institute
Dr. K. Vivekanandan	Chief Research Officer	Research Division of Forest Department
Dr. D.T. Wettasinghe	Director	Coconut Research Institute

* Members of Subcommittee

I.2 Terms of Reference: Analysis and Evaluation of the Agricultural Research System in Sri Lanka

In virtually all development plans of this country, agricultural development is charted out to be achieved with a strong backing from agricultural research. By improving yields, income enhancement and employment creation is the assumed corollary. Hence, agricultural research has a recognized role to play. But at the same time, its organization, management, and administration can hinder and at times completely obstruct its contribution to development.

The purpose of this study is to take a critical view at the research structure of the country in order to understand how it functions, its limitations and potentials, all with the objective of improving its contribution to the development efforts of the country.

The analysis of the agricultural research system in Sri Lanka will cover the following areas :

A. Research Structure

The institutions included in the inventory will be characterized in terms of area of concentration, research facilities and equipment, research personnel, policies, and programmes broken down by regions or other meaningful geographical zones. This covers an inventory of all public and academic bodies that carry out some form of research.

B. Manpower Resources and Development

This area refers to recruitment practices and policies, deployment of subject matter specialists to specific research station vis-a-vis sharing from central location, specialists versus technical and support staff, training for research management, incentives and retention.

C. Administrative and Financial Structure

This area applies principally to research institutions under government departments and semi-autonomous boards or corporations. This section requires concentration on policies, procedures, and regulations both with respect to financial management and personnel. It also includes service regulations and matters concerning capital and recurrent budgets.

D.* Priorities and Policy Guidelines for Particular Research Institutes

The process of formation, discussion planning, and execution of research is to be characterized and evaluated. Decisions on commodity specific research and problem oriented research is to be reviewed, evaluated, and commented upon.

E.* Institutional Linkage.

This area refers to the linkages that exists between international research institutions and the various domestic bodies, the linkages among national research institutions themselves, the linkages between research and extension and between research and agricultural policy makers.

F.* National Research Priorities

This section entails a review of the extent to which national research priorities are spelt out and divulged. Also requires an understanding of how research priorities at the institutional level relate to the national priorities (if at all).

G.* Alternative Research Structures

On the basis of the findings in the previous sections suggestions will be made with regard to alternative arrangements to the present research structure. To be considered here is the feasibility of establishing a coordinating body to define national research orientations, directives, and guidelines. The needed level of coordination/linkage and mechanisms to facilitate and ensure it among research institutions will also be dealt with.

H.* Preliminary Identification for Project to Strengthen Agricultural Research

The expected result of this section is the preliminary identification of major elements of a project to incorporate the findings of the present review and measures proposed to strengthen agricultural research in the country. This should lay the foundation for a formal request for findings.

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* To be implemented with the assistance of ISNAR

I.3 Questionnaire Sent to Research Institutions

This is a copy of the questionnaire sent to all research institutions by the Subcommittee of the Agricultural Research Group.

A. Structure and Organization of Research System

i By means of charts provide:
   a. Position of your institution in relation to your Ministry;
   b. Position of research within your institution where relevant (e.g., Department of Agriculture);
   c. Structure of the research system - location of the main station, regional station, sub-stations etc., - and how they relate to Headquarters.

ii Fill in the attached chart (I) for each station.

iii Indicate regularity of meetings/discussion between headquarters and regions.

iv Indicate level at which linkage and communication that takes place between the Research Department, Division, or Institution and the Ministry in which it is located.

v Describe current procedures by which communication between the Research organization and the Secretary/Minister on technical matters take place. How often are such meetings held and who attends? Are these meetings regular, sporadic, or ad hoc? Who is responsible for follow-up of decisions taken at such meetings?

B. How the Research System Works

i Is there a statement of long-term, medium-term and short-term research objectives?

ii If so, is this revised periodically and describe how this is done?

iii What are the main objectives of each research station?

iv What is the method of selecting research projects, how are they drawn up, and who decides on research programmes?

v What role do policy makers at Ministry, Budget people, Extension services and other clients of research play in determining research priorities? Is the present situation satisfactory, if not, what suggestions can you make to improve situation?

vi How is the research programme documented, implemented, and results communicated?

C. Research Programmes

i List principal ongoing research projects.

ii Is orientation of programmes disciplinary, commodity, or inter-disciplinary?

iii Broadly classify the ongoing projects into the three above types.

iv What is the approximate duration of a programme?

v How do the programmes respond to changing needs of the country?

vi What mechanisms exist for monitoring and evaluating research programmes?

D. Linkages of Research

i Within the country, describe the linkages with:
   a. Policy makers
   b. Senior politicians
   c. Extension workers
   d. Farmers and other user clients
   e. Other research organizations.

ii Outside the country, describe the linkages with:
   a. International Agricultural Research Centres (e.g., IRRI)
   b. Other research organizations
   c. External funding agencies

iii How can these links be improved?

E. Manpower Resources and Development

i Provide a stationwise copy of the Cadre for 1983 (including administration personnel) as it appears in your estimates for 1983.

ii Fill in attached chart (II) titled 'Stationwise data on Technical Cadre' (including middle level grades) for 1983.

iii Fill in attached chart (III) titled 'Data on available Technical Staff for each Station in 1983.

iv Is available manpower adequate? Specify detailed medium term training requirements.

v Are training opportunities available as per your requirements? Elaborate on the subject of training.

vi What are the reasons for trained staff seeking other jobs? Suggest measures and means of retaining experienced staff including avenues for promotion.

vii What proportion of time do research scientists spend on administrative matters?

viii Provide a copy of the salary structure of your organization.

F. Budget and Financial Allocation

i Provide a copy of the approved budget for 1982 and 1983 as it appears in your files.

ii What is the relationship of your budget to that of your Ministry/Department?

iii How is the budget formulated and disbursed? At what point is control exercised?

iv Provide total budget and breakdown for each unit under the two headings: Capital and Recurrent Expenditure, together with the appropriate sub-headings under each heading (for 1982 and 1983).

v How are funds allocated to the various stations, crops, and activities?

vi Is allocation of funds done on a systematic and regular basis with assured continuity? Elucidate.

vii What are the sources of funds for your budget?

viii What is the relative importance of different sources of funds?

ix State budget sought and budget approved for each station under Capital and Recurrent Expenditure for 1982 and 1983.

G. Extent of Foreign Assistance

i Provide list of Projects with foreign assistance.

ii Give data on:
a. Capital - Equipment, Vehicles, books, etc.
b. Training - Long term, Short term.

H. What do you consider as the principal areas of weakness in:

(i) the research structure?
(ii) the administrative and financial procedures?
(iii) the investment vs. recurrent allocation of funds?

I. Chart indicating data on facilities at Research Station

Item	Station.....			
	Adequate	Adequate but need repair	Inade-* quate	Not Available
1. Land				
2. Laboratory buildings				
3. Stores buildings				
4. Instrument repair workshop				
5. Machinery repair workshop				
6. Laboratory Equipment (Elaborate if possible)				
7. Transport facilities for staff				
8. Transport facilities for goods				
9. Agricultural machinery				
10. Tools and allied equipment				
11. Telephone				
12. Radio				
13. Other means of communication (Specify)				
14. Quarters				
a. Executives				
b. Middle level				
c. Minor employee				
15. Amenities				
a. Electricity				
b. Water				
c. Schools				
d. Medical				
e. Social				

* Where inadequate, provide a list of requirements in the relevant units (e.g. Land in acres, buildings in sq. feet, machinery and equipment by type etc.).

II. Stationwise data on Technical and Supporting Staff (including middle level grades) for 1983.

Station	Designation	Details of Cadre 1983	
		Approved Cadre	Number Available

III. Data on Available Technical Staff for each Station in 1983 (including all graduate level Cadres)

Station....

Division	Name	Designation	Qualifications and area of specialization	Grade	Age	Service

I.4 ISNAR Team Members

Dr. Matthew Dagg, Senior Research Officer, ISNAR.
(5-30 November 1983) Team Leader.

Mr. C. William Brookson, Tropical Agronomist, Consultant.
(11-30 November 1983).

Dr. Fred Haworth, Senior Research Officer, ISNAR.
(5-30 November 1983).

Dr. Arthur T. Mosher, Agricultural Economist, Consultant.
(5-30 November 1983).

Mr. Peter Oram, Senior Research Officer, ISNAR.
(5-30 November 1983).

Professor Dick Zwart, Faculty of Tropical Veterinary Medicine, University of Utrecht, Consultant.
(12-30 November 1983).

I.5 Itinerary of ISNAR Team

Date			
5-6 November		Arrival in Colombo, M. Dagg, A. Mosher, F. Haworth, and P. Oram.	
6 November		Brief meeting with members of the Subcommittee.	
7 November	am	Team meetings with:	
		Additional Secretary, MADR	D. Nilaweera.
		Secretary, MFP	W.M. Tilakaratna
		Director, Planning Division	L. Fernando
	pm	Meeting (F. Haworth and P. Oram) with:	
		Secretary, MCI	D. Wijesinghe
		Meetings (M. Dagg and A. Mosher) with:	
		General Manager, JEDB	K.D.W. Ratnayake
		General Manager, SPC	T.R. Goonewardena
8 November	am	Team meetings with:	
		Head of Mission, USAID	S.J. Littlefield
		Chief of Rural Development	M.J. Korin
		Secretary, MPI	I.D.K.G. Fernando
	pm	Director, ARTI and staff	T.B. Subasinghe
		Meeting (M. Dagg, A. Mosher, and P. Oram) with:	
		Secretary, MHE	F.S.C.P. Kalpage
9 November	am	Team meeting with Subcommittee, Agricultural Research Group: R.L. Wickremasinghe, M.F. Mohideen, E.H.V. Jayasekera, C.R. Panabokke, O.S. Peries and R.J. Jiron.	
	pm	Meetings with:	
		Secretary, MLLD	N. Abeywickrema
		Secretary, MRID	K.N. Weerakkody
		Travel from Colombo to University of Peradeniya, Kandy.	
10 November	am	Team meetings with:	
		Director of Agriculture, MADR	G.W.E. Fernando
		Deputy Director (Research)	S.D.I. Gunawardena
		Deputy Director (Education and Training)	S. Natesan
		Deputy Director (Extension)	P.O.S. Abeywardena
		Deputy Director (Agricultural Economics)	N.F.C. Ranaweera
	pm	Team meetings with:	
		Director CARI and senior staff	Mrs. N. de Alwis
		Officer-in-Charge, ISTI, Peradeniya	

11 November	am	Meetings with:	
		Director, PGIA, University of Peradeniya	T. Jogaratnam
		Dean, UPFA	H.P. Gunasena
		Arrival W. Brookson in Kandy.	
	pm	Visit to Regional Research Station, Banderawela (M. Dagg and F. Haworth) meetings with:	
			S.R. Arasasingham D. Wirasinghe.
12 November	am	Meetings (M. Dagg and F. Haworth) with:	
		Regional Research Station, Bandarawela	S.P.R. Weerasinghe
		Officer-in-charge, ISTI	N. Ranatunga
		Deputy Director (Education and Training)	S. Natesan.
		Visit (A. Mosher and W. Brookson) to Minor Export Crops Research Centre at Delpitiya, meetings with:	
		Director	S.T. Kirinde
		Deputy Director	W.S. Alles
	pm	M. Dagg and F. Haworth return to Kandy.	
		Visit (A. Mosher and W. Brookson) to site for International Winged Bean Research Institute with:	
		FAO/UNDP	V.J. Jacob
		Arrival D. Zwart in Kandy.	
13 November		Team discussions in Kandy.	
14 November	am	Meetings (M. Dagg and A. Mosher) with:	
		Director, RRC, Maha Illuppallama	M.H.J.P. Fernando
		Deputy Director (Research) RRC, Kilinochchi	J.A. Lewis
		Research Officer, RRC, Karadian Aru	W.S. Manoharan
		Assistant Director (Training) Regional Training Centre	H. Gamage
	pm	Assistant Director, Agriculture, Anuradhapura	W. Ratnayake
	am	Visit (W. Brookson and F. Haworth) to Minor Export Crops Research Centre, Matale, discussions with:	
		Director	W.S. Alles
		FAO/UNDP	V.J. Jacob

		Meetings (P. Oram and D. Zwart) with:	
		Director, DAPH	S.B. Dhanapala
		Project Leader, Dutch-Sri Lanka Project	A. Nell
	pm	Deputy Director, Division of Veterinary Research and Investigation, Gannoruwa	J.A. de S. Siriwardana
15 November		Travel to Kantalai (M. Dagg and A. Mosher), meetings with:	
		General Manager, Sri Lanka Sugar Corporation	P.K. Jayatilake
		Acting Director, SRI	K. Chapman
		PRO, Agronomy	U. Ratnaweera
		Visit to TRI Talawakella (W. Brookson and F. Haworth), meetings with M.F. Mohideen and R.J. Jiron and:	
		Director	K. Sivapalan
		Deputy Director (Research)	S. Kulasekaran
		Stay at TRI.	
		Visit (P. Oram and D. Zwart) to Livestock Research Project and Veterinary Investigation Centre, Polonnaruwa, discussions with:	
		Swiss Technical Assistance	K.C. Somapala
16 November		Meetings (M. Dagg and A. Mosher) with:	
		Deputy Director, Central Breeding Station, Batalagoda	D. Senadhira
		Coordinator, Cropping Systems Research	M. Sikurajapathy
		Travel to Colombo (W. Brookson and F. Haworth) via Tea Research Substation at Ratnapura, meetings with:	
			Mrs. S.I. Vitharne
			G. Wadasinghe
			M. Watson
	am	Meeting (D. Zwart) with:	
		Dean, Faculty of Veterinary Medicine	S.T. Fernando
		Department of Veterinary Medicine, Para-Clinical Studies	E.A. Wijewantha
		Department of Animal Science	R.W.A.S.B. Rajaguru
	pm	Visit to mid-country Livestock Centre (P. Oram and D. Zwart), discussions with:	
		Livestock Research Project (Livestock Development Board with Dutch Technical Assistance)	J. Westerbrink

17 November		Meeting (M. Dagg, A. Mosher, and P. Oram) with: Land and Water Use Division, Department of Agriculture	P. Krishnarajah
		Visit to Central Agricultural Research Institute, meetings with:	Mrs. N. de Alwis S.N. de S. Seneviratne, M.E.R. Pinto C.D. Dharmasena S.B.D.G. Jayawardena.
		Return to Colombo.	
		Visit (W. Brookson and F. Haworth) to Coconut Research Institute, Lunewila, discussions with:	
		Chairman of the Board	D.V. Liyenage
		Director	D.T. Wettasinghe
		Deputy Director and staff	R. Mahindapala
		D. Zwart return to Colombo via Investigation Centre and Training School, DAPH, discussions with:	P. Godwin.
18 November	am	Meeting (M. Dagg) with: Deputy Director, Meteorological Office	D.K.R. Karunaratne
		Meeting (W. Brookson and F. Haworth) with: Director General, Tea Board	R.L. de Silva
		Meeting (D. Zwart) with: General Manager, Livestock Development Board	P. Perera
	pm	Deputy Director, International Winged Bean Research Institute	W. Herath.
19-20 November		Team discussions	
21 November	am	Meetings with: Charge d'Affaires, Royal Netherlands Embassy	J.H. Daman Williams
		Resident Representative, IBRD	K.S. Lateef
		Meeting (D. Zwart) with: Secretary, MRID	K.N. Weerakkody
	pm	Director, NARESA	R.P. Jayawardene
		Meeting (W. Brookson) with: Secretary, MPI	I.O.G.K. Fernando
22 November		Visit to (W. Brookson and F. Haworth) RRI Aglawatta, discussions with:	
		Director	O.S. Peries
		Deputy Director	A. de S. Liyanage
		Assistant Director	D.M. Fernando

	am	Meeting (M. Dagg) with:	
		Land Use Division, Department of Irrigation	S. Dimantha I. Ozorai
		Meeting (M. Dagg, A. Mosher, P. Oram, and D. Zwart) with:	
		Resident Representative, FAO	N. Bradshaw
		Resident Representative, UNDP	R. Olver
	pm	Chairman, Agricultural Development Authority	Ranjan Wijeratne
23 November	am	Team meeting with Subcommittee	
	pm	meeting with:	
		Secretary of Ministry of Mahaweli Development	I. Samarawickrema
		Meeting (D. Zwart) with:	
		Chairman, National Livestock Development Board	L. Fonseka
		Meeting (W. Brookson) with:	
		Director, Ministry of Janatha Estates Development	R. Wijeratne
24 November	am	Meeting (M. Dagg, F. Haworth and D. Zwart) with:	
		Director, Institute of Fish Technology, NARA, MF	B. Subasinghe
	pm	Meeting (W. Brookson and F. Haworth) with:	
		Rubber Controller	M. Lelaratna
		Secretary, Ministry of State Plantations	E.D. de Alwis
25 November	am	Meeting (W. Brookson and F. Haworth) with:	
		Secretary, Coconut Development Authority	D. Wijesinghe Sumit de Silva
		Team meeting with Subcommittee	
	pm	Meeting (F. Haworth and P. Oram) with:	
		Secretary, Ministry of Public Administration	D.B.I.P.S. Siriwardhana
		Consultant to JEDB	R. Wijewardena
26-27 November		Team discussions and writing	
28 November	am	Meeting (P. Oram and D. Zwart) with:	
		Deputy Director, Livestock Planning Unit	A. Shakthivale
		Agricultural Economist (GTZ)	H. Dirksen
	pm	Meeting with Subcommittee	

29 November		Meeting (M. Dagg, A. Mosher, P. Oram, and D. Zwart) with Planning Division, Ministry for Plan Implementation	
		Director, Progress Control	H.P. Wijewardene
		Director, Food and Nutrition Policy	J. Amerasekera
	pm	Meeting (D. Zwart) with:	
		Deputy Director, Livestock Planning Unit	A. Shakthivale
		A. Mosher, departure for Amsterdam.	
30 November	am	Meeting (M. Dagg, P. Haworth, and P. Oram) with:	
		Deputy Director, Forestry Research Division	K. Vivekandan
	pm	Meeting with subcommittee and Director, Planning Division, Ministry of Finance and Planning	L. Fernando
		Departure for Amsterdam.	

ANNEX II

STRUCTURE OF THE AGRICULTURAL RESEARCH COMPLEX

Agricultural research is carried out in several research institutes and departments which function under seven ministries and the Office of the President. Although all research units come under the aupices of their respective ministries, some are controlled by boards, and therefore, are semi-autonomous. These units have greater flexibility of work and financial management than those in line ministries. In this annex, structures and organizations are considered with the emphasis on structure in relation to procedures and functions, that is, how the units work.

The ministries with responsibilities for research in agriculture, forestry, and fisheries are:

Ministry of Agricultural Development and Research (MADR)
Ministry of Lands and Land Development (MLLD)
Ministry of Rural Industrial Development (MRID)
Ministry of Plantation Industries (MPI)
Ministry of Coconut Industry (MCI)
Ministry of Fisheries (MF)
Ministry of Higher Education (MHE)

In addition, the Natural Resources, Energy, and Science Authority (NARESA) in the Office of the President supports agricultural research in areas deemed to be of high national priority.

II.1 MINISTRY OF AGRICULTURAL DEVELOPMENT AND RESEARCH (MADR)

This ministry, which has responsibility for research and development of all crops, except for rubber, tea, coconuts, and cashews, has four separate research units:

Department of Agriculture (DA)
Department of Minor Export Crops (DMEC)
Agrarian Research and Training Institute (ARTI)
Sugarcane Research Institute (SRI)

II.1.1 Department of Agriculture (DA)

Within this department, which is headed by the Director, there are eight divisions each headed by a Deputy Director: Research, Extension, Training. Economics, Farms and Planting Material, Engineering, Administration, and Finance. There are also units responsible for projects, and the Botanic Gardens.

The Director and the heads of divisions meet to formulate work programmes and to prepare budgets. The Director reports to the Secretary of MADR and through him to the Minister. Individual deputy directors may be asked to work directly with the Secretary and/or occasionally with the Minister on particular topics.

DA is responsible for the development and dissemination of new technology for the small farm sector and has specific responsibility for food crops. The generation of improved technology is the responsibility of the Research Division.

Research Division

In Sri Lanka, many crops can be grown successfully, but often the area suitable for a particular crop is small. Those crops on which research is being carried out are:

* rice, which is the staple food;
* coarse grains (maize, millets, wheat, and triticale);
* roots and tubers (potato, cassava, sweet potato, yams, and taro);
* grain legumes (mung, cowpea, blackgram, soya bean, pigeon pea, and chick pea);
* condiments (chilli, onion, garlic, turmeric, fenugreek, cumin, and fennel);
* agro-industrial crops (cotton, kenaf, groundnut, sesame, castor, sunflower, and safflower);
* horticultural crops (vegetables, fruits, and cut flowers).

The Research Division is responsible for the formulation of the national research strategy for these crops, including the establishment of priorities and the facilities and staff necessary to do the work.

Research is organized on a regional basis. The three main climatic zones have been divided into eight agro-ecological regions on the basis of climate, relief, and soils. The main irrigated and associated non-irrigable areas of the Mahaweli System C are regarded as an additional region.

There are nine regional research centres (RRC), and three research centres devoted to special crops or situations. Some RRCs with responsibility for a large area have smaller satellite experimental stations under their control. The RRCs together with their satellite stations are set out below:

1. Regional Research Centres	Satellite Stations
Killinochchi (northern dry zone)	Thirinelvely Paranthan Murunkan
Maha Illuppallama (central dry zone)	
Karadiyan Aru (eastern dry zone)	
Angunakolapelessa (southern dry zone)	Ambalantota
Makandura (low-country intermediate zone)	Wanathavillu Kalpitiya
Bandarawela (up-country intermediate zone)	Rahangala Monaragala Bibile

Gannoruwa (mid-country wet zone)	Pussellawa
Bombuwela (low-country wet zone)	Labuduwa Bentota
Gira Andura Kotte (for Mahaweli System C)	

2. Special Research Centres

Batalogoda, for rice breeding and agronomy

Sita Eliya, for potatoes and vegetables

Aralanganwila, for Mahaweli System B

The Land and Water Use Division and the Soil Conservation Division together with the headquarters administrative and technical staff, which are located at Peradeniya, make up the rest of the Research Division.

Within broadly defined national objectives, research programmes are increasingly being formulated at the regional level. Close linkages have been established with extension services and farmers through the formation of regional technical working groups (RTWGs) which meet twice a year. These groups are made up from staff from the following divisions within DA: Research, Extension, Education, Training, and Farms and Planting Materials, but officers from other organizations are also invited to meetings. These meetings, together with work in the agricultural extension and adaptive research programme ensure active interaction between research, extension, and farmers. Researchers teach in courses in the regional In-Service Training Institutes, which are attended by both extension officers and farmers.

The overall programme of the Research Division is considered by divisional committee, and later as part of the departmental programme at meetings of divisional heads which are chaired by the Director of Agriculture.

The concept is of lead stations for particular commodities and nationally coordinated programmes for the major crops. These lead stations or the programme coordinators take the lead in establishing or developing linkages with international research institutes or project agencies through the divisional headquarters in Peradeniya. At present, these are linkages with:

* International Rice Research Institute (IRRI);
* International Maize and Wheat Improvement Centre (CIMMYT);
* International Potato Centre (CIP);
* International Institute for Tropical Agriculture (IITA);
* International Crops Research Institute for the Semi-Arid Tropics (ICRISAT);
* Asian Vegetable Research and Development Centre (AVRDC).

This regionally oriented programme with emphasis on applied and adaptive research in response to client needs contrasts sharply with the earlier centralized programme based at the station at Gannoruwa. It has many important advantages, but the balance between problem-oriented research and opportunity-seeking research may need further

consideration. In addition, ways will need to be found of providing central specialist services and of maintaining the disciplinary competence of staff on the widely dispersed stations. These issues are within the purview of the Director of Agriculture.

Staff from the Division of Agricultural Economics and projects are posted to the RRCs under the respective station directors. To date, their work has been mainly concerned with data collection and agricultural statistics. While they assist the regional research and extension staff in various ways, the potential of this division in the study of production economics, farming systems, and in planning of research programmes has not as yet been developed.

For funding of the research programme, the consolidated budget of DA is forwarded through the Secretary of MADR to the Ministry of Finance and Planning. There is very little opportunity for senior research workers to interact with the higher level administrative officers in finance and planning, hence the political visibility of research and the contributions which research can and should make to the information for national development planning depends largely on the Secretary. Development issues are often seen to be of more immediate concern and are given higher priority than research.

Under present procedures, budgets cannot be approved and allocated for research specifically, because allocations are made to the MADR under "object codes" which each cover a range of activities, such as research, extension, and education. Although in DA this system has worked satisfactorily in the past, it is not conducive to effective planning of priorities, allocation of resources, and monitoring of the results in relation to declared objectives.

II.1.2 Department of Minor Export Crops (DMEC)

This small department was started in 1972. Construction of the main station at Matale began in 1974 and has been developed with FAO assistance, which is scheduled to end early in 1984. DMEC has responsibility for a large number of mainly non-food crops which have local and potential export markets. From these, seven have been selected for initial attention: cocoa, coffee, clove, nutmeg, pepper, cinnamon, and cardamon. The Director of DMEC is responsible to the Secretary of MADR. There are two divisions: the Research Division; and Technical Division dealing with extension, training and related activities; each is headed by an Assistant Director. Administrative and accountancy units complete the department.

Although most crops for which DMEC is responsible are mainly grown in the wet zone, conditions at Matale are not ideal for all these crops. Substations for specific programmes have been established at:

1. Delpitya (4.9 ha), for multistorey cropping of mid-country tea areas under the National Agricultural Diversification Authority;

2. Kundasale (5.3 ha), for work on cocoa;

3. Wariagalla (20 ha), for work on cinnamon and cocoa;

4. Gammaduwa (4.9 ha), newly acquired.

Only the Research Division is based at Matale, the Extension and Administrative Divisions are located in Kandy. A good start has been made on the establishment of the Matale station,but extra resources will be needed if it is to work on the wide range of crops for which it is responsible.

Research programmes are formulated within the Research Division for submission to the Director of DMEC and then to the Secretary of MADR.

Because the staff cadre of 29 graduates has not yet been filled, some research has been contracted to CRI, TRI, and PGIA, while staff of RRI have assisted the Station Director in various ways.

The research programmes are devoted to germ plasm collection and evaluation; and agronomic and crop protection studies in monocultures and, more often, in mixed cropping situations. These programmes are proceeding reasonably well, and the farmers are expanding output of some commodities. Unfortunately, there is no economic planning unit at the national level to provide market forecasts on which to base development and, therefore, research programmes. Guidance on production targets would be valuable to the Research Division in setting priorities.

To date, the Research Division has produced 10 technical bulletins on the main crops and 16 technical leaflets on specific topics. Some of these include guidance on the economics of producing crops in mixed cropping situations.

II.1.3 Agrarian Research and Training Institute (ARTI)

ARTI is an autonomous unit established by Act of Parliament and is governed by a board nominated by the Minister of MADR. There is wide representation on the Board;

*the Secretary of MADR (chairman);

* representatives from the following ministries
    Land and Land Development (MLLD)
    Mahaveli Development (MMD)
    Rural Industrial Development (MRID)
    Trade and Shipping (MTS)
    Finance and Planning (MFP)
    Regional Development (MRD)
    Plantation Industries (MPI)
    Higher Education (MHE)

* ex-officio members
    Director of Agriculture
    Land Commissioner
    Commissioner of Agrarian Services
    Director of Irrigation
    Commissioner of Cooperative Development
    Director of Rural Development

other members
    Director of ARTI
    representative of the Central Bank of Sri Lanka
    representative of the Faculty of Agriculture, University of Peradeniya;
    Country Representative of the Food and Agriculture Organization of the United Nations (FAO).

The composition of its board reflects ARTI's mandate to work on research and training on social, economic, and institutional aspects of agriculture. ARTI is the only major state organization in this area and has the largest group of socio-economists in the country. ARTI is organized into four research divisions: Agricultural Planning and Evaluation; Production Economics and Extension; Irrigation, Water Management, and Agrarian Relations; and Market and Food Policies. The Director is assisted by two Deputy Directors, and each division is headed by a Research and Training Officer with several years of experience.

The ARTI budget is received through the Ministry of MADR but is at the disposal of the Director for programmes agreed on by its board. Unfortunately, this budget is claimed to cover only staff and institutional costs; and all programme operating costs have to be obtained from other sources. The programme consists, therefore, essentially of contract work in or for development projects which provide the funding. While this system has worked well, it has not permitted ARTI to develop its own research programme, and it is difficult to manage a programme made up entirely of project-type activities. The advantage of this type of funding is that disbursements are not subject to the cumbersome bureaucratic procedures of the public service.

In spite of the broad composition of the board, there is insufficient formal contact between ARTI and policy makers in government. Similarly, the formulation of the programme depends more on the availability of project funds than on identified development needs brought to the notice of the institute by the board members.

II.1.4 Sugarcane Research Institute (SRI)

Prior to 1981, research on sugarcane was carried out by the Sri Lanka Sugar Corporation, which extended the work already done in the late 1940s by DA and established the basic agronomic and disease control practices for two small production areas. Production from these areas amounts to about 10% of the estimated annual sugarcane consumption of 250,000 tons. The government has taken steps to increase local production and, recognizing the need for effective research support for an industry expanding into new areas under both irrigated and rainfed conditions, has established the autonomous Sugarcane Research Institute (SRI).

The Act of Parliament setting up SRI was passed in 1981, but since there have been delays in starting work, the institute is still in the formative and planning stage. Although administratively within MADR, it is controlled by a board of five members:

* Director of National Institute of Plantation Management (chairman);
* Director of Agriculture (MADR);
* representative of the Faculty of Agriculture, University of Peradeniya;
* Chairman of Sri Lanka Sugar Corporation (ex-officio);
* a representative of MFP.

It has been recognized that there is substantial world knowledge on the growing of sugarcane and that germ plasm has been collected for breeding work at several institutes. Linkages have been established with the Sugarcane Breeding Institute at Coimbatore, the Sugarcane Research Institute in Mauritius, the United States Department of Agriculture, and the Canal Point Research Station in the United States.

A detailed plan for the development of SRI has been drawn up including provision of facilities for research on sugarcane production and on mill technology. It seems likely, however, that the organization of production and transport systems, and the construction of new factories will be the main immediate concerns. Operational and management research will be important at this stage. Most research on the crop itself will be adaptive, because the basic agronomic requirements of cane are known, and Sri Lanka does not have any unusual pest or disease problems. Some breeding work may be needed but, initially, efforts will be on the collection of varieties from other countries (subject to adequate quarantine safeguards) for testing under Sri Lankan conditions. SRI has yet to recruit the essential small core of experienced scientists required. It is necessary that SRI has flexibility to respond to identified needs rather than to fit into a particular organizational form.

II.2 MINISTRY OF LANDS AND LAND DEVELOPMENT (MLLD)

The main responsibilities of this line ministry are land use policy and planning, and settlements especially in the large irrigation schemes. Two departments of the Ministry have small research programmes, in addition to irrigation research on engineering aspects of water management.

II.2.1 Forest Department

Forestry Department's main task is to provide services and resource management planning advice. For many years, it has had a research unit; but at present this unit is very small with only one research officer in post out of an establishment of four. At first, research was concentrated on the botanical characteristics of indigenous species in the forests covering 54% of the land area i 1954, and the management of natural forests.

Since 1954, the forest cover has been rapidly depleted and replanting with exotic species with faster growth rates than the indigenous species started. Again, research was on silvicultural practices for these species grown in pure stands. In the last few years, forest composition improvement work has been started. In all of this work, the cooperation of the conservators of forests has been essential in order to get the work done with the small research staff available.

Several other activities of the department have what may be regarded as research components, but are usually described as forest management studies. These range from watershed management practices to prevent siltation of large dams, provision of fuelwood for new settlements (coppicing capacity being important here), and community forestry projects to provide local sources of fuel, poles, and timber.

The national concern to grow as much fuel as well as food as possible, and the interactions between forestry and agriculture needed to do this, suggest that, even though there is a basic structure to enable research to be done, the size of the unit and its comparative isolation from the Department of Agriculture preclude its making its full contribution to increased production.

II.2.2 Irrigation Department

Although the Irrigation Department is mainly concerned with the supply of irrigation water for crop production, the Land Use Division within this department also has responsibility for the National Soil Survey. The Irrigation Department carries out research in two areas: the design of water supply structures; and land capability surveys to assist in land-use planning and the establishment of rational land-use policies.

There is as yet no mechanism for identifying problems in the field (e.g., in-field water management, and water use by crops). However, there is a growing realization by field engineers that research is needed at this level, and some research on in-field water management has been supported by a grant from a donor.

Linkages have been established with MADR and MMD to identify research problems in some areas. The work itself has been on-farm but confined to land-forming and other land preparation activities. There have been discussions about the formation of a national multidisciplinary committee or group to identify and to channel problems and opportunities to the appropriate research unit. One proposed division of work would leave engineering aspects to MLLD, water use studies to MADR, and socio-economic studies to AKTI and the universities. Essentially, these studies would be joint programmes.

Irrigation Department has considerable professional strength in the hydrology and design, and the Land Use Division has the technical staff and laboratory facilities to carry out modest research programmes. Given the strength of the Irrigation Department and the linkages already formed with MADR, the cooperation could be extended to include forestry in soil and water conservation studies in cultivated and forested catchments.

Strengthening of the research capacity of the Irrigation Department so that it may interact effectively with the newly formed International Institute of Water Management is under consideration.

II.3 MINISTRY OF RURAL INDUSTRIAL DEVELOPMENT (MRID)

MRID is responsible for the overall development of the livestock and small industries sectors. Its main activities in the livestock sector are:

* direction and supervision of
  Department of Annual Production and Health (DAPH)
  National Milk Board
  Ceylon Oils and Fats Corporation
  National Livestock Development Board
  Livestock Development Division;

* formulation of livestock development policy;

* preparation, implementation, monitoring, and control of plans for the livestock industry;

* provision of supporting infrastructure and services, and regulatory activities;

* promotion of research and extension on profitable livestock production.

These activities, which constitute about 90% of the work of MRID, are under the direct control of the Secretary. There is an Additional Secretary responsible for the small industries sector. The value of a strong planning unit has been recognized and donor support for its development has been secured.

II.3.1 Department of Annual Production and Health (DAPH)

Research undertaken by the MRID is formally located in DAPH, but there is also an element of adaptive research in several of the development projects. Within this department, which is headed by the Director, there are the following divisions:

* Animal Health and Extension
* Animal Breeding
* Education, Training and Information
* Livestock Farms
* Livestock Development
* Research
* Administration
* Accounts
* Engineering

Research Division

Within this division, research staff are concentrated at the Veterinary Research Institute (VRI) at Gannoruwa. As the division also has responsibility for the vaccine laboratory, animal virus laboratory, and the regional veterinary investigation centres, research work can be done at several sites if required. The VRI has seven subsections:

* Pasture and fodder crops
* Animal nutrition
* Animal breeding
* Bacteriology
* Virology
* Parasitology
* Reproductive disorders

The main objectives of the research work are to contribute to the solution of problems in animal health and livestock production. Research projects are submitted by individual scientists or assigned by the Deputy Director. The research group discusses all proposals but final decisions are made by the Head of the Research Division.

There appears to be no mechanism for involving a wider group in the setting of research priorities. Firm links have been established with the veterinary officers who are responsible for advising farmers and extension workers on livestock production. In addition, the Deputy Director is a member of the ministerial pasture development committee which meets twice a year.

Although the National Livestock Development Board (NLDB) is under MRID, the seven-member executive committee of the board has no representatives of MRID or of the Faculty of Veterinary Medicine in University of Peradeniya. Similarly, the Deputy Director of VRI reports through the Director of DAPH to the Secretary of MRID, but is called only occasionally for discussions. Since the Research Division is small in

relation to the total number of livestock development staff, and since it is not represented formally at policy making levels in MRID, it is difficult for research to make its potential contribution to livestock development known at these levels.

The research programme is heavily biased towards the extremely important field of animal health. The small amount of work on pastures and feeds overlaps with work being done in University of Peradeniya and the Department of Agriculture of MADR. There is no joint or collaborative programme, or, indeed, a mechanism by which such a programme could be formulated.

Since NLDB has large herds of cattle, which are grazed mainly under coconuts, there is opportunity for research on the whole production system in cooperation with the Coconut Research Institute (CRI), VRI and NLDB. Although the need is recognised, as yet such research has not been carried out.

On most small farms, crop production is the dominant activity with livestock taking a secondary but often essential place. Research is needed, therefore, on crops and on livestock within the context of the farm as an economic unit. At present, there is no formal mechanism by which appropriate research programmes can be formulated jointly by MADR and MRID, the ministries responsible respectively for research on crops and livestock.

Efforts are being made to overcome some of these problems. Strengthening of the Planning Division of MRID should be helpful in identifying ways in which essential programmes can be formulated.

II.4 MINISTRY OF PLANTATION INDUSTRY (MPI)

MPI has responsibility for plantation crops other than coconuts and sugarcane. The two main export crops, tea and rubber, are each served by a long-established specialist commodity research institute. There are differences between these research organizations primarily because of the different structure of production in the two industries.

Organizationally, the boards and offices responsible for the tea and rubber industries come under the Secretary of MPI. Operationally, however, the industries are controlled by boards established by Acts of Parliament. The legislation also provides the basis for funding the research institutes through cesses on exports. Other development activities in connection with tea and rubber are funded in other ways. The boards are largely autonomous in their day-to-day operations within the general policies established by the group consisting of the Ministers of Finance and Planning, Plantation Industry, and Trade and Shipping. The group is serviced by a Secretary-level consultative committee.

II.4.1 Tea Board (TB)

The Tea Board is directly responsible for:

* Tea Research Institute (TRI)
* Division of the Tea Commissioner
* Tea Promotion Bureau.

It is also indirectly responsible for the Tea Smallholders Development Authority (TSHDA) for which it provides funds. This authority, which has its own board distinct from the Tea Board, is a semi-autonomous unit.

The Tea Research Board, which assists the Tea Board in the control of TRI, consists of three research scientists, two representatives of the trade (brokers or exporters), and one representative of the private estate sector; but at present there is no representative from the plantations sector.

Tea Research Institute (TRI)

The Tea Research Institute was established on St. Coombs Estate near Talawakelle in the up-country zone by the tea industry itself. As a consequence, it has developed as an integral part of the industry, with the producers playing a major role in determining research policies and in carrying out part of the work at minimum cost to the institute. Until comparatively recently, 12 out of 18 members of the management committee were drawn from the industry.

For various reasons, the effectiveness of this management pattern has declined and efforts to find viable alternatives have not been successful. Thus, while the linkages with the policy making levels within the Tea Board have been maintained, the Director of TRI is in an isolated position when setting research priorities and drawing up research programmes. This relative isolation also affects his capacity to interact with full confidence at policy levels. Action has recently been taken to re-establish a management board with wide representation.

The administrative headquarters and main laboratories of TRI are on St. Coombs estate; there are two Research, Advisory and Extension Centres, one at Kandy for mid-country tea, and the other at Ratnapura for low-country tea. In addition, to cover other ecological areas, there are three Advisory and Extension Centres which also carry out some trials. The organization of the Tea Research Institute is set out in Figure II.1. The research complement is 33 officers plus support staff; currently about 21 officers are in post.

TRI is responsible for research on production and processing. Its advisory responsibilities are limited to estates of more than 50 acres, mainly under the Janatha Estates Development Board (JEDB) and the State Plantations Corporation (SPC), both of which come under the Office of the President. TRI is also expected to provide assistance to TSHDA with the work with smallholders.

Funding is provided directly by the Tea Board on the basis of the cess on exports. Budgetary procedures are flexible and designed to promote and support research subject to adequate auditing safeguards.

Linkages with other research units in Sri Lanka are mainly on an informal basis, but TRI has received funds from EAEC for work in the mid-country areas on growing pepper as an intercrop in some areas. There is little interaction with tea research institutes in other countries.

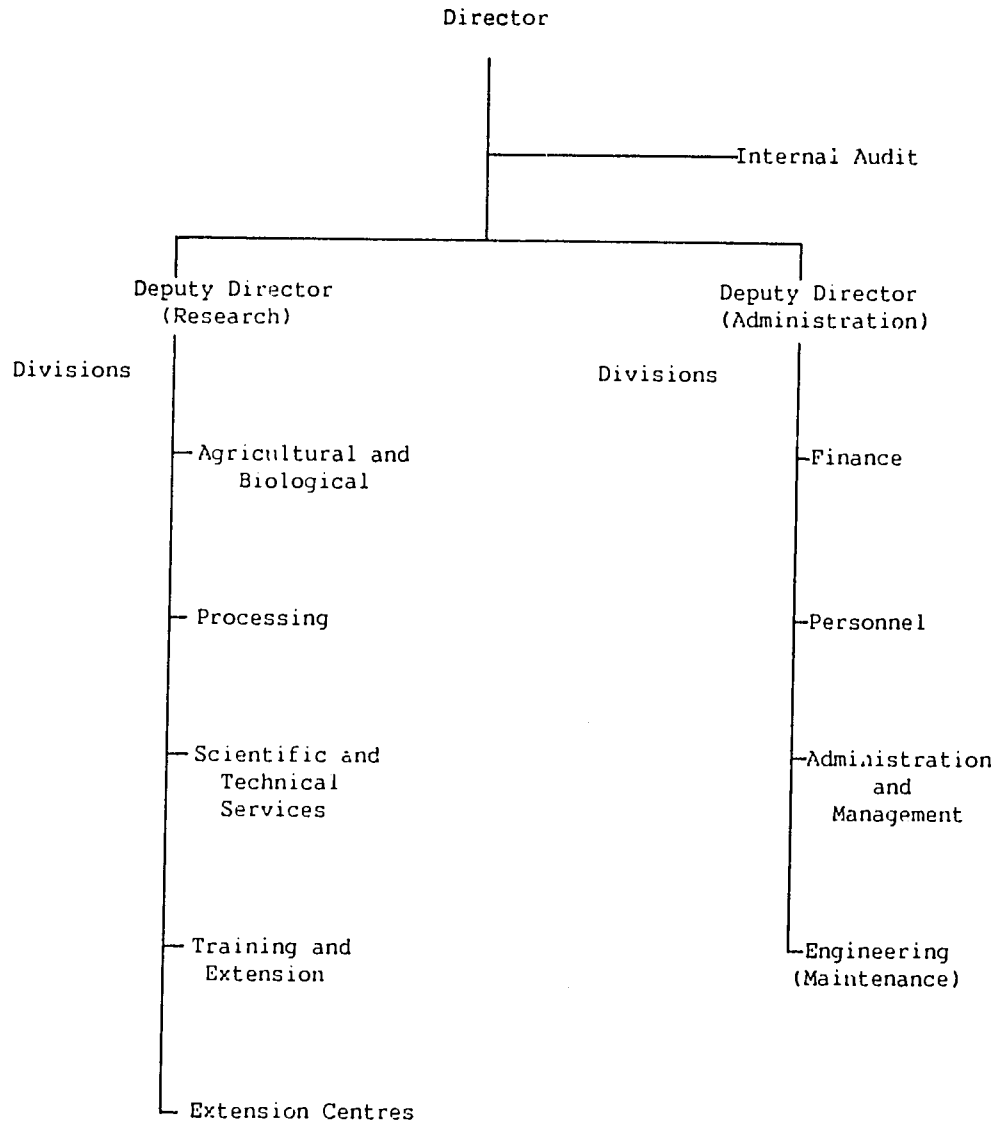

Figure II.1 Organization of the Tea Research Institute

Programmes are drawn up by the senior scientists, and after agreement with the Director are submitted to the Tea Board for approval. This is an effective process but means that the Tea Board itself has a relatively small formative role in the process. Producer-institute-board linkages in programme formulation could usefully be strengthened.

Smallholder Development Authority (TSHDA)

TSHDA has no research responsibilities or functions. Nevertheless, as the official body with responsibilities for smallholders, it has a potentially important role in extension service. Its main activities are the provision of processing facilities and buying green leaf for processing in its own factories. TSHDA also administers all grants and improvement schemes for the tea smallholders. Advice on production represents a small part of its activities.

It has been proposed that TRI should take a more active role in extension and training in both production sectors. Considering the large number of smallholders, it would be impossible to reach them all on an individual basis. Leaf collection points and factories which are focal points of contact between the producers and the authority, may be used to advantage in any intensified extension service.

II.4.2 Rubber Research Board (RRB)

There is a broad division of responsibilities and activities between RRB and the Office of the Controller of Rubber. The RRB is responsible for research and advisory services on production and processing. The main board sets the overall policy for the industry and deals with commercial aspects of replanting and development schemes. The two groups work closely together and are linked to the International Rubber Research and Development Board (IRRDB) which meets in various countries. At these meetings representatives of the producing countries decide on internationally agreed policies on all matters pertaining to the rubber production industry. The representative for Sri Lanka is drawn from RRB, and is usually the Director of the Rubber Research Institute (RRI), who is Vice-Chairman of the Board.

The composition of RRB differs in principle from that of the Tea Board. The members of RRB are chosen to represent specific interest groups, whereas the members of the Tea Board act in individual capacities. The composition of the RRB is:

* Chairman, elected by the members;
* Director of RRI (ex-officio), vice-chairman;
* Director of Agriculture;
* Rubber Controller;
* one member of the National Assembly, usually from the rubber districts;
* two members nominated by the Planters Association;
* two members nominated by the Low-Country Products Association;
* one member nominated by the Minister of MPI to represent the smallholders;
* Deputy Secretary to the Treasury or alternate.

Rubber Research Institute (RRI)

RRI operates directly under RRB; there is no intervening research management committee. This is made possible by the close integration of policy, research, and production which exists and is necessary, if the

rubber industry is to remain competitive in world markets. The Director and the staff of RRI develop research programmes within this context, and RRB exercises a monitoring and evaluation role through programme reviews at two to three year intervals. These reviews are carried out by groups from outside RRB.

The organization of RRI is set out in Figure II.2. The Director of RRI has three main areas of responsibility:

* RRI and its substations at Nivitigalakele and Kuruwita;
* Advisory Services Department (ASD), and the training centre at the Nivitigalakele substation;
* RRI office in Colombo.

Apart from the Rubber Chemistry Department, the main laboratories, experimental areas, and processing facilities are located at the main station. Most field trials, however, are carried out on estates controlled by JEDB and STC. The estates bear the usual estate costs, while RRI pays only for additional experimental costs and for recording. The organization of ASD is set out in Figure II.3. Consideration is being given to a proposal that ASD should become a separate unit with its own director.

The Colombo office houses the Rubber Chemistry Department, the library, general administration and accounts, and the Head of the Intercropping Department. It has a specialist electronic instruments repair unit, which is available to service equipment from other research units on a fee basis, and which is potentially an extremely valuable service for the research service as a whole.

Research activities are funded by a cess on rubber exports, which is paid directly from the Customs Department to RRB. The Advisory Services Department and its training school are funded partly from the cess and partly by government grant, because the service has major responsibilities under SRRP. The Director of RRI administers the agreed budget, subject to approval from the Chairman of the Board for certain capital items. There is adequate flexibility in the financial procedures to accommodate modifications to programmes as the work proceeds. Unfortunately, this essential flexibility is being gradually eroded by changes being imposed on the Board from MPI.

II.5 MINISTRY OF COCONUT INDUSTRY (MCI)

The coconut industry in Sri Lanka has several important features with regard to research and extension needs and the present organization of the research and extension services.

Unlike rubber and tea, coconuts must be regarded as a major food crop as well as a source of industrial products some of which are exported. Recent estimates suggest that from 70% to 80% of the crop is consumed in the country. The industrial products are diverse, as both kernel and non-kernel items are involved. There are no recent figures available on the size distribution of coconut holdings, but in 1973 it was estimated that 65% of the area was in holdings of less than 20 acres, with a large number of very small units. It is known that changes have taken place in the large estates as a result of legislation, and it is believed that the number of small holdings has increased. Because coconut is a major food source, it has been planted in areas which are ecologically unsuitable. Yields in these areas are affected by drought in most years.

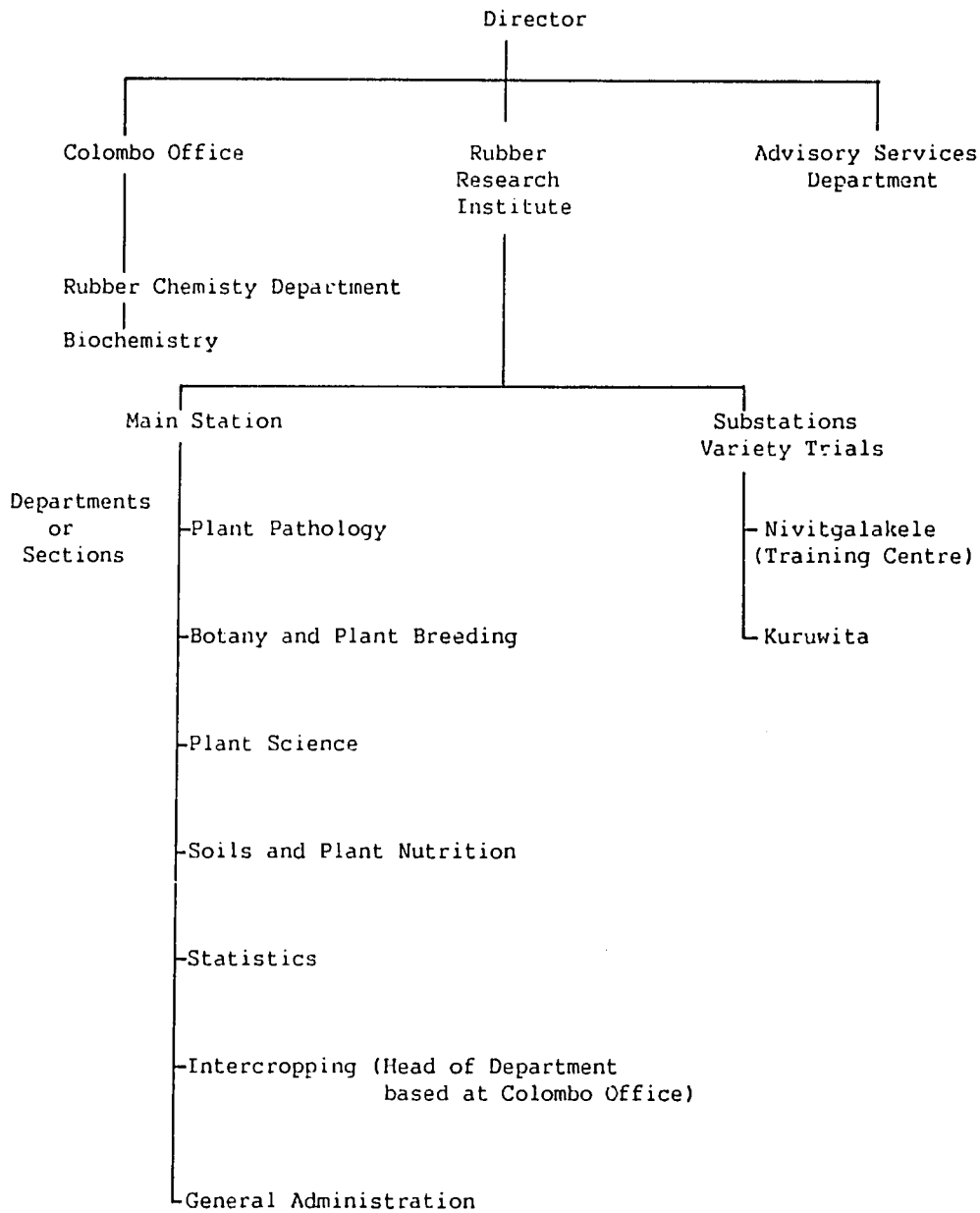

Figure II.2 Organization of the Rubber Research Institute

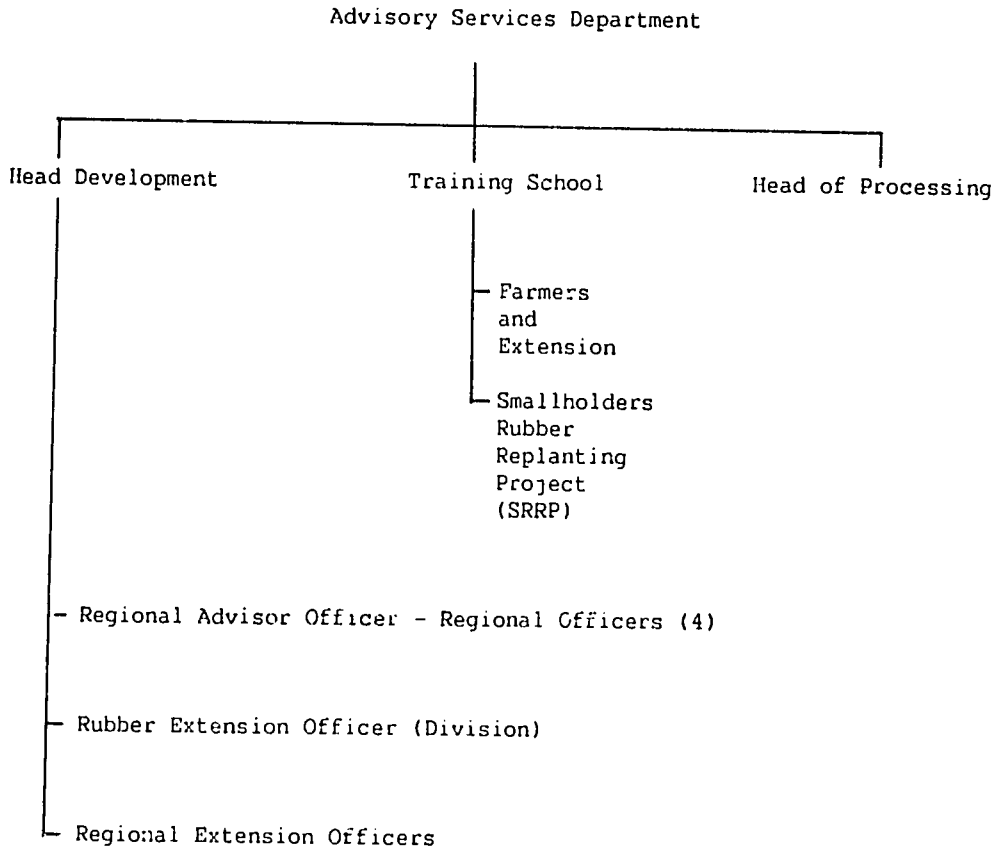

Figure II.3 Organization of the Advisory Services Department

MCI is responsible for the industry as a whole. There is the Coconut Development Authority (CDA), which has a board of five full members and four observer members; the Secretary of MCI is Chairman of the Board. The observer members are ex-officio, but the full members are nominated by the Minister and act in their individual capacities. The work of the authority in relation to production and research is split between the Coconut Cultivation Board (CCB), which is responsible for the advisory and extension service and the administration of development schemes; and the Coconut Research Board (CRB), which is responsible for research on production and aspects of processing. CDA itself carries out some research work on processing and product development.

The members of the two boards are nominated by the Minister and represent a wide range of interests in planting and processing. Although both the Chairman of CCB and of CRB are observer members on the Board of CDA, no individual serves on both CCB and CRB.

II.5.1 Coconut Research Institute

The general organization of the CRI is presented in Figure II.4. There are broad subcommittees of the Board of CRI for research, administration, and estate management. The research subcommittee has six members: the Chairman and one other from CRB; the General Manager of CCB; representative of JEDB; and the Director and Deputy Director (Research) of CRI. This recently established subcommittee is responsible for planning, programming, and monitoring of the work of CRI. It does not include representatives from the Department of Agriculture (MADR), Minor Export Crops (MADR), or the Livestock Department (MRID) which deal with research on a range of crops and on livestock possibly of relevance to increasing incomes and production in the coconut growing areas.

The main station of CRI is located at Lunewila in a major coconut growing area, but is itself on an area of only moderately fertile soil. CRI has nine outstation units, of which, four may be regarded as substations to provide appropriate sites for aspects of the general programme. The other five outstations are specialist units:

* parasite breeding station for work on biological control of pests;
* adaptive research farm, mainly for work on intercropping;
* unit of three farms on the east coast for work on agronomy in the dry zone;
* nursery in Colombo for the sale of plants;
* isolated seed garden for the production of improved planting material.

The headquarters station houses an international documentation centre on coconuts, which was developed to serve the region as a whole and which offers an abstracting service. It does not receive financial support from the member countries of the Asian and Pacific Coconut Community (APCC), and is in effect a national unit supported by one external donor.

Funds are allocated on an annual basis from the ministry to CRB which operates essentially as a department within a line ministry in budgetary matters. The budget of CRI is, therefore, less stable than that of TRI or of RRI which depend on cess contributions. Although the cesses depend on the quantities exported, the amount is reasonably predictable. As it is many years before research on tree crops can produce results, security of funding on a programme basis is essential.

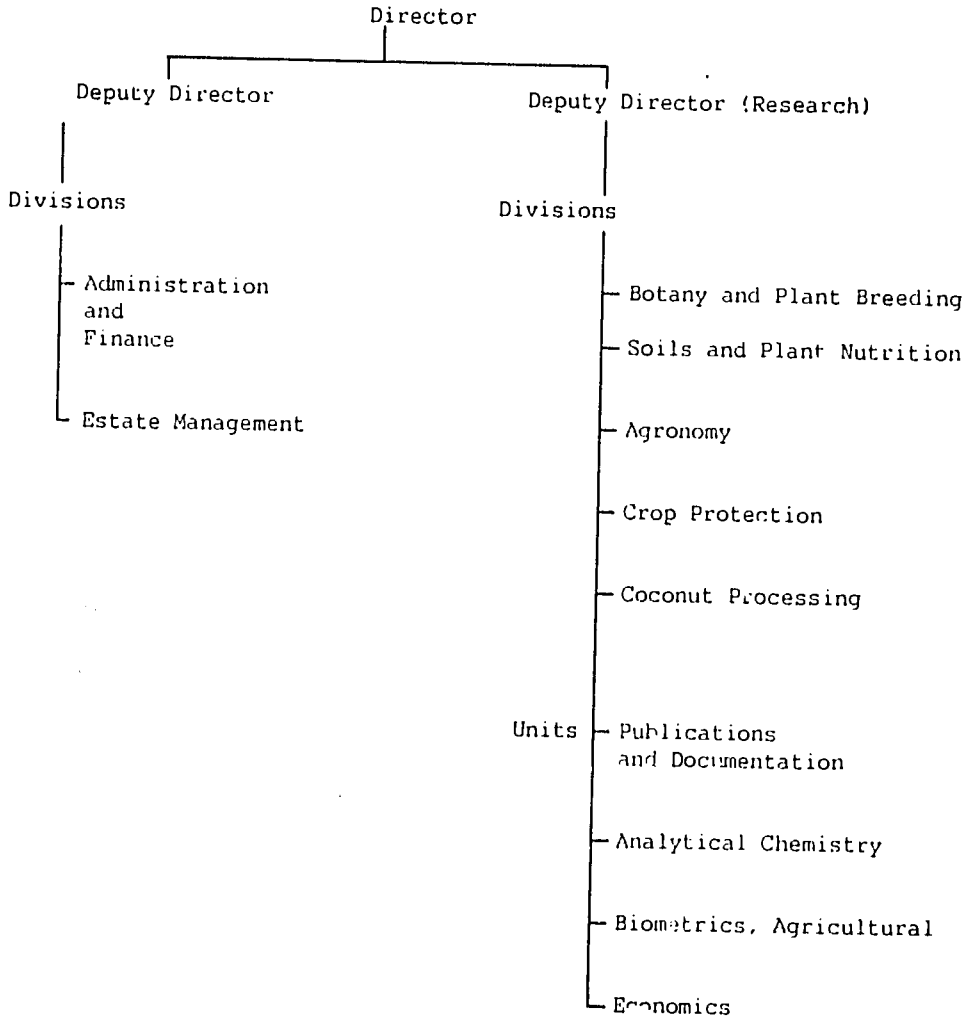

Figure II.4 Organization of the Coconut Research Institute

Apart from contacts with the Asian and Pacific Coconut Community (APCC), there are few contacts with research organizations outside Sri Lanka. Within the country, there are no formal contacts with other ministries or research units. On a personal basis, discussions are held at director and individual specialist levels.

Within the industry as a whole, and hence affecting the ability of CRI to plan a long-term programme effectively, there is lack of guidance on a long-term strategy for the edible oils sector, of which coconuts provide the greater part at present. If export of kernel products are to be maintained or increased and the needs of the increasing population are to be met, the overall edible oil strategy merits early consideration.

II.6 MINISTRY OF FISHERIES (MF)

MF is responsible for the overall development, regulation, and control of marine and inland fisheries, fishery harbours, handling of the catch, and coast conservation. Within MF, research is carried out by the National Aquatic Resources Agency (NARA), a semi-autonomous unit established by Act of Parliament in 1981. The Fisheries Research Branch of MF and the Institute of Fish Technology form the nucleus of the organization.

II.6.1 National Aquatic Resources Agency (NARA)

NARA is controlled by a board, of which the Secretary of MF is the chairman. This board is responsible for general policy guidance and for provision and control of funds. The larger management council (32 persons) gives technical guidance to the Minister and to the board. The council has representatives of several ministries, including Ministry of Finance and Planning, and Ministry of Trade and Industry, the fishing industry in various regions, and universities, in addition to the senior staff of NARA and others from MF.

The executive head of NARA is the Director General. This relatively new organization has eight units or divisions together with a secretariat. The units, which, except for the library are headed by directors, are: Marine Biological Resources; Post-Harvest Technology; Inland Aquatic Resources; Oceanography and Survey of Resources; Statistics and Data Processing; Engineering Technology; Services and Operations; and Library (headed by a chief librarian).

There is no specific planning unit under the Director General. Programmes are formulated annually, and after discussion at director level and clearance by the Director General, are submitted to a scientific technical committee of 25 persons appointed by the board. Individual directors are required to argue their proposals before this committee, which is required to approve all programmes to be funded by the board. Legally, the committee is required to meet every two months but this schedule is not kept. On the other hand, the board meets once a month, and clearly has an executive role as well as being concerned with general policy.

There is no planning unit in NARA, but the general policy of MF, which has been laid down after a major baseline survey of resources, provides firm development guidelines from which research policy and programmes are derived. Current research programmes reflect the broad national policy, which is in three parts:

* maintaining the present offtake, which represents about 60% to 70% of the estimated sustainable catch, from inshore fisheries and maximizing the proportion of the marine catch used directly for human consumption;

* developing the considerable areas of fresh and of brackish water which are not fully exploited at present;

* exploring and responding to market opportunities, including some overseas, for other aquatic production, e.g., exotic fishes for aquaria, and brine shrimp from the salt plans or produced in special cultures.

Although the total financial allocation to NARA is modest, the Director General has sufficient flexibility and budgetary authority to support efficient working. The headquarters station near Colombo and three regional stations are in process of development so that appreciable capital expenditure may be needed in the near future.

II.7 MINISTRY OF HIGHER EDUCATION (MHE)

Within the universities system, there are five main units concerned directly with agriculture, and animal health and production:

* Faculty of Agriculture, University of Peradeniya;
* Faculty of Veterinary Medicine and Animal Science, University of Peradeniya;
* Faculty of Agriculture, University College of Ruhuna;
* Faculty of Agriculture, University College of Batticaloa;
* Postgraduate Institute of Agriculture, Peradeniya (PGIA).

The largest of these units is the Faculty of Agriculture, in the University of Peradeniya with about 100 members of staff. Within a few years all staff members will be qualified to at least at the M.Phil. level with the majority at the Ph.D level. The Faculty of Veterinary Medicine has about 25 staff members of whom about half have Ph.Ds. The Dean of the Faculty of Agriculture is responsible for coordination of teaching and research in six departments: Crop Science; Agriculture; Biology; Agricultural Chemistry; Economics; Agricultural Engineering; and Animal Science. The Department of Animal Science is financed jointly by the Faculties of Agriculture and of Veterinary Medicine; and the Head of Department has voting rights in both faculties. This department has a large farm which is currently underused as regards research.

The smaller Faculties of Agriculture at Ruhuna and at Batticaloa together have about 50 staff members. In general, the staff are less experienced than those in the University of Peradeniya because these colleges have been established more recently.

Considered to be primarily teaching institutions, the facilities are appropriate for these purposes. Some special research facilities are available, but these are mainly used for the training of students as part of the courses at the Postgraduate Institute of Agriculture.

The Director of PGIA reports to a board of which the Vice-Chancellor of the University and the Director of Agriculture are members. The Deans of the Faculties of Agriculture and of Veterinary Medicine and the Director of PGIA report to the Vice-Chancellor, who is responsible to the University Grants Commission (UGC).

Funding for teaching comes from UGC. However, funding for research which comes from MHE is quite inadequate, and, therefore, research depends largely on external funding from either NARESA or abroad. Funding for training at PGIA comes from several sources, including the Department of Agriculture, which sponsors members of its own staff. This forms a valuable link between the university and the organizations which employ its graduates.

As there are about 180 well-qualified members of staff in these faculties, and the annual intake into PGIA is about 70, the provision of secure recurrent funding to ensure that this large manpower resource can be used to the full in the national agricultural research effort merits urgent consideration.

II.8 THE OFFICE OF THE PRESIDENT

One unit in the research complex in Sri Lanka reports directly to the President. This is the Natural Resources, Energy and Science Authority (NARESA) which was constituted by Act of Parliament in 1981. The main objectives of NARESA are to advise the President on policies concerning science, natural resource development, and energy; to initiate and sponsor research in these areas; to collect and disseminate information; and to study and report on matters of importance regarding science and technology, natural resources, and energy.

The governing board of NARESA consists of the Director General, who is chairman, and ten members appointed by the President from a wide range of mainly scientific and socio-economic disciplines. There are ten working committees in the various areas of NARESA's responsibility.

The main activity of NARESA in agricultural research so far has been the channelling of funds to priority research areas in response to specific requests from staff in public sector institutions. These grants are made from local resources or from funds provided by donors for specific purposes.

The number of staff of NARESA is small, but it can draw upon the full range of expertise available through its working committees and by interaction with other research units.

ANNEX III

LINKAGES AFFECTING POLICY, PLANNING AND RESOURCE ALLOCATION IN AGRICULTURAL RESEARCH

The main objective of a national agricultural research system is to enhance the economic and social welfare of the country. Although this may involve the pursuit of a varied range of component and intermediate objectives, and the evolution of a complex of mechanisms and structures which are not necessarily the same in every country, improvement of economic and social welfare should be the ultimate goal of the system and its separate institutions. If the research system is to be successful in achieving this goal in the long-term, certain prerequisites concerning linkages and communications must be fulfilled.

The managers of the research system must be well aware of the national objectives, and when necessary, given clear directives as to the national policies to which research should be directed. There should, therefore, be opportunity for dialogue between research managers and policy makers. This should allow research managers to indicate to planners the needs and problems of producers and feasible ways of approaching them through research, and thus to contribute to the formulation of realistic and attainable national objectives. Such dialogue should facilitate clearer understanding by both planners and researchers of priorities in national goals, and it should permit interchange of ideas as to the resources needed to attain these goals, the scientific probabilities of success, and the probable time horizon for the research. Efficient dialogue should lead to resources being allocated to the research system commensurate with national research needs and appropriate to the individual components of the system in relation to national priorities, as assessed with respect to current value and future potential.

Within these main priorities, managers of the various components of the system must decide which programmes and/or projects within programmes are most likely to provide solutions to the problems impeding achievement of their objectives. They must allocate their share of national research resources accordingly. The latter, again, should not be simply a passive top-down planning process. There should be opportunities for dialogue between the managers of the research systems as a whole and those responsible for implementation of major programmes in the research institutes. At the research station, the scientist should be in easy two-way communication with his main clients, the farmers and extension service.

The research system should be sufficiently flexible to foster, not merely dialogue and interchange of ideas, but also active cooperation among its component research institutions to help achieve national goals. In other words, there should be two-way interactions, both vertically and horizontally, within the research complex, and from research to its clients, whether the latter be policy-makers and planners "upstream" or producers and consumers of the products of research "downstream".

Successful planning thus depends heavily on intercommunication between all those involved, in order to increase understanding of their aims and (sometimes conflicting) objectives and to devise policies which will as far as possible reconcile conflicts.

To be useful to policy makers, research information needs to be collated, analysed, and interpreted in terms they can appreciate, usually economic, and suited to macro-economic research and macro-policy decisions at the national level. The producers and consumers are equally concerned about the implications of improved technology on their enterprises and well being, which need interpretation on a micro-economic scale. An economic research input is, therefore, an essential component in effective linkages between the research group and both policy makers and producers.

III.1 Levels of Policy Decision

A sound mechanism for planning, setting priorities, and allocating resources to research is not in itself a guarantee of a successful and productive system, because it may be nullified by inadequate financial or human resource management within the system, or circumstances and policies outside the system which frustrate the adoption of the results of research. However, a good match between national objectives, research priorities, and research resources is essential if research is to contribute adequately to national and regional goals. Policy decisions which may critically affect this ability to contribute may be taken at several levels within government, but usually at least three levels are involved.

Firstly, there is the interministerial level, where resources are allocated to major sectors of the economy, by various mechanisms (planning or finance ministries, ministerial councils, presidential decree, etc). Political considerations weigh heavily at this level; and subsectoral priorities or components of ministerial budgets, such as research, may not be considered individually. However, how a particular ministry vote fares overall, nevertheless may have a profound impact on the budgets of its constituent components. The opportunity for individual agricultural researchers to exert direct effect on policy at this level is likely to be small but collectively, research can be of great value in providing objective guidance. Such questions which may be required to be answered here include: are the problems essentially research-oriented or are the causes rooted elsewhere; how large a research system can the country sustain; what sectors (or clients) need help or will benefit most from research; what price policies or other policies are likely to be most conducive to the achievement of technological progress in agriculture.

Secondly, there is the level of line ministries, where direct decisions are taken on the priorities in subsectors, such as, crops and livestock, or components, such as, research and extension. Here, research results and insight should have a major impact on decisions as to where and how to allocate resources, not only to research but to other competing needs. Research directors should be in close contact with their respective ministers. At this level, resources are usually committed to major research priorities.

Thirdly, there is the level of individual research departments, experimental stations, and major research programmes. Usually, these will be lead stations, for example, institutes responsible for controlling research on key commodities (coconuts, rubber, and tea in Sri Lanka, for example), even if they have substations; or a research division within a line ministry with a number of stations under its control; or a collaborative programme involving several institutes, departments, or even more than one ministry. Decisions at this level are likely to be based more on scientific goals and possibilities, and less on broader socio-economic objectives and commodity targets than at the first two levels mentioned above. Priorities will be narrowed down from between crops to within crops, and within crops to specific pathogens or other critical problems affecting their performance. Scientific experience and creative judgement rather than the application of objective criteria mainly decide what should be done.

Thus, even though a systematic process of decision making on priorities for best use of resources is important at all levels, the opportunities to influence the magnitude and direction of resource allocation become progressively more restricted as the ladder of planning is descended. At the individual station level, several options for resource application still exist, but the total amount available for the research programme at a particular station is more or less fixed from above.

Resource allocation at the station level is critical in determining the final national research programme. It is the turning point in the process. Knowing the resources available, the researcher at the station level has to choose experiments and studies that can best address the farmers' production problems and meet the national requirements for increased production. The national research programme is the aggregation of all small projects proposed at or for the research stations.

Thus, the main focus for objective decision making on major research priorities and resource allocation will usually be at the line ministry level, or where a number of ministries contribute to a sector, possibly through some mechanism, such as, a Council for Agricultural Research Policy designed to reconcile their various claims to the national budget, and on additional funds which may be forthcoming from other internal or external sources.

III.2 Review of Responses to Questionnaire on Linkages

In the questionnaire sent to research institutions, a set of questions was designed to find out the extent of these mechanisms and channels of communication in Sri Lanka to ensure adequate dialogue between researchers and their clients, and their effectiveness in helping to produce a rational set of research priorities to address major national development objectives and needs of producers.

The relevant sections of the questionnaire were:

A.iii Indicate regularity of meetings/discussion between headquarters and regions.

iv Indicate level at which linkage and communication takes place between the Research Department, Division, or Institution and the Ministry in which it is located.

v Describe current procedures by which communication between the Research organization and the Secretary/Minister on technical matters take place. How often are such meetings held and who attends? Are these meetings regular, sporadic, or ad hoc? Who is responsible for follow-up of decisions taken at such meetings?

B.i Is there a statement of long-term, medium-term and short-term research objectives?

ii If so, is this revised periodically and describe how this is done?

iv What is the method of selecting research projects, how are they drawn up, and who decides on research programmes?

v What role do policy makers at Ministry, Budget people, Extension services and other clients of research play in determining research priorities? Is the present situation satisfactory, if not, what suggestions can you make to improve situation?

C.v How do the programmes respond to changing needs of the country?

vi What mechanisms exist for monitoring and evaluating research programmes?

D.i Within the country, describe the linkages with:
a. Policy makers b. Senior politicians
c. Extension workers d. Farmers and other user clients
e. Other research organizations.

ii Outside the country, describe the linkages with:
a. International Agricultural Research Centres (e.g., IRRI)
b. Other research organizations c. External funding agencies

Several of the questions were subjective and required value judgements. Many of the issues were followed up in interviews to clarify responses and to gain a more uniform impression on which to base conclusions.

The results are summarized in Table III.1 and III.2. Although the results show quite wide variations between and within ~~ministries~~ boards, and institutes, they are nevertheless revealing. Some of the indications are:

* Several research institutions have either no line of communication with policy makers in their ministries, or a very indirect line of communications through at least two senior officers, sometimes non-technical. Export crops and fisheries seem to have the best organized channels of communication.

Table III.1: Summary of responses to the questionnaire: linkages of research[a]

	Question	DA Research & Division	SRI	ARTI	DMEC Research Division	RRI	CRI	TRI	DAHP	NARA	MLLD Forest Research Division
A.	Organization of Research Within Ministry										
iii	Regularity of discussions between HQ and regions	Pre-season, twice yearly plus ad hoc	3 monthly plus twice yearly	n.a.	Most staff at H.Q.: monthly plus ad hoc	Frequent staff conferences: Dir. & Chair. regular contact with Colombo	Frequent, about every 2 weeks	Monthly incl. extension	n.a. Div. Heads meet 2-3 times per year	n.a. No functional reg. stations	n.a.
iv	Level of communication research/ministry	Dep. Dir.(Res) and D.A with Sec. and Minister	Chairman and Dir. with Sec.	At Board, Sec. MADR is Chairman	Frequent with Dir. Occasionally A.D (Res) + Dir. to Sec.	Dir. & Chair. easy and regular access to Sec.	Dir. &/or Ch. to Sec.	Dir. at regular staff meetings at Ministry	Via Dir. and Dep. Dir. (VRI) sometimes	Via Management Council: advises Minister	Via DCF and DFOO Conference
v	Procedure for meetings	Sec. or Minister calls	Chairman arranges	Called by Chairman	Sec. or Minister calls		Ad hoc	Ad hoc meeting decisions via Tea Board	Ad hoc	Council meets by decree	Low level of communication
v	Regularity	Pre budget and ad hoc	Ad hoc	Monthly	Pre budget and ad hoc	Frequent	2-3 times per year		Not regular	quarterly	Ad hoc
v	Responsibility for follow-up	D.A and Dep. Dir. (Res)	Chairman	Director	DMEC	Director	Director	Director	Dep. Dir. (VRI)	Dir-General	
B.	Linkages of Research										
i	Within Country										
	a Policy makers	Dep. Dir. (Res) Dir. of Ag.	None	Board members	Via Director: loose, ad hoc	Good, via Sec. and Rubber Board	Indirect via Chairman CRB and Secretary	Via Tea Board Not good to JEDB and SPC	Loose, ad hoc	Via Governing Board and Management Council	Nor-
	b Senior politicians	Via Sec.	None	Through reports	Little				Via Minister		None
	c Extension workers	Monthly meetings plus systematic RTWG	Close; part of SLRC and SRI.	None	Quarterly meetings: good	Good with ASD; training courses	Via CCB not good. Leaflets.	Part of TRI for large farmers. Via TSHD for s/h.	Poor via Div. of Educ.Train. & Inf.: Leaflets.	Via Technical Advisory Ctte. Also direct link in fresh	None
	d Farmers and other users	Field days and adaptive res. trials	Via SLRC	During data collection and discussions	Farmer-training; demonstration plots	Via Extension. Plantation via seminars not good.	Poor to farmers. Informal with JEDB staff.	Field days for planters via TSHD for smallholders.	Farmer traing. Programme limited.	water fish. otherwise via Extension.	Little
	e Other research organizations	Dep Dir. (Res) on committees, PGIA, TRI	Via Board members, especially Dir. of Ag.	Joint seminars and workshops; Panel Consultants	Good. TRI, CRI, PGIA, CISR	Not good	Improving with D A. RTWG meetings regions.	Poor, personal contacts only	Univ., NARESA, ARTI. Poor to D of A	University	CISR
ii	Outside Sri Lanka										
	a IARC	Close; germplasm Training, CIP; IRRI	n.a.	Report's sent to IARCs	n.a.	Mainly via IRRDB	None	n.a.	None	None	None
	b Other research organizations	Many	SBI Coimbatore USDA Florida SRI Mauritius	Many close contacts	Via FAO, conferences	IRRDB	Informal	TRIs in India, Indonesia & E. Africa	Uppsala Univ: via FAO IAEA, SAREC	FAO	Commw. Forestry Inst.; CSIRO; Univ. Hawaii
	c External funding agencies	Many: WB; FAO/ UNDP; Bilateral	Australia	Many	FAO/UNDP	Many; multi & bilateral	None direct?	UNDP/FAO	Many, incl. Swiss & Neth. TA	UNDP; SIDA IDRC	WB; USAID; ADB

a) Numbering of questions follows that of the questionnaire.

Table III.2: Summary of responses to the questionnaire: research planning and evaluation[a)]

	Question	DA Research Division	SRI	ARTI	DMEC Research Division	RRI	CRI	TRI	DAHF	NARA	MLLD Forest Research Division
B.	How the Research System Works										
i	Is there a statement of long, medium, short objectives?	Not systematic but implicit	Yes	One overall broad objective	Yes	Yes, corporate plan	Yes	Yes	No	Yes, over 2 - 3 years	Medium term, reviewed annually
ii	If so, is it revised periodically?	Yes; AR coordinators' conference	Yes	Annually	Yes, with UNDP/FAO	Yes; staff conference Estate Adv. Ctte; Sci. Ctte	Periodic review by Res. Ctte. of CRB and Board	Yes, meeting of project leaders and Director	Determined by Dep. Dir. (VRI)	Yes, by Board Committees	Yes, annually
iv	Method of selecting projects? Who decides?	Dep. Dir.(Res) consults regions including extension	Divisional Research Cttes; reviewed by Board Cttes (proposed)	Proposed by officers, ministries, international organizations Development Agencies; approved by Board	Proposed by ROs; discussed at monthly meetings; decided by Director	ROs to sub-cttes, to staff meeting; approved by higher ctte:	Heads of Divisions for approval by Res. Ctte of CRB	Drawn up by senior scientists, approved by Director and Board	Proposals by scientist discussed by research group; decision by Dep. Dir. (VRI)	Proposals by Division Head after consultation with ROs; evaluated by Technical Ctte	Proporals discussed and decided on by HQ staff
v	Role of policy, budget, personnel, extension, client producers in priority for projects?	Extension considerable; policy little	None (still new)	Little; Min. reps. on Board not clear on policy	Extension considerable; policy little	Extension & clients suggest proj. considered at staff meetings	Respond to feedback from Extension could be improved	Interaction with planters and Extension	None	None?	Donor has influence
C.	Research Programmes										
v	How does programme respond to changing needs?	As and when needed	Through feed-back from industry	As needed	Still relatively new	Geared to changes in nat. demand & economics at farm & nat. level	Regular provision constrained by lack of staff to respond	Via Experim. & Extension ctte, attend. by growers & policy makers	As needed	-	5-year programme cycle
vi	What mechanisms exist for monitoring/ evaluation	By coordinators at pre-season meetings	By committees of Board	Internal monitoring; external evaluation	Internal monthly meetings	2-3 year regular staff work evaluation	Quarterly & annual reviews	Periodic at project level	At research meetings	At scientific & technical committees.	No formal
	What percentage of researchers are economists?	5	0 (and none proposed in new plan)	40	5	0	0	0 (lowest priority for extra staff).	0	3	0

a) Numbering of questions follows that of the questionnaire

* No independent mechanism exists whereby the views of the research directors, either individually or collectively, can be brought to the notice of senior politicians, except through their ministers. Because of the poor links indicated above, this is not always easy. No collective dialogue on national agricultural research priorities or on the implications of research work for national policy is feasible because an effective mechanism for it does not exist.

* In so far as national policy makers are among the main clients of a national research system, it may be said that in Sri Lanka they are poorly served, except perhaps through contacts with ministries or boards responsible for controlling research. Indeed, the hierarchical structure in some cases, and the general absence of any mechanism for collective dialogue makes it difficult, if not impossible, for research to influence or to feed policy information upwards. Although scientists are not always good at communicating with non-scientists, they need to be given an opportunity to do so. In particular, the scientists need to give attention to making themselves understood in terms that are relevant to policy makers.

* Other clients of the research system 'downstream' may be better served, since most research organizations have some arrangements for communicating with producers, either directly or through extension services. The latter, however, vary widely in their strength, training, and organization.

* In general, there is little cooperation between various institutions responsible for crops and for livestock except through personal contacts at both research and extension levels. Cooperation among those working on annual crops, minor export crops, coconuts and livestock is, however, necessary in order to develop more productive integrated farming systems which are of great importance to producers. These opportunities are not being exploited because of lack of cooperation between institutions both in research and extension.

* A major weakness in most research organizations is the absence of diagnostic socio-economic research at the producer level. Thus, producers' needs, perceptions, constraints, costs, and reactions to new opportunities and technology are not always properly understood. Such information is therefore not often transmitted to research managers and policy makers and as a consequence, both research planning and national planning may be less effective.

* Although communication between research organizations within Sri Lanka, and especially between field crops and livestock, leaves much to be desired, communication with research institutions and development assistance agencies outside the country seems reasonably good. The Sri Lankan researchers' contact with the international institutes of CGIAR are largely confined to the Department of Agriculture staff. This is logical, since CGIAR deals only with food crops and ruminants, and not with tree crops, forestry, and fish. However, NARA and the Research Division of DMEC have valuable contacts with overseas research groups through their contacts with FAO. TRI has links with the tea research institutes in India, East Africa and Indonesia; and RRI has links with other natural rubber research groups through the International Rubber Research and

Development Board. There does not seem to be any effective mechanism for assessing the priority of arrangements between individual ministries and donors for support to research oriented activities.

* Most ministries and boards have informal arrangements within their organization for fairly frequent meetings of research staff. These meetings often involve staff from regional stations and extension staff, as well as headquarters staff. Some ministries and boards, (DA, SRI, TRI, SKI, Fisheries, and ArcTI) have more formally structured and even statutory meeting arrangements. However, most research directors seem to have only ad hoc and infrequent contacts or meetings with their ministers.

* Procedures for research planning and evaluation also vary from closely structured to ad hoc. Some research institutions have no explicit time-horizons in planning; most have rolling review proposals, with opportunities for clients to contribute. Most research institutions claim to have some monitoring and evaluation arrangements, either at the project or individual researcher level, but few offered much detail. It seems that few institutions have systematic arrangements for monitoring or evaluation ex post.

* Finally, policy makers at the ministries seem to have a very small role in helping to set research priorities, as compared with that of extension and other clients. Few institutions indicated their selection criteria. Two or three institutions claimed to base decisions on economic studies, but seem to have no economists on their staff.

III.3 Conclusions

On the basis of this review and analysis, it can be concluded that, with one or two exceptions, the arrangements for research programming within the various research institutions seem to be adequate. Linkage with producers outside the institution is not strong because guidance for programming at the research station level rarely has the benefit of diagnostic socio-economic insight into the producers' most critical production problems.

At the institutional level of research planning, arrangements for interaction between policy makers and planners and research direction within the ministry are generally inadequate, thus seriously limiting the contribution of research to the planning process, and the guidance from planning to research direction.

At the national level of research planning, the agricultural research system suffers from being essentially a complex of largely independent institutions reporting vertically to boards and ministries, and with very little horizontal communication or interaction. Often interaction seems to be better with institutions outside rather than within Sri Lanka. Eight ministries have some responsibilities for research, but there is no overall research plan; no economic research and policy analysis mechanism to provide objective guidance and to assist in preparing such a plan; and no adequate provisions for continuing interaction horizontally among research planners or for dialogue between research planners and national planners on key issues of policy and resource allocation.

A contributory factor is the absence of guidance for research from a formal National Development Policy, articulated, for example, as a 5-year plan. Sri Lanka does not have such a plan at present, although recently two steps have been taken which are helpful in this respect, and which together seem likely in future to provide more precision to national planning and resource allocation for the agricultural sector. These are, first, the document 'Public Investment 1984-87' produced by the National Planning Division of the Minstry of Finance and Planning in May 1983. This incorporates a moving one-year time horizon. The second is the 'National Agriculture, Food, and Nutrition Strategy' also initiated by the National Planning Division in 1983.

A further factor mentioned earlier is the absence of social scientists in the agricultural research system both in the "downstream" micro-economic situation and on "upstream" policy issues. The proportion of research staff in post who have had training in economics is small: no more than 5% in DA (CARI and RRCs); about 3% in NARA and in CRI; and apparently none at all in any other institutes except ARTI, which, being a policy-oriented institute, has about 40%. The Faculties of Agriculture at Peradeniya, Batticaloa, and Ruhuna have Departments of Agricultural Economics, but the number of teaching staff is limited, and socio-economic research (mainly at Peradeniya) seems to be largely at the micro-level. NARESA and the Food and Nutrition Division of the Ministry of Plan Implementation also have some research under way. However, these efforts are not coordinated and except in DA, and there is no link between macro- and micro-level research. Thus, there is no central focus in Sri Lanka for socio-economic research in agriculture and related policy analysis. Such a focus could be very valuable, as an economic framework is often most useful to facilitate joint discussion on priorities between technical researchers and policy makers.

ANNEX IV

COORDINATION OF NATIONAL AGRICULTURAL RESEARCH

IV.1 NEED FOR COORDINATION OF AGRICULTURAL RESEARCH

The most conspicuous feature in the agricultural research complex in Sri Lanka is its state of dispersal among several ministries. This makes it quite impossible for there to be a coherent spokesman on behalf of agricultural research's coordinated contribution to national planning and development. It also makes it very difficult to organize an integrated research effort on development problems that fall between the jurisdiction of two ministries. This leads to a degree of inefficiency in research entirely due to the ministerial structuring, but which really could and should be remedied.

Historically, research services have developed in association with various ministries and boards. The distribution and range of ministries have been determined by the strategic allocation of responsibilities for the dominant development activities, not the relatively junior research component. It seems unlikely that considerations of research responsibilities will change the strategic distribution of ministries, and it is very important that a research group be linked closely with the development processes it serves. It has already been argued that the highest priority for increased research effectiveness is, indeed, closer linkage between development policy planning and research within ministries. There is not the same strategic need for separation of research efforts as there is for development activities; indeed as already indicated, there is an urgent need for improved coordination and use of scarce research resources.

There are two main reasons. Firstly, clients of the research system, planners, development agencies, and producers, often need a broader national perspective on research than is usual within the dispersed ministries and boards. There are national priorities that transcend those of the narrower component groups.

Secondly, there is an urgent need for inter-institutional research. The main research activities of the various institutions are fairly distinctive with little overlap or confusion. But there are some conspicuous gaps in research coverage, particularly in "fringe" areas between two or more research institutions, such examples include intercropping with annual crops, minor export crops, or livestock in coconuts; integration of food crop and livestock production. These mixed areas are very important to the client producer, but tend to receive low priority in the more narrowly based research institutions. They deserve more intensive research attention, and some means of generating effective interaction between institutions on these issues are needed.

There is, therefore, a good and urgent case for establishing an entity or body, which could give full consideration and expression to national agricultural research policy, and which could mobilize resources to enable research on interinstitutional problems to be carried out. Such a body could also serve as the "voice" of agricultural research in the country, and also as a focus for national arrangements concerning agricultural research. One especially important role could be to arrange for systematic postgraduate training for research staff.

IV.2 PROPOSED FUNCTIONS OF A COORDINATING BODY FOR NATIONAL AGRICULTURAL RESEARCH

Proposed functions of a coordinating body for national agricultural research are summarized as follows:

1. Coordination of the national research effort by
   * identifying national research priorities;
   * promoting interinstitutional coordination of the national research effort;
   * procuring additional funding to match more realistically the broad requirements of the national research effort.

2. Improvement of the articulation of research programmes and development programmes by developing mechanisms to present the research viewpoint to planners in a regular and purposeful way.

3. Improvement of linkages between research organizations by
   * promoting interinstitutional research projects;
   * providing leadership in bringing scientists from different institutions together;
   * providing a forum to highlight research findings for benefit of other institutions, policy makers, and controllers of the budget.

4. Promotion of linkages with international organizations by
   * arranging funding programmes for exchange of scientists on a regular basis;
   * arranging funding for sabbaticals, postdoctoral fellowships, etc.;
   * promoting attendance at international seminars, workshops, etc.

5. Promotion of measures to improve administrative and financial procedures in agricultural research management.

6. Promotion of systematic evaluation of research programmes by encouraging the development of improved evaluation methodologies for use by research institutions.

7. Arrangement for and provision of selected centralized services by
   * making an inventory of existing equipment to promote interinstitutional use of such equipment;
   * facilitating the use of sophisticated and expensive equipment by making it accessible in whatever research organization it may be located;
   * studying the feasibility of centralizing facilities, such as,
     - Central Biological Control Unit
     - Pesticide Residue Laboratory
     - Soil Laboratory
     - Central Library
     - Electronic Equipment Servicing and Repair Unit
   * reviewing the national needs for further special research facilities.

8. Improving manpower planning by
   * maintaining a register of research scientists involved in agricultural research in Sri Lanka and reviewing their distribution and qualifications in light of national priorities;
   * arranging funding and supervising the systematic training of agricultural research staff at postgraduate level in appropriate subjects.

The question then arises how such a body to carry out this range of functions should be constituted. Various procedures for coordinating agricultural research have been adopted in other countries. An appropriate arrangement needs to be devised for Sri Lankan circumstances. The relevant features of the Sri Lankan agricultural research complex may be summarized as follows:

* Many ministries are involved in agricultural research.
* There are several modes of governance of research institutions within these ministries: semi-autonomous boards and in-line ministry control.
* Research-extension-producer linkages seem to be more effective within the line Ministry of Agricultural Development and Research than within the board institutions, (although this may be of recent development in a dynamic situation).
* The weakest linkage in the system seems to be between the research groups and policy makers within their respective ministries, with inadequate communication of research conclusions upwards to policy makers, and inadequate research policy guidelines delivered to research directors.
* The process of technical review of research project proposals is good in most research groups.

IV.3 POSSIBLE OPTIONS FOR COORDINATING AGRICULTURAL RESEARCH

Five possible options for coordinating agricultural research emerged from discussions with research leaders and administrators.

IV.3.1 Option 1

This would involve the establishment of an Agricultural Research Authority with control of the organization and funding of all research. Establishment of such a body would require considerable reorganization to enable the Authority to exert maximum control over the determination of research priorities, and to be independent of divisive development ministries. The Authority would, indeed, operate as a junior ministry, or out of the President's office. Research could speak with a clear and powerful voice. Suitable terms of service for research staff could be arranged to match research performance and values, rather than simply reflecting usual civil service values of hierarchal responsibility for control over resources. It would imply that the contribution of agricultural science deserved to be treated as a full element in the national strategy for development, rather than as a tactical element within strategic development ministries as at present. The pattern of financial control could be flexible to meet research requirements, as is the present situation in some institutes under boards. In addition, there are other noteworthy advantages.

The prime task of national agricultural research service is, however, to serve the development processes in the country, and therefore, very close links between the Agricultural Research Authority and the development ministries would have to be forged. Yet this linkage between research and policy makers within ministries has been identified as the weakest link in the research/development process at present, and this should not be weakened further. Similarly, if extension services were to remain within the development ministry, additional mechanisms for linkage would have to be established to maintain the commendable

research/extension interaction established in the Department of Agriculture. Such a massive change in the system would also require considerable changes in legislation concerning the operation of all semi-autonomous research institutions which are covered by separate Acts. A modification of this option would be to set up a few, say three, Research Authorities with responsibility for Permanent Tree Crops Research, Field Crops Research and Livestock Research. This would preserve some of the main divisions of responsibility between types of crop, but at the expense of achieving a unified Authority.

IV.3.2 Option 2

This option would leave research institutions within their respective parent development ministries and boards with core support funding in direct ministry or board control, but a Council for Agricultural Research Policy would be established with responsibility to develop national agricultural research policy and to allocate incremental funding to projects of high priority in research institutions in any ministry, or under any board. The Council would have particular responsibility for funding interinstitutional research projects, and could usefully supervise a systematic programme of postgraduate training for research staff.

This option would require appreciably less change to the present system than option 1, and would preserve links within the ministry and with extension services, while still retaining some control of the research programme. This could possibly be sufficient control to have a strong impact and to encourage ready collaboration between institutes. The likely benefits of autonomous control of terms of service and more flexible financial procedures would be lost in some institutions. This could be achieved in another way, for instance, by converting research divisions in a line ministry into semi autonomous research institutes with independent boards.

However, if the Council had direct control over appreciable funds for research, then it would have to have a full establishment for financial control, with all the bureaucracy that entails. The mode of disbursement would have to be closely examined: a body only responding to research project proposals faces the danger of not being able to influence the choice of projects, and, therefore, of encouraging research effort in the direction of high national priority.

IV.3.3 Option 3

This option would leave research institutions in parent development ministries but an Advisory Council for Agricultural Research Policy would be established. This council would not control funds directly, but would recommend high priority research programmes to the Ministry of Finance and Planning which would provide incremental funds to the appropriate Ministry or Board through the normal channels of budget allocations.

This option would cause little disturbance to the present system and preserve most of the independence of the various ministries and boards, while still ensuring that national priorities as identified by the Advisory Council were being brought to the attention of research institutions. It could still fulfil many of the functions prescribed

for a coordinating body, and give high visibility to a corporate national research policy. But it would have given up the "teeth" of direct control over allocation of funds, which would be the responsibility of the Ministry of Finance and Planning.

IV.3.4 Option 4

This would leave research institutions within their respective parent development ministries without the establishment of a Council or Authority for Agricultural Research, and also with the introduction of an Agricultural Research Policy Planning Committee. This committee would be made up of the proposed Additional Secretaries (Technical Liaison) from each ministry with operational agricultural research facilities, together with an Agricultural Research Secretariat in the Planning Division of the Ministry of Finance and Planning.

The committee would be able to influence the allocation of funds by the Ministry of Finance and Planning, even if not as strongly as in Option 3. It would, meanwhile, provide an extremely valuable input into the planning process and be a good vehicle for two-way communication between planners and researchers. The development of such an Agricultural Research Secretariat would be essential whether or not a senior Council was established as it would serve as the working Secretariat for the Council.

IV.3.5 Option 5

As a substantial extension to Option 4, the regular meetings of the Agricultural Research Policy Planning Committee could be complemented by one or two meetings per year of the Secretaries from the ministries with operational agricultural research facilities, together with the Secretary for Finance and Planning. The weight of their decisions could then be applied to influence the allocation of funds for high priority agricultural research projects.

The success of such an arrangement would depend critically on the efficient preparation of material by the Committee, and there would be considerable merit in having formal coordination at Secretary level. However, such a group would be unlikely to be in a position to administer funds directly to deserving high priority projects within ministries or to interinstitutional research projects, as each member would be heavily identified with his own research programme.

IV.4 MEMBERSHIP OF THE COORDINATING BODY

The membership of the body in Option 5 is self-evident and has the inevitable disadvantage of being representatives of interested groups. The same stricture could be applied to Option 4, although the Committee could be supplemented by some independent advisors.

The membership of the other Authorities and Councils should be as independent as possible and consistent with the need to ensure balanced coverage of the major research, planning, and production communities. It would not be sufficient only to represent one of the groups, say the research community, as that would leave it open to a charge of vested interests. One or more members should be nominated by the President to ensure adequate scrutiny of the body's operation.

ANNEX V

INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

Sri Lanka has had fruitful links with international agricultural research centres for many years, especially with IRRI and CIP. The Department of Agriculture, in particular, is well aware of the benefits that can be derived from the international centres: in germ plasm for introduction or for breeding purposes; in participation in international research networks for development of research methodologies and comparative international research studies; in opportunities for training oriented to research conditions in the tropics; in participation in international conferences and seminars on current status of research on problems pertinent to agricultural development in Sri Lanka; and from visits of scientists from international centres at the request of Sri Lanka.

Germ plasm exchange has been easier for food crops than for competitive export crops, such as, tea and sugar. However, international linkages through membership of the International Rubber Research and Development Board has enabled RRI to keep abreast and take advantage of research progress in natural rubber in other producing countries, and has made it possible to obtain recently bred rubber clones from elsewhere.

The value of such international linkages are now well appreciated and every effort should be made to facilitate close collaboration in international research activities in order to take advantage of the opportunities offered. This will involve investment in time and resources, both for participation in experimental work and for attendance at international meetings and seminars. It should be recognized that there is likely to be a good return on a modest investment which enables the national research system to tap research bodies and organizations funded on an international scale.

However, a judicious balance must be maintained. The national research service's main task is to carry out the national research programme for the benefit of national clients. At no time should international trials and activities be permitted to distract unduly from the research effort on high priority national problems in agricultural production. International research contributions must fit in with national research priorities. The guideline for the national research organization is to know clearly what it wants to achieve; what the international research organizations can offer; and to take best advantage of the services offered.

V.1 International Research Organizations within Sri Lanka

Sri Lanka is fortunate in having two international agricultural research centres established recently within the country: the International Winged Bean Research Institute, and the International Irrigation Management Institute*. A special situation arises when international research organizations are sited within a country. While the general guidelines set out above still apply, the expectations of national benefit from the organization's research programme must be higher than if it were located in another country. It is, therefore, worth a much higher national investment to ensure close collaboration with international institutions within the country. Nevertheless, the investment must still be consistent with nationally determined research priorities and the overall national research programme.

* The International Coconut Information Centre based at CRI is a third centre, but this was established much earlier in the early 1970s. This centre has built up a comprehensive collection of literature on coconuts, and provides a service to several countries. To date, it has been funded by IDRC of Canada with Sri Lankan assistance, but this support may cease soon. The centre is undoubtedly useful to Sri Lankan coconut research, and the international service could be continued with national funding. However, it would certainly be more appropriate, if all users contributed or some further international support was secured on a continuing basis.

ANNEX VI

REVIEW OF THE RESEARCH ORGANIZATION FOR MAJOR AND MINOR EXPORT CROPS

The objective of this annex is to examine the present and proposed direction of research in the three major commodities; tea, rubber and coconuts; and in some of the core of minor export crops; pepper, cocoa, coffee, and some spices.

VI.1 TEA RESEARCH INSTITUTE

VI.1.1 Size and Area of the Tea Industry

TRI is responsible for research and advice on production and processing to the tea industry, the size and area of which is presented in Table VI.1. In the Central Bank of Ceylon Report 1982, the figures presented in Table VI.1 are questioned. The report states that the Tea Commissioners Division of the Tea Board has not updated its land registers to reflect changes in cultivation 'over the past several years'. The Bank considers that there is a wide gap between the area actually under cultivation and that registered and calls for up-to-date and reliable data to permit proper development planning and performance evaluation. This is a valid comment on the lack of basic data on the country's major industry. While the monitoring of such a survey, probably by interpretation of aerial photographs for evaluation of stands, would be the responsibility of the Tea Board, the design (for maximum information) and the implementation either directly or by contract would be properly the task of TRI. In particular, identification of mid-country tea areas suitable for rehabilitation to full production would be of value for increasing production for exports to likely markets in Australia and United Kingdom.

Table VI.1 Size and area of tea estates and smallholdings in Sri Lanka

	No. of estates	Area of estates (ha)	No.of smallholdings	Area of smallholdings (ha)	Total (ha)
Tea only	3,868	188,795	136,269	51,864	240,664
Interplanted with other crops		215		1,263	1,478
TOTAL	3,868	189,010	136,269	53,132	242,142

Source: Ceylon Tea Review 1982; figures rounded to nearest ha.

Table VI.2 Estimated area under tea cultivation in the estate sector in Sri Lanka

	High-country (ha)	Mid-country (ha)	Low-country (ha)	Total (ha)	No. of estates	Proportion of total estate area (%)	Mean estate size (ha)
JEDB	39,169	31,001	4,843	75,013	309	39.7	243
SPC	23,557	21,379	18,414	63,358	351	33.5	180
Land Reform Commission	370	1,302	795	2,467	53	1.3	46
Other organizations	794	2,405	3,819	7,018	187	3.7	37
Individual estates	6,063	17,322	17,779	41,164	2,968	21.8	14
Total	69,953	73,409	45,650	189,012	3,868		

Source: Ceylon Tea Review 1982; figures rounded to nearest ha.

About 70% of the total area under tea cultivation in Sri Lanka is in the estate sector. The area cultivated by each organization is given in Table VI.2. These figures are also open to question in the same ways as those in Table VI.1.

The importance of the state companies in the estate sector of the industry is emphasized by the comparison presented in Table VI.2. The two major organizations, JEDB and SPC, cover 73% of the total estate area and 57% of the total tea area and have the largest estates. Individual estates occupy 22% of the estate area, or nearly 17% of the total tea area. There are 2,968 such estates with a mean size only 14 ha. The 136,269 smallholders have holdings with a mean area of 0.39 ha each and represent 22% of the total industry. It is clear that the three subsectors of large groups, individual estates, and smallholdings present different aspects to problems of research, extension, and development.

VI.1.2 Location

The offices and laboratories of TRI are situated at St. Coombs Estate, Talawakelle in the high-country. TRI operates two Research, Advisory and Extension Centres, one for mid-country tea at Kandy, and the other for low-country tea at Ratnapura. TRI also operates two advisory and extension centres, one for the southern province at Talgampola and the other for Uva province at Debedde near Badulla. A third centre has recently been established at Deniyaya. St. Coombs Estate consists of 169 ha of which 104 ha is under tea. Lamiliere Estate adjacent to St. Coombs of 59 ha of which nearly 40 ha is under tea, is also managed by TRI. There is a modern factory at St. Coombs. The stands of tea are excellent and the site upkeep and building maintenance is good.

The low-country station at Ratnapura is situated on St. Joachim Estate of 168 ha of which about 53 ha is planted with tea. The balance of the land unsuitable for tea has been planted with other crops, timber species, rubber, and oil palm. There is a modernized factory dating from 1965. Due to poor soil and recent drought, the stands of tea are not good and are unlikely to convince visiting planters of the known expertise of TRI. The only crop showing a good stand and bearing well is the oil palm, which has not received fertilizer for two years. There is no doubt that the site is unsatisfactory for a research station and every effort should be made to obtain more land for research and demonstration, and the balance of the site should be used for diversified crops. The upkeep and maintenance of the station is otherwise good.

The mid-country research station at Kandy and the two advisory and extension centres were not visited by the review team. The Kandy station has almost 23 ha of which about 14 ha is under tea; Talgampola centre has almost 37 ha of which 23 ha is under tea; and the Deniyaya centre has about 13 ha to be planted with tea.

VI.1.3 Organization

Under the Director of TRI, there is the Deputy Director (Research) and the Deputy Director (Administration), and in addition there is an internal audit unit. The Deputy Director (Research) controls four divisions. The Agricultural and Biological Research Division incorporates the following disciplines: agronomy; entomology; genetics

and propagation; nematology; plant pathology; plant physiology; soil chemistry; and soil physics. The Processing Research Division incorporates biochemistry; mechanical engineering; process engineering; process technology; and pilot plants. The third division is known as Scientific and Technical Services, and provides central analysis, glassware and chemical stores, library and documentation, metereological observations, photography and statistics, and data processing. The fourth division is concerned with extension and training, the operation of the five extension and advisory centres, and of the three estates.

The graduate staff cadre for the research divisions is as follows: one research assistant and one experimental officer in agronomy, and an entomologist; one plant breeder, two research officers, one research assistant and one experimental officer in genetics and plant physiology; one nematologist; one research officer and one research assistant in pathology; one agricultural chemist, one biochemist, one research officer and two research assistants in biochemistry, a technologist, a research officer and a research assistant in biochemistry. There is an electronics engineer and an experimental officer statistican. At Ratnapura, there is an officer-in-charge, an agronomist, a research officer and an experimental officer. At Kandy, there is a research officer and an experimental assistant. With the Director and the Deputy Director counted as researchers, the total graduate staff in post for research is 33 and there are 12 vacancies.

There is a post for a micro-economist within the statistics and data processing section; the economist is currently under training. In view of the extensive number of smallholders and small estates sector, farming systems analysis in both monoculture and intercropped tea is required. Problems concerning the scale and efficiency of the larger estate groups require investigation. In addition, the need to advise the Director on macro-economic problems and to evaluate the possible economic effects of proposed research raises the question as to whether the post of one economist is sufficient. It may well be that an economics section is required. At present, such investigations are, of course, considered but do not receive adequate analysis. This having been said, TRI appears sufficiently well organized to service the industry efficiently, and to offer clear decisions on most problems of large, medium, and smallholders.

VI.1.4 Research Programmes

At present the research programme consists of four multidisciplinary projects, 15 monodisciplinary projects and nine divisional activities. The multidisciplinary projects are: development of an adequate advisory service for the tea industry which also takes into consideration economic factors; development of renewable sources of energy for tea plantations; improvement and maintenance of the fertility of tea lands; and product development.

Of the monodisciplinary projects, five are concerned with processing and presentation; four with pests and diseases; two with harvesting and pricing; and two with water and weed management, one with the development of new clones and the other with the microbiology of tea leaves. The divirional projects, which are designed to support projects listed above are in agricultural chemistry; agronomy, both up- and low-country, biochemistry, agricultural economics; entomology and nematology, plant physiology, propagation and breeding; plant pathology and technology.

The top priority of the development of an adequate advisory service, in view of the present relations between the industry and its research institute, cannot be questioned, especially because of the make-up of the industry. However, it is not clear whether the methodology has been thought through to a logical end. Experience indicates that, in spite of the comprehensive publications produced by TRI, transfer of new technology to large estate groups, particularly those as large as JEDB and SPC, is best undertaken at the highest possible level by appointing working senior research officers as board members, as individual regional and general managers, and as agricultural advisors. Acceptance of technology at this level initiates a tumble-down effect and results in feedback on practical problems. While this is already in operation to a degree, it is inhibited by the unequal salary structure imposed on research workers, thus making social contacts difficult. Possibly, a liaison allowance to the selected officers would improve the position. For the 2,968 individually owned estates, the extension service with its five centres would suffice, provided sufficient staff and transport were available.

TSHDA is theoretically responsible for providing extension advice to the 136,269 smallholders. While its main interest is in the processing of green leaf, THSDA took steps to strengthen its limited extension service in 1982. The Bank of Ceylon in its 1982 report is critical of the TSHDA concentration on processing, and suggests that it might be more beneficial to smallholders, if greater emphasis were placed on extension and fertilizer distribution to improve production and incomes, that is, as far as financial constraints will permit. This is a view with which one must concur. The role of TRI in such a programme would be to train extension officers, and to allow its own extension officers at the five centres to act as subject-matter specialists for TSHDA.

TRI itself is concerned about the lack of basic data on the industry. It estimates that at present only about 205,000 ha are under tea and a further 15,000 ha may be currently being lost to other uses. An investigation into the problem of the size of the industry, and the composition and age structure of plantings would also warrant a multidisciplinary project of top priority, should the Tea Board agree to such an undertaking.

Given the lack of central direction as to the future size and production of the industry, and as to processing methods to be employed, and also given the lack of socio-economic inputs, the TRI research programme seems to be appropriate and well balanced. There is only one omission, perhaps minor, which should be noted. Although only about 1,500 ha of tea is currently intercropped, it would seem that some attention from both the agronomic and socio-economic viewpoints is called for, should further expansion become necessary. Attention should, perhaps, also be given to diversification out of tea in uneconomic areas. Such investigations would include cooperation with other organizations, as for example, the Departments of Agriculture, and of Minor Export Crops in MADR, and with Forestry Research (MLLD) and Livestock Research (MRID). No machinery at present exists for such cooperation or for joint funding, except on an informal basis.

In addition to the above, six high priority projects have been singled out for accelerated development under the medium-term investment programme, together with a seventh project to improve staff amenities at St. Coombs. Again, the strengthening of the advisory and extension services is given the highest priority, including staff training and provision of transport. Second is a project to set up pilot plant facilities to develop the technology of new tea-based products devised and patented by TRI, to be monitored by the Products Development Committee. While the case for the expenditure of US$586,000 over three years is well argued, it would have been strengthened by identification of possible market demands for the products before formulating the project, and by an examination of the economic factors likely to be involved. No doubt these were precluded by lack of finance and staff trained in the appropriate disciplines. The third project, evaluation of the efficiency of the use of potash, is designed to settle a longstanding difference as to the effect of this nutrient on tea yields in India and Sri Lanka. The other four research projects are all designed to improve production or reduce processing costs.

The final project is to improve amenities and to support staff at TRI. All the points outlined in the proposed project appear reasonable, involving an outlay of Rp. 26 million over five years. Many of the points raised: childrens education, staff training, housing, transport, isolation of research workers from the industry because of financial constraints, and lack of minor amenities, are also common to CRI and RRI. It would seem that some 'across the board' consideration of these matters is called for in order to avoid competition and insidious comparisons as a matter of GOSLs internal housekeeping. The matter of adequate technical support staff could be emphasized with advantage.

Research undertaken at the Ratnapura and Kandy centres is on location-oriented aspects of low and medium altitude tea cultivation, respectively. In the absence of national policy and targets for the expansion of lowland areas of tea, as recommended by the master plan, work to this end is largely on a piecemeal basis at Ratnapura. If brokers and shippers reports are correct, some intensification of the mid-country tea areas may be called for in due course. This would involve further work at Kandy.

VI.1.5 Linkages with Clients and other Research Organizations

The Director attends regular staff conferences at MPI; otherwise communications with MPI are by correspondence and 'ad hoc' meetings channelled through the Tea Board. Policy is channelled down from MPI through the Tea Board. Contact with clients is through TRI research staff, extension staff, publications, meetings, field days, and seminars. It is admitted that such contacts are at present inadequate and that more informal dialogue and participation would be desirable, should transport and financial constraints be overcome. Apart from informal contacts, linkage with other national research organizations is minimal.

International contacts are also minimal, although there is some contact with cognate institutions in India, East Africa, and Indonesia. More opportunities for visits and discussions with counterparts overseas would assist in obtaining insight into present problems: the work on potash on yield is such a case.

VI.1.6 Market Prospects for Tea

India and China together account for 49% of world tea production, 36% of world consumption, and 43% of world exports. The internal balance between supply and demand in these countries, thus, has considerable effect on international markets. East African producers have shown a recent large increase in output. Their desire to market all produce inhibits the formation of an international tea agreement which would impose quotas, a position desired by south and east Asian producers. Consumption is increasing in developing countries, but is relatively static in developed countries. The World Bank forecast, which is known to GOSL, took the view that, in the first half of 1983, price prospects for tea were not encouraging.

In view of recent price rises, brokers and shippers in Colombo take a more optimistic view of the situation. They consider that due consideration has not been given in official forecasts to population growth and to the rapid expansion of markets in developing countries. The annual world increase in demand is estimated to be 30 million kg. Evidence to atest this factor has lead to stocks being run down with a shortfall of 20 million kg and a certain degree of 'panic' buying. London auction prices rose from 157 pence per kg in October 1983 to 237 pence per kg in November 1983, with a likelihood of further increases. If the trade has correctly assessed the annual increase in demand, prices will be higher than the World Bank forecast and Sri Lankan share of the market could rise from 175 to 200 million kg.

The Cabinet Committee on Tea Production, which is chaired by the Secretary of the Ministry of Trade, monitors progress and seeks advice from producers, processors, brokers, and shippers. However, continuous macro-economic monitoring of the international and internal marketing position would be advisable to detect trends and to advise on policies. Such a unit could be properly located in the Ministry of Plantation Industries.

VI.1.7 Conclusions

TRI is a research institute with considerable competence, although there are some staffing problems. The determination of research priorities could be improved provided that: decisions are reviewed annually on a five to ten year rolling plan, on the direction and size of the industry, its location, and its type of produce in relation to an overall national plan; adequate baseline data on the industry is obtained as a first priority; the international and national market situation and future prospects are continually reviewed; and certain peripheral areas of research and extension are re-examined critically.

VI.2 RUBBER RESEARCH INSTITUTE (RRI)

VI.2.1 Area and Size of the Rubber Industry

The rubber industry in Sri Lanka has reached a static position as regards size, as there are no further areas for expansion. Indeed, plantings at certain altitudes would be considered by some to be inappropriate. Minor changes can still occur by the diversification of unsuitable lowland tea areas into rubber, but this is probably compensated for by the reverse movement. This factor has implications for research programmes of RRI.

In 1982, the registered area under rubber cultivation was estimated at 205,700 ha with 171,700 ha in tapping. RRI is doubtful about these figures and considers that a significant amount of land has been lost to urban development and infrastructure. Information on this has not yet reached the Controller of Rubber. RRI consider that an aerial survey of the rubber growing areas is as a matter of priority to determine the size and age composition, and to provide baseline data for future development planning. The relatively low average yield of 726 kg dry rubber per ha in 1982 may reflect this overestimation of the area under cultivation.

The state corporations, JEDB and SPC, account for 32% of the area (nominally 65,800 ha); the remainder is composed of small estates resulting from land reform and original smallholders. No distinction is made between these two subsectors of the industry.

Production in 1981 was 124 million kg of which 50% was processed into ribbed smoked sheet (RSS). This product originates mainly from smallholders and appears on the market with a preponderance of lower grades, RSS III, IV, and V. The 1982 Annual Report of the Bank of Ceylon points out the loss to the small farmer as a result of poor quality by bad processing, and recommends intensification of group processing and marketing methods be demonstrated by ASD of RRI.

About 27% of rubber production is marketed as latex crepe, 3.5% as sole crepe, and 7.3% as scrap crepe. These products originate mainly from large estates and are of high quality; sometimes involving specialist markets. Of the remainder, 1% is marketed as latex, and 11% as technically specified rubbers; 13% is consumed locally; and 27% represents stock-in-transit. It should be noted that Sri Lanka has a virtual monopoly on the production of sole and latex crepe. Labour costs for such processes are considered to be uneconomic in other rubber producing countries.

VI.2.2 Location of RRI

The headquarters of RRI is on Dartonfield Estate, Aglawatta, where the laboratories and factory are located, together with housing and ancillary buildings. The estate itself is of uneven topography limiting severely the type of fieldwork and experimentation that can be carried out. For this reason, the nearby estate of Nivitigalakele is used for genetics and plant breeding work. It also houses the training school, now mainly used for training staff for the World Bank supported (and relatively successful) Smallholders Rubber Replanting Project (SRRP). A substation, also for genetics and plant breeding, is maintained at

Kuruwita. The Chairman of the Rubber Research Board has an office in the Colombo office of RRI in the suburb of Ratmalana. The building also contains the Rubber Chemistry Department (Technology) and the Advisory Services Department (ASD) responsible for SRRP. The Head of the Intercropping Department is stationed here and the office contains sections of the administration and accounts. In addition, there is a specialized library with a Publicity Officer, and also an instrument repair unit.

VI.2.3 Organization of RRI

Currently, the Director is in charge of both RRI and the Advisory Services Department. In the research institute, the Director is responsible for all stations, substations, and the Colombo office. He has his own internal audit unit. He is assisted by a Deputy Director (Research) and a Chief Administrative Officer. The Deputy Director (Research) has an Assistant Director and eight heads of research departments and sections. The cadre of graduate staff, including the Director and research and experimental officers, is 43, of whom 16 are graded as experimental officers. There are two vacancies, one for an assistant geneticist and plant breeder, and the other for an experimental officer. The present staffing of the research departments and sections may be summarized as follows:

* Plant Pathology, the head of which is the Deputy Director (Research), two assistant plant pathologists;
* Genetics and Plant Breeding, the head of which is the Assistant Director (Research); one geneticist and plant breeder;
* Plant Science with a head, two assistant botonists and an experimental officer;
* Intercropping with a head only;
* Soils and Plant Nutrition with a head assisted by an agricultural chemist, an assistant soils chemist and an experimental officer;
* Rubber Chemistry Department at Ratmalana with a head, two rubber chemists, one chemist/specifications officer, seven assistant rubber chemists, two assistant development officers, two experimental officers as rubber chemists, and a research assistant;
* Biochemistry Section with a biochemist, an assistant biochemist and an experimental officer biochemist;
* Statistics Section with an assistant statistician.

The Director has an experimental officer as technical assistant. This makes a total of 56 staff, with the two vacancies there is a shortfall of five, presumably under recruitment or training, such as, the economist. It is noteworthy that for the cadre of 43, there is a 49 technical officer cadre of which six posts are vacant, a lower proportion to research staff than would be expected.

Because of the international linkages discussed later and because of the land constraint to significant expansion of the industry, an adequate appreciation of research priorities has been arrived at, which is reflected in the research programme. These priorities may be summarized as follows:

* improving the yield per unit area by the provision of superior planting material;

* reducing inputs while maintaining such yields;

* improving the presentation and quality of conventional rubbers;

* investigating novel and altered rubbers, and preparing them for presentation;

* supporting the local manufacturing industry;

* assisting the export industry;

* investigation of possible by-products and use of local products.

Of the 16 projects in the Plant Pathology Department, four are concerned with leaf diseases; three are on pathogens causing bark rot and tapping panel diseases; and four are connected with the incidence of root disease. New fungicides are also screened and there is a project on the control of stain fungi. These are 13 disciplinary projects 12 of which deal with constraints in the planting/replanting cycle and in the deciduous habit of Hevea. There are three interdisciplinary studies on nitrogen fixation, on diseases of intercrops, and on mould growth studies on processed rubber.

The Intercropping Department carries out intercropping trials on estates and smallholdings with established crops and also new trials of possible intercrops, perennials, semi annuals, and annuals. It should be noted that Hevea planted at the economic stand of 460-500 per ha usually does not permit intercropping unless the canopy is severely affected by disease, or the stand has been reduced by age or thinning. Semi-annual and annual intercrops for about 3.5 years after establishment provide a source of income to the smallholder during the immature period of rubber after replanting. All such work is necessarily interdisciplinary and involves some informal cooperation with other organizations, for example, Departments of Agriculture and of Minor Export Crops (MADR).

The Plant Science Department is carrying out 11 disciplinary studies: one on tissue culture; six on the formation of latex and the nature of the latex tissue and methods of exploitation; two on stock/scion or crown budding effects; one on characterization of clones; and one on nursery and planting techniques. Apart from tissue culture work which is an exploratory stage, all projects are relevant to industry problems. There is an interdisciplinary project on brown bast, a physiological condition involving drying up of the latex bearing tissue. This condition is sometimes reversible but often not, and frequently occurs as a result of overtapping or excessive yield stimulation in attempting to obtain maximum production.

The Biochemistry Section cooperates in the work on brown bast. It has four disciplinary projects: one on the enzyme deproteinization of latex which is relevant to the production of a deproteinized natural rubber, and another on non rubber constituents of latex, involving resins and natural antioxidants. The carbohydrate metabolism in the cycle ending in latex is also being studied. Similar investigations are carried in other such research institutes in efforts to affect the cycle to favour production. A project is being carried out on the use of latex serum after coagulation of the rubber fraction (together with certain solids not rubber). There is an interdisciplinary project on the biochemistry of disease resistance and a similar project on the genotype/environment interaction on the properties of the raw rubber. These investigations are relevant to the production and processing problems of the industry.

The Genetics and Plant Breeding Department has two interdisciplinary trials on stock/sion and genotype/environment interaction. It also carries out annual flower inducement, hand pollination, and selection programmes. There are 35 field trials; five are interdisciplinary, six are on the discipline and the remainder on production. Six of the trials are located on the institute land and 29 on its estates. The trials are of satisfactory statistical design for the purposes for which they were established. They are also designed to find out whether an increase in profitability or of income can be obtained or both; whether a decrease of inputs is possible, and to increase theoretical knowledge and understanding.

The Soils and Plant Nutrition Department is undertaking three interdisciplinary studies, on the economics of fertilizer application to rubber, on brown bast, and on the use of isotopes in plant nutrition and latex physiology. A fourth interdisciplinary study concerns the transmission of results to ASD. There are seven disciplinary studies in progress: the development of analytical methods, soil survey and classification, the response of Hevea to fertilizer application, components of yield; soil moisture studies; the mineral nutrition of Hevea and associated cover crops; and a study of nutrient deficiency. The work in progress is relevant to the economic production of natural cis-polyisoprene. The department claims to be aware of the need for economic evaluation of overall fertilizer requirements and of effective farm and plantation inputs.

The Chemistry Department is carrying out 16 disciplinary projects some of which are partly advisory. In summary, these are: a study of the manufacture and use of liquid rubber; development and production of natural rubber with bound antioxidants; presentation of new rubber to consumer requirements (constant viscosity, master batch and anticrystalline rubber, proper packaging and marketing); improvements in the manufacture of cyclized rubber; preservation, modification, and end use of latex; development of the local manufacture of rubber products; the manufacture of thermoplastic rubbers by modifications or by blending with plastics; production of powdered natural rubber; chemical modification of natural rubber by grafting and epoxidation; evaluation of rubber compounding ingredients and vulcanization and network degradation; low temperature curing systems, use of NR/SR blends; routine technical testing including certification, latex and miscellaneous analysis; development of the local processing industry; technological studies (carried out by the Biochemistry Section); and studies on non-rubber resources (rubber seed oil, cashew nut shell liquid). Although all these studies are valuable and some are essential, the question can be raised as to whether the department is being overextended.

The Statistical Section, which is responsible for design and analysis of experiments, is currently short of the statistician (under recruitment). While one economist is to join the section after training, it is doubtful whether he would be able to deal with the amount of work in the research programme of RRI. Apart from this, the programme seems to be satisfactory and adequate for the needs of the industry with the possible exception of overextension in the Chemistry Department.

RRI has proposed a medium-term investment programme to accelerate progress in seven key projects and to introduce a new project. These projects, work on which is in progress, are:

* presentation of new clones with high yield, vigour and disease resistance, and a shorter immature period;

* studies on soil fertility, and on the effect of added fertilizer on yield and growth;

* improving planting material by upgrading the quality of budwood and stock seedlings;

* research on the physiological basis of yield and propagation to increase productivity;

* studies of nitrogen fixation by cover crops and the mechanism of disease resistance to economize on fertilizer and fungicide inputs;

* product modification to suit end user requirements;

* the use of solar energy for cost-efficient drying of crepe.

The above accelerated projects are all on varying time scales of benefit to the industry, either in increased production or in cost efficiency. The new project is being developed on the control of environmental pollution through efficient control of factory effluents. Such an investigation is overdue in view of the serious effects effluent, particularly serum even if diluted, can have on local riverine ecology and paddy cultivation. It is also a serious problem in other rubber producing countries.

While facilities in general are adequate, RRI requires more transport in order to service field trials adequately. There is also a need for two further substations in known microclimates from which trials could be established and serviced, and extension staff stationed. At the main site, there is need for further storage space and for a radio link to all units to supplement the inadequate telephone service. There are staff problems similar to those occurring at TRI. In addition, there is a requirement for one executive, four middle level and ten minor staff quarters. The water supply is inadequate, and estate staff quarters do not have piped water.

RRI finds that reliance on foreign external funding is not satisfactory for the training of sufficient research officers at the postgraduate level. It is felt that the Board should have power to make up any incidental funds to an agreed manpower plan. In view of recent resignations, it is also felt that back-up research officers should be available in each department, although this would seem to be an expensive luxury.

With an adequate research programme and with provision of the minor requirements in infrastructure, RRI would be in an adequate position to service the rubber industry.

VI.2.4 Linkages with Clients and other Research Organizations

It is considered that both the Chairman of RRB and the Director of RRI have convenient access to the Secretary of MPI. The Director has good lateral contacts with TRI, CRI, ARTI, and SRI, both officially and informally. Contacts with JEDB and SCP also seem to be good. Seminars and regular meetings are held with agricultural advisors and planters, feedback from superintendents is not as good as could be desired, but has improved since the regionalisation of the state corporations. RRI holds

four meetings annually with SCP and four with JEDB, one meeting annually each with smallholders, Low Country Products Association, and the Ceylon Planters Association. In the case of the state corporations, frequent transfer of staff inhibits good relationships as does financial stringency. There is good cooperation with JEDB on experiments on estates; JEDB pays the usual estate costs and provide transport for RRI staff. Apart from the present intercropping experiments, RRI is willing to consider cooperative research on other crops. It is of interest to note that brokers and shippers in Colombo value the services of RRI highly and emphasize its close cooperation.

Internationally, the Director of RRI has a direct link with the International Rubber Research and Development Board which holds meetings in various rubber producing countries. A representative of RRB attends all meetings to decide on internationally agreed research priorities. Contacts are also made with research workers abroad and occasionally meetings of IRRDB are held in Sri Lanka. Contact is also maintained by correspondence and personal contact with similar research institutes.

Through contacts in MPI and as representatives, members of RRB and the Director of RRI are aware of the work of International Rubber Study Group (IRSG) to collect data and to estimate short- and long-term production and demand. IRSG meets alternately in producing and consuming countries two to three times per year. Through MPI, the RRB sends representatives to meetings of the Association of Natural Rubber Producing Countries (ANRPC), the secretariat of which is in Kuala Lumpur. This association monitors the interests of rubber producers and considers policy and research priorities. Through the International Natural Rubber Organization information is also available on buffer stock transactions.

Both RRB and RRI are thus well aware of the international situation and forward planning for natural and synthetic rubber. There is, therefore, a good match between national research policy and the research programme.

VI.2.5 Market Prospects

Even if present development plans are only partly achieved, it would seem that Indonesia has a 60% probability of producing up to 2 million tons in 1995, and almost 3 million tons in 2,000, thus becoming the world's largest rubber producer. The probability of a glut of natural rubber under these conditions is still only estimated to be 5% and 16% in 1995 and 2000 respectively. On the basis of present and expected increases in supply and demand, the New York average RSSI prices (at current US dollar value) is estimated to be between US$1,500 and US$1,800 per ton in 1995; and US$4,185 and US$5,025 per ton in the year 2000.

It would, therefore, seem that, if the present increase in rate of replanting in Sri Lanka were to continue and overall yields were to increase by 100% to about 1,500 kg dry rubber per ha per annum, then the increased production of about 125,000 tons would have little effect on world market conditions in 1995 and 2000. Subject to continuous monitoring of current conditions, replanting of rubber in Sri Lanka would seem to offer an economic rate of return of about 20%; which is satisfactory.

VI.2.6 Conclusions

The research policies and programmes for rubber are currently appropriate for the needs of the industry, although there does seem to be some danger on overextension in work on processing and presentation. Subject to the considerable assumptions in demand and supply projections being of the right order of magnitude, it seems that markets will hold out and will offer adequate return for capital expenditure in replanting. On other matters, the research capacity of RRI would be enhanced by certain minor infrastructural improvements and by the provision of two additional substations. While cooperation with the industry is good, there is room for improved cooperation between research and production. Certain aspects of staff welfare need to be improved; these problems are common to all the research institutes. There is need for a survey of the industry as a matter of priority to establish areas, age classifications, and types of planting material required.

VI.3 COCONUT RESEARCH INSTITUTE (CRI)

VI.3.1 Area and Size of the Coconut Industry

The agricultural census of 1973 assessed the holding size and area under coconuts in 1962. At that time, 40,900 ha was in estates and 410,600 ha in smallholdings, making a total of 451,500 ha under coconuts. Of this area, 5% was in holdings of between 0.5 ha and 10 ha; 17% between 10 ha and 40 ha; and 19% over 40 ha; and the remaining holdings were less than 0.5 ha in area. Since these figures represent the situation prior to completion of land reform, they are of little relevance except to indicate that at that time, only 9% of the area under coconuts was under estate management, and that the industry was composed of smallholders and small proprietary estates. The situation will have been altered with the implementation of the land reform so that units in the medium-sized section will have become smaller.

While there are a number of estimates of the present composition of the industry, reliable data are not available. The area under coconuts is thought to have altered considerably because of the extension of urban and rural developments. A survey of the producing area is urgently required in order to establish areas and ages of palms for future planning and development. The present coconut estates are managed mainly by JEDB. While the National Livestock Development Board has some of the best estates, the remainder are managed by SPC, Sri Lanka Estates Development Board, CCB and CRI, and 13 other organizations.

Coconut consumption per capita in Sri Lanka is considered to be 125 fresh nuts per annum, of which 35 represent oil equivalent and 90 fresh consumption. It is also considered that this does not include king coconuts used mainly for drinking. Supply of fresh coconuts to local markets is essential and recent price rises (Rp 5 per coconut in Colombo) have brought reactions from the poorer consumers. In 1982, local consumption of fresh coconuts was 1,893 million out of a production of 2,521 million coconuts. The remainder was use for commercial processing: dessicated coconut; and three grades of copra, edible (white) copra, estate copra (commercial grade 1), and dealers copra (commercial grade 2). Production of edible copra is a specialised process confined to a few estates and most edible copra is exported. Estate copra is a product from known estates prepared by the estate or a particular dealer, and is

mainly but not currently entirely for export. Dealers copra is manufactured by dealers from coconuts from a variety of sources and is used exclusively for oil milling. Estate copra culled from export consignments as being under-dried, mould-affected by green fungus, burnt, or pitted, is also sold for local milling. About 20% to 40% of export consignments is rejected by shippers.

In 1982, dessicated coconut production was 42,100 tons and copra production 120,000 tons. Initially, all dessicated coconut was exported as was 3,500 tons of copra, the balance of copra was expelled to produce 75,000 tons of oil, of which 12,000 tons was exported. Dessicated coconut production has varied between 30,300 to 51,600 tons during the last ten years, and oil production has dropped from 162,900 tons in 1964 to 102,500 tons in 1982. Production of oil was particularly low in 1977 (49,100 tons) because of drought. The fall in oil production is attributed to population growth and an increased demand for fresh coconuts, together with loss of producing area, and a skew of the normal curve of age groups of trees towards senility and thus lower yields.

In 1982, coconut by-products included 231,000 tons of six types of coir fibres of varying quality together with finished products, the resultant cake (poonac) after oil extraction, coconut shell powder, coconut shell charcoal, and activated coconut shell charcoal. The palm is also tapped for sugar, toddy, and alcohol production. In 1982, exports of shell charcoal (for steel making) amounted to 38,000 tons; the recently established industry of activated charcoal (by national and joint venture companies) exported about 1,000 tons at a value-added price of ten times shell charcoal prices; the pore size of activated charcoal must be tailored to the specific purpose for which it is required. Most poonac, about 51,000 tons, is consumed locally as animal food, and perhaps 10% is exported.

Although few data are available, it is known that there are imports of edible, mainly refined, palm oil, and inedible, mainly tallow for blending with coconut oil in soap fats. Refined palm mesocarp oil can be substituted for coconut oil as a cooking fat, or in margarine or vanaspati. These imports are made to render possible exports of the more valuable coconut products: dessicated coconut, copra, and coconut oil. With increasing population and consumption of coconut products and with aging of coconut stands and declining yields, alternative sources of edible oil will have to be found. There is a certain degree of reliance on developing a soya bean and oil industry; no doubt this has been examined economically. However, the value of soya bean lies in the meal and not in the oil which is virtually a by-product. On the other hand, the economic rate of return on oil palm is about 35%, and the palm grows well in the wet zone, the mesocarp oil is edible, and the lauric kernel oil is a direct substitute for coconut oil. Instead of replanting tall coconuts as a monocrop with an estimated rate of return of 10%, limited pilot diversification into oil palm could be considered.

Whatever the decision, an investigation into the total edible oils and fats situation should be launched as a matter of priority in the national interest to preserve the position of coconut products, and to maintain their position in world markets, particularly in the dessicated coconut and fine chemicals areas.

VI.3.2 Location of CRI

The main station of CRI is located on Bandirippuwa Estate at Lunewila, north of Colombo in a major coconut growing area. CRI has nine outstations including:

* a parasite breeding station;
* an adaptive research farm, mainly for intercropping;
* a project of three farms on the east coast for rectification of typhoon damage, working on agronomic research in the dry zone;
* a nursery at ARTI in Colombo for the sale of coconut seedlings;
* an isolated seed-garden for the production of improved planting material.

The four remaining units are field stations in appropriate areas and carry out research programmes decided by the relevant Heads of Divisions.

VI.3.3 Organization

In the case of CRI, the Internal Audit Unit is attached to the Coconut Research Board and not to the Director. The Director is assisted by the Deputy Director (Research) and the Deputy Director (Administration and Finance). The latter, in addition to his obvious duties, is responsible for the Division of Estate Management and the nurseries unit. The former is responsible for the five research divisions, three service units, and two service stations.

Research staff in post include the Director and the Deputy Director (Research) who is a plant pathologist. The present staffing in the five research divisions is as follows:

* Botany and Plant Breeding, a head and three assistant geneticists;
* Soils and Plant Nutrition, a head and five assistant soil scientists;
* Crop Protection, a head, two assistant crop protection officers, and a graduate technical assistant;
* Agronomy, a head, an agronomist, and four assistant agronomists;
* Coconut Processing, a head, three assistant technologists, and an experimental officer.

The service sections include: the Biometry Unit with an officer-in-charge, an assistant agricultural economist, and an assistant biometrician; the Botany Unit with a botanist (tissue culture), and a botanist (physiology); and the Library Unit with a publications/publicity officer, an assistant, and a documentation officer. Excluding the graduate estate manager but including an outposted crop protection officer, there is a total of 37 graduate staff in post. Of these, 21 have had only five years or less service in any post, and 12, only two years or less service with CRI. This lends force to the claim that there is a rapid turnover of staff and that some in the middle level are relatively inexperienced. There is no available table of the establishment but, in conversation, it was understood that all posts were filled. There is reported need (which is apparent) for postgraduate staff training. Only one scholarship is available biannually, while there is a requirement for training twelve postgraduates.

CRI operates an International Coconut Information Centre at its main site. This centre has been funded since its inception by the International Research and Development Centre, Canada but funding is due to cease at the end of 1983.

The administrative and financial procedures followed by CRI are those of government departments and could with advantage be made more flexible. Budgeting is on an annual basis which tends to inhibit the continuity of research projects. The allocation of funds for capital expenditure is considered to be inadequate. As examples of this, at the main site, the research equipment and facilities are good but there is need for a central analytical laboratory. The buildings, laboratories, stores, workshops, and living quarters are all considered inadequate as are the water supply, and school and social amenities. There is no provision for medical services. There is need of a radio link with outstation units, most of which do not have a telephone. Conditions on these diverse, and perhaps too numerous stations, vary considerably.

VI.3.4 Research Programmes

The research programme is set out in projects. There are five in agronomy on the evaluation of pastures, annual, semi-perennial and perennial crops and on the evaluation of a coconut-based farming system. However, it was understood that intercropping in the wet zone has a low priority in the research programme mainly because of lack of interest on the part of smallholders. It is not clear whether this lack of interest extends throughout the smallholder sector or whether it is confined to the small estates subsector. Elsewhere, intercropping particularly with cocoa as opposed to monoculture of tall palms has indicated economic rates of return of about 10% for the former and 20% for the latter. This includes the automatic rehabilitation of the mature stands of tall palms.

CRI currently has little capacity to carry out socio-economic studies, or to finance systems research on intercropping because of the absence of the agricultural economist. CRI does not have formal links with the Department of Minor Export Crops, but it would be advisable to re-examine this situation, in particular because of 400,000 ha said to be available for such a purpose under mature coconuts by DMEC. A study tour of other cognate coconut producing countries, for example, India and Malaysia may be called for. There seems to be some difference of opinion within the various organizations dealing with coconuts as to who has responsibility for research on intercropping.

The seven projects in the Botany and Plant Breeding Division dealing with genetics and plant breeding, controlled pollination, genotype/environment interaction, and nursery techniques are self-explanatory as are miscellaneous genetic studies on typical tall coconuts and on the physiology of the palm. Evaluation of performance of hybrids is divided into assessment of dwarf x tall and tall x tall hybrids. Because dwarf palms are self-fertilizing, they display a high degree of homozygosity. When crossed with tall palms which also possess some homozygosity by reason of location (Rennel or West African Talls), the assisted-pollinated progeny, when properly selected in the nursery, show high yields; 6 tons of copra per ha in experiments, and 4.5 tons in commercial production. Such yields require a high degree of management and inputs, and the performance under present smallholders conditions has not yet been properly evaluated.

Tall x tall hybrids are from seed-gardens of selected tall prepotent palms and, from their origin, are thought to be more tolerant of smallholders management. There is as yet insufficient production to supply requirements which presently are provided as seed from selected mother palms. The performance of tall x tall hybrids does not seem to have been evaluated under smallholder conditions even though, pending adequate transfer of technology, policy would favour tall x tall hybrids. However until further evaluation, the tall x dwarf hybrids should not be used except under estate management.

There are eight projects being carried out on processing, improved preparation of the kernel for a cooking medium; extraction of dessicated coconut from unsecorned nuts; oil extraction; timber technology; matress fibre extraction (r rubberised coir) from shell products and fuels; coconut oil is a fuel for internal combustion engines; and use of coconut water. Work thus covers not only aspects of the main products but also the valuable by products. The cost of production of dessicated coconut is covered by the value of oil extracted from the pericarp parings, and that of oil is covered by the value of the resultant cake (poonac).

From time to time the suggestion has been made that Sri Lanka should become the centre for Southeast Asia for research on coconut by-products in view of existing private and public interests. Because of the considerable increases in prices which can be obtained for cocom . products after processing, a plan to achieve this deserves serious consideration.

There are nine projects in the Crop Protection Division, seven concerned with insect pests and their chemical and biological control; one on new pests and diseases; and one on sterile insect techniques. All these projects are relevant to countering pests and diseases of the palm. There is an interdisciplinary project on the causal agent of leaf scorch decline.

There are five projects in the Soils and Plant Nutrition Division: two to establish the fertilizer requirements of young and adult palms; a study on micronutrients; soil moisture studies; and a study to determine nutrient requirements by soil and leaf analysis. The central analytical laboratory is required for this last project. The Biometric and Agricultural Economics Unit have three projects: studies of yield parameters in evaluating experiments; irrigation studies on adult palms and nurseries; and studies on agricultural economics. No doubt, the last project will be more clearly defined on the return of the agricultural economist from training.

Under the medium-term investment programme, eight projects have been identified:

* establishment of a central analytical laboratory for site-specific fertilizer recommendations;
* continuing studies on biological control of pests;
* facilities for genetics and plant breeding to establish low technology palms;
* expansion and improvement of nucleus seed-gardens to produce quality seed nuts;
* operational assistance to the International Centre on Coconut Information (ICCI);
* staff training and improvement of infrastructure;

* strengthening of extension services for technical training of CCB field staff;
* establishment of the Coconut Processing Research and Development Centre in Sri Lanka (CPRDC).

Some of these projects are related to industry problems and some recognize weaknesses in present research programmes and are an attempt to rectify them as, for example, the analytical laboratory and the proposed work on low technology palms. It is open to question whether national funds should be used to support ICCI when Canadian funding ceases at the end of 1983, or whether international funding should be sought. Some regional funding might also be sought for CPRCD. The notable omission is the lack of interest in the economic use of established coconut areas by intercropping or livestock or both. It would have been of advantage had funds been sought for socio-economic work and farming systems analysis in the extensive smallholders sector.

VI.3.5 Linkages with Clients and other Research Organizations

The Director of CRI through the Coconut Research Board has indirect contact with MCI; CRI has no other contact with government. Through CCB, the Director of CRI has contact with the extension service for the industry; and feedback is received from both these sources. It is considered that policy planning and research work are carried out in isolation from other agricultural activities and that policy guidelines are not reviewed at regular intervals. Further, the linkage between extension and research is considered to be inadequate. Contacts with the estate sector are not as good as could be desired, and contacts with other institutes are largely informal.

There is no international institute conducting coconut research in Sri Lanka. Correspondence is maintained with allied research institutions overseas, however, exchange visits would be an advantage. The Asian Pacific Coconut Community (APCC) is not mentioned, but it is known that MCI and CRI are in touch with this organization.

VI.3.6 Market Prospects for Coconuts

There would be scope for incremental increases in exports of coconut oil, if milling procedures were improved and some substitution of other fats made for edible and inedible coconut oil. Sri Lankan white oil commands a premium over other oils. Dessicated coconut produced in Sri Lanka has both a flavour and an odour advantage over that produced elsewhere. Were the millers able to improve milling practices, particularly in regard to hygiene, a growth in export potential might be possible. Prospects for brown fibre are promising, provided processes can be improved. While the quality of matress fibre could be improved, bristle fibre is a premium product. Coconut shell power, shell charcoal, and activated charcoal all have firm markets. It is unlikely that copra of any grade will again be exported in large quantities; most poonac is consumed internally as animal feed.

The main problem is thus the export of coconut oil. The current World Bank projections seem to be realistic, except perhaps that the effect of an ageing palm population has not been taken into consideration. In the next two decades, it is also possible that technological progress may not be so great as to make all oils substitutable and that the preference for lauric oils will remain.

Consequently, prices would not decrease as rapidly as forecast and, in current US dollars (c.i.f. Rotterdam), prices per ton dried nut might be: 1985, US$948; 1990, US$1,283; 1995, US$1,628; and 2000, US$1,885.

VI.3.7 Conclusions

Certain deficiencies apparent in the current research programme could be remedied provided some of the suggestions in the medium-term investment programme were accepted. There are two priorities which have not been considered. The first is the need to collect baseline data on the coconut industry. The second is the problem of intercropping; this would seem to require a joint study with MADR, with CRI as lead institute in both agronomy, socio-economics, and farming systems. If, however, MCI and its subordinate bodies do not agree with this, some arrangement should be made for the lead to be taken by DMEC (MADR) with appropriate funding.

The problems of staffing and staff amenities can only be settled within the country by internal housekeeping. The provision of certain extra facilities is called for at the headquarters of CRI but, on the other hand, whether the present number of outstations is required should be examined. The funding of the International Centre on Coconut Information and of the proposal processing centre requires further consideration.

VI.4 DEPARTMENT OF MINOR EXPORT CROPS RESEARCH DIVISION

VI.4.1 Location

The main station for research (about 150 ha) of the Department of Minor Export Crops (DMEC) is at Matele, about 23 km from Kandy. Planning for the construction of this station commenced in 1974 and some parts are only newly completed. Although the minor export crops of Sri Lanka are grown mainly under rainfed conditions in the wet zone, or occasionally in the intermediate zone, conditions at matele are not ideal for these crops. Therefore, substations in the wet zone have been comissioned for specific purposes at:

* Delpitiya (4.9 ha), for work on multistorey cropping specifically for the National Agricultural Diversification Authority;
* Kundasale (5.3 ha), for work on cocoa;
* Wariagalla (20 ha), for work on cinnamon and cocoa;
* Gammaduwa (4.9 ha), recently acquired.

VI.4.2 Organization

DMEC is headed by the Director, who is stationed in Kandy and who is directly responsible to MADR. The Assistant Director (Technical) and the Assistant Director (Administration) are also stationed in Kandy. The Assistant Director (Research) has his headquarters at Matele where the laboratories and offices are located. These consist of three units totalling 800 square metres. There is an office, a farm office and store, a main store, two nursery service buildings, three residential quarters, 11 labourers cottages, and a garage.

The laboratory space is inadequate, and there is no insectary or plant house, and no facilities for pilot plant processing studies. In addition, the residential, canteen, and recreational facilities are inadequate. While this situation reflects in part inadequate planning of the FAO/UNDP research project, it also represents a considerable achievement in establishing a necessary research institution. With the cessation of the research project, further development of infrastructure will necessarily be geared to national economic planning and hence research priorities. Once these have been established, it is hoped that the initial momentum can be continued to complete the infrastructure.

The approved cadre of the Research Division of DMEC is 29 graduates for research supported by ten technical assistants. As at mid-July 1983, 20 research posts were filled and two technical assistant posts. All graduate staff have at least first degrees and some are undergoing training under FAO/UNDP technical assistance, while others have been given part-time leave to pursue training courses at the Postgraduate Institute of Agriculture at the University of Peradinya. This together with delays in the recruitment procedure at MADR, but not a shortage of candidates, has resulted in DMEC operating until recently at only 50% of cadre. At present it is operating at about 65% cadre, although not all staff are working full-time. The lack of support staff is noticeable and leads to uneconomic use of research staff. There is also a shortage of other subordinate technical staff.

The research programme operates on an annual budget, which is divided into capital and recurrent expenditure. The unspent portion of the allocation lapses at the end of the year. Capital expenditure has not proved a problem to date, but because of the time-consuming procedures required by GOSL, funds for such purposes often lapse before the procedures are finalized. To date, the FAO/UNDP project budget has assisted with capital expenditure on equipment, but some of this expenditure has had to be postponed because of delays in counterpart funding for land acquisition and infrastructure completion. Recurrent funding would be inadequate, if the staff cadre were filled. To date virements have been made of funds for staff emoluments to other heads of expenditure, but this practice must cease when vacancies are filled. FAO/UNDP funds have provided considerable flexibility in this respect, but this will no longer be available in 1984.

The position previously in regard to expenditure and use of GOSL funds has not been improved by the government regulations regarding the level of administrative staff provided for the research project, their powers being limited by their appointments. This situation will be aggravated when all funds have to be disbursed under GOSL procedures.

VI.4.3 Research Programmes

Since the research division deals with a large number of crops, initially research officers were assigned to one or more crops. It later became necessary to identify officers for the following disciplines: genetics, agronomy, entomology, pathology, biometrics, soil and plant nutrition, post-harvest technology, and microbiology. In view of the staff situation, some research officers have had to accept responsibility for both a discipline and a crop or crops. No pattern of functional organization will emerge until the cadre is filled and postgraduate training completed.

The main objectives of the research programme are:-

* to assist GOSL in its long-term objective to increase foreign exchange earnings through expansion and diversification of agricultural exports;
* to establish a research institute on minor export crops;
* to expand the cultivation of minor export crops through monoculture but mainly by intercropping;
* to promote processing and packaging of such crops.

The immediate objectives are: to organise discipline-oriented research programmes in the disciplines listed above; to develop multidisciplinary programmes for crop production and protection; and to lay out feasibility trials in areas other than the wet zone with suitable minor export crops. Team leaders in the appropriate disciplines are also being trained.

Other objectives include:

* to train extension liaison staff for the Technical Division;
* to develop crop diversification models for tea and rubber;
* evaluation of trials already established;
* the final release of improved varieties of rubber, coffee, cocoa, and cinnamon;
* to support the extension service and development projects with new technology, improved planting material, in-service training and assistance in field days and similar operations;
* to provide technical advice and information for international or bilateral project formulation;
* to establish seed-gardens and budwood nurseries;
* to develop suitable processing and packaging methods.

Although the Research Division has been established relatively recently, some progress has been made, particularly in the establishment of pools of genetic material in cocoa, coffee, pepper, and cinnamon; in the core crops; and in the general issue of planting material. A particularly ingenious method of vegetative propogation of pepper has been devised. A demonstration plot of multistored crops for the World Bank Midland Tea Diversification Project is now in bearing at Delpitya, with the main cash crops being coffee and pepper. It is considered that there is potential for planting the following minor export crops on almost 100,000 ha: 4,600 ha of equivalent tea land for pepper intercropping; 45,000 ha of equivalent coconut land for various crops; 23,000 ha of equivalent rubber land for cocoa; 20,000 ha of uncultivated land; and 3,000 to 4,000 ha of forest for underplanting cardomoms.

VI.4.4 Linkages with Clients and other Research Organizations

The Assistant Director (Research) may be invited by the Director to meetings at MADR. Such meetings are not held on a regular basis, although this has been suggested. All other contact is through the Director. The ministerial meetings are chaired usually by the Secretary and are on a variety of matters which may concern research. There is no national economic plan for the development of minor export crops. Contacts with the Faculty of Agriculture at the University of Peradeniya are informal but good, particularly with the Postgraduate Institute of Agriculture (PGIA). DMEC funds its research projects; in 1983, to the extent of Rp 500,000. There are no formal agreements for cooperation with CRI, TRI, or RRI, but in 1983 DMEC provided Rp 200,000 for research

in CRI and Rp 100,000 each for TRI and RRI. The Research Division has good contacts with the Technical Division of DMEC; ten technical bulletins and 16 technical leaflets of good quality have been published. Except for occasional technical correspondence, there is no cooperation with similar research institutions overseas. Cooperation with FAO/UNDP has been good.

VI.4.5 Market Prospects for Minor Export Crops

Coffee. The lack of a national planning unit may have reprocussions for the development of certain crops, particularly in the multistoried cropping models which lean heavily on coffee and pepper. In the case of coffee, after internal consumption has been satisfied (for which data are not available), the International Coffee Agreement (ICA) quota for Sri Lanka is believed to be 3,000 tons which could be sold at ICA prices. However, export is not recorded in the Bank of Ceylon statistics. The World Bank considers the average annual ICA price, in 1983 US dollars and current US dollars, will be US$1,750 and US$3,829 respectively in 1995; and US$1,750 and US$5,092 respectively in 2000. Excess production over internal demand and quota would have to be disposed of, against considerable competition, in the non-quota market at a discount. Extensive planting of coffee might be unwise.

Pepper. Sri Lanka is a minor but significant producer of pepper, exporting nearly 19,000 tons out of a production of 20,00 tons in 1982. The price of pepper has dropped from US$ 50 per lb in 1945 to US$ 45 per lb in 1983. Pepper prices fluctuate significantly and leading producers have joined the International Pepper Community (IPC) in an effort to hold the price at not less than US$ 0.65 per lb c.i.f. New York for ASTRA Grade I, and US$ 0.55 per lb for Grade II. The ability of IPC to maintain prices has been questioned. Prices are not expected to improve much before 1987, in spite of a recent rise due to crop failure in Brazil. The world market will again approach oversupply and, with traditional markets saturated, the only outlets would seem to be eastern Europe, other developing countries, and the Sri Lankan domestic market. The extent of new pepper planting thus requires careful consideration.

Cloves. Of the estimated world production of cloves of about 45,000 tons, about 30,000 tons is consumed by Indonesia in 'Kretek' cigarettes (20% by weight of tobacco). Considerable plantings have been established recently in Indonesia, but the crop is being severely affected by Sumatera disease (a rickettsia-like bacteria) and clove leaf blight (Phyllosecta sp). In West Sumatra about 10,000 ha of young and bearing trees have died. There seems to be no early solution to the problem and Indonesia will continue to be a large importer. Prices have shown an upward trend in the period 1974 to 1982 with a slight decline in the period, 1979 to 1980. It is expected that demand will remain steady. Sri Lankan cloves, however, sell on the edible market (1,350 tons in 1982) at a premium of £stg 740 to £stg 1,000 per ton. Production above this level for this market would certainly not attract the same premium and might, in fact, depress it overall.

Cocoa. Sri Lanka presently produces 11,200 tons of cocoa of which only about 1,000 tons is exported. This is an insignificant amount compared with world trade of about 2.5 million tons. The short-term prospects for cocoa exports are poor, if exports from West Africa return to previous levels in 1984. However, production in Ghana has more than halved in eight years, and Nigerian production is static and possibly

de lining. Even a considerable cocoa planting programme, particularly as an intercrop, could probably find a market. Perhaps, smaller outlets in Australian and New Zealand could be explored. The World Bank figures and forecasts are being revised and are likely to present a more optimistic picture.

Experience with the International Cocoa Agreement has shown that a buffer stock can deal with cyclic fluctuations, as with rubber for example, but not with a structural surplus of production. The next cocoa agreement may include some quota system similar to the International Coffee Agreement. This is unlikely to be of importance to Sri Lanka in the short-term, but if extensive new planting is intended in a national plan, export quotas in the future will have to be carefully watched during the negotiation of any new agreement.

VI.4.6 Conclusions

The position concerning training of research staff in post will be resolved by time. The development of infrastructure will require further funding for the Research Division when national research priorities have been set. Budgeting, disbursement, recruitment, procurement, and administration present more intractible problems. Perhaps, consideration could be given to establishing the Research Division as a separate research institute similar to the other commodity research institutes with similar sources of funding. There is need to examine market futures at the departmental and national level, and to analyse and quantify the farming systems involved at the research level; neither of these matters is at present in hand. There are staffing problems comparable with other research institutes in regard to accommodation and amenities; and there is also need for a manpower plan.

STATISTICS ON AGRICULTURE IN THE ECONOMY OF SRI LANKA

Table VII.1. Changes in GDP 1970-1981 at 1970 Constant Factor Cost Prices

	Values (Rs. million)				Average Rate of Growth (%)		Contribution to Change in GDP		Percentage Share of Increase	
	1970	1977	1978	1982	1971-1977	1978-1982 Provisional	1971-1977	1978-1982 Provisional	1971-1977	1978-1982 Provisional
GDP	13817	16078	17401	21775	2.9	6.2	2691	5697	100	100
GDP per capita Rs.	1054	1153	1226	1429	1.3	4.4	99	276	-	-
Value added in Agriculture	3732	4299	4532	5238	2.1	4.0	567	939	19.6	16.5
of which										
(a) Tea, Rubber and Coconut	1191	1052	1111	1160	-1.7	2.0	-139	108	-4.8	1.9
(b) Paddy & other domestic Agriculture	2541	3247	3421	4078	3.5	4.7	706	831	24.4	14.6
Mining & Quarrying	95	515	619	742	27.1	7.6	420	227	14.5	4.0
Manufacturing	2197	2357	2541	3046	1.0	5.3	160	689	5.5	12.1
of which industry other than tea, rubber & coconut processing	1304	1534	1701	2225	2.3	7.7	230	691	7.9	12.1
Construction	744	619	794	1013	-2.6	10.4	-125	394	4.3	6.9
Services	6419	8288	8315	11736	3.7	7.2	1869	3448	64.5	60.5

Source: Annual Reports of the Central Bank: Figures for 1982 are provisional estimates.

Note: This table has been taken in its entirety as published in Public Investment 1983-1987 by National Planning Division, Ministry of Finance and Planning, Colombo, Sri Lanka, May 1983.

Table VII.2. External Trade - Exports

	Unit/Rate	1980	1981	1982
Value of Exports (f.o.b.)	Rs. Mn.	17,595	21,043	21,454
Agricultural Exports	Rs. Mn.	10,873	12,170	11,806
Tea	Rs. Mn.	5,170	6,444	6,342
Rubber	Rs. Mn.	2,590	2,889	2,323
Coconut	Rs. Mn.	1,234	1,438	1,496
Minor Agricultural Products	Rs. Mn.	879	1,399	1,645
Industrial Exports	Rs. Mn.	5,814	7,296	8,271
Textile & Garments	Rs. Mn.	1,826	3,021	3,502
Petroleum Products	Rs. Mn.	3,123	3,375	3,280
Other Industrial Products	Rs. Mn.	865	900	1,489
Mineral Exports	Rs. Mn.	805	792	859
Gems	Rs. Mn.	664	633	685
Other	Rs. Mn.	141	159	174
Export Volume Index	1978=100	99	102	122
Export Price Index	1978=100	126	129	119
Terms of Trade	1978=100	58	46	38
Balance of Trade	Rs. Mn.	-16,347	-15,539	-20,492

Note: This table has been taken in its entirety as published by the Statistics Department, Central Bank of Ceylon in Sri Lanka. Socio-economic data 1983. All data are presented in current Rupees.

Table VII.3. External Trade - Imports

	Unit/Rate	1980	1981	1982
Value of Exports (c.i.b.)	Rs. Mn.	33,942	36,582	41,946
Consumer Goods	Rs. Mn.	10,158	9,219	8,601
Rice	Rs. Mn.	882	992	925
Flour	Rs. Mn.	1,825	28	62
Sugar a)	Rs. Mn.	2,026	2,826	955
Other	Rs. Mn.	5,425	5,373	6,659
Intermediate Goods	Rs. Mn.	15,522	19,275	21,640
Investment Goods	Rs. Mn.	8,144	7,956	11,591
Fertilizer	Rs. Mn.	1,339	1,202	560
Petroleum	Rs. Mn.	8,090	9,958	12,274
Import Volume Index	1978=100	140	145	148
Import Price Index	1978=100	217	282	309

a) Refined and other.

Note: This table has been taken in its entirety as published by the Statistics Department, Central Bank of Ceylon in Sri Lanka. Socio-economic data 1983. All data are presented in current Rupees.