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Policy Paper No. 5

**Achieving High Productivity
in
Irrigated Agriculture:
A Programme of Research and
Development (R & D)
for
Technology Generation and Diffusion**

IMPSA

IRRIGATION MANAGEMENT POLICY SUPPORT ACTIVITY

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Preface

THIS PAPER IS a product of the Irrigation Management Policy Support Activity (IMPSA). IMPSA is a programme to assist the Government of Sri Lanka (GSL) in the implementation of its accepted policy of participatory management in irrigation and settlement schemes, in order to improve productivity, profitability and equity in the irrigated agriculture sector, subject to safeguarding and maintaining national food supply through domestic production.

IMPSA was initiated by the Ministry of Lands, Irrigation and Mahaweli Development in association with the Ministry of Agricultural Development and Research. It is sponsored and financed by the United States Agency for International Development (USAID), through the Irrigation Support Project for Asia and the Near East (ISPAN) and is assisted by the International Irrigation Management Institute (IIMI).

For the execution of IMPSA, the GSL set up an inter-ministerial advisory committee, the Irrigation Management Policy Advisory Committee (IMPAC) to provide broad guidance for the implementation of IMPSA and to institute a mechanism to achieve consensus among the Divisions and Departments of the concerned Ministries on the recommendations to be adopted and implemented by the GSL. IMPAC is chaired by the Secretary, Ministry of Lands, Irrigation and Mahaweli Development, and comprises of the Secretaries of State of the relevant Ministries, together with the Heads of the Departments and Agencies under them. IMPAC is assisted by a Working Committee, the IMPAC Working Group, which consists of some of the IMPAC members as well as several other officials drawn from the relevant Ministries and Agencies.

Under the IMPSA Programme, ten Policy Papers are scheduled to be prepared and processed for presentation of the government. Each Policy Paper will be a concise statement of the recommendations of IMPAC Working Group. Four Policy Papers have already been approved by IMPAC.

This document is the fifth in the series of ten Policy Papers to be prepared under the IMPSA Programme. It is based primarily on two Staff Working Papers on the issues related to the topic.

Chapter 1

INTRODUCTION

THE FOLLOWING METHODS were used in the development of this paper.

- i. Examination of available literature on the subject;
- ii. Informal and formal discussions with key officials of the irrigation management agencies and the research personnel of the institutions which are concerned with training;
- iii. Information and feedback obtained from consultative workshops held for selected groups of experts drawn from various public institutions as well as a selected number of farmer representatives;
- iv. Discussions between the IMPSA Secretariat and IIMI/SLFO staff in the IMPSA Team; and
- v. Consultation with senior government officials through the medium of a 'Consultation Panel' set up to develop the two Staff Working Papers that supported the development of this Policy Paper.

Chapter 2

BASIC CONCEPTS AND DEFINITIONS

FOR THE PURPOSE of this paper, the terms 'technology,' 'research,' 'technology generation,' 'technology diffusion,' 'basic research,' 'applied research,' 'adaptive research,' 'participatory action research,' 'disciplinary research' and 'multi-disciplinary action research,' are defined as follows:

Technology for irrigated agriculture includes both the *components* and *processes*. *Components* usually refer to land, water, and other resources including human resources. *Processes* involve the application of information about the components, technical knowledge and managerial skill to a given production environment in a given socio-economic setting.

Research is a scientific process of generating new knowledge and translating new and existing knowledge into optimal management innovations.

Technology generation refers to the tasks involved in the development and delivery of technology. The main phases of technology generation and development are: i) basic research, ii) applied research, iii) adaptive research, and iv) participatory action research.

Technology diffusion is a process with multiple functions, including dissemination of information on technology, and teaching and training on the same subject.

Basic research is the process of generating knowledge which is required for the development of technology.

Applied research is the process of finding practical use for existing or newly generated technology and knowledge. This process involves 'exploratory development.'

Adaptive research is a process of consolidation which translates the results of basic and applied research into location-specific recommendations.

Participatory action research is a process where researchers, in collaboration with the farmers, design some activities to be introduced into the community. The action itself and the outcome are subject to evaluation and modification. Action research is a cyclical process with five phases: diagnosing, action-planning, evaluating, specifying learning, and testing and adopting.

Disciplinary research relates to specific discipline-oriented research such as irrigation technology, hydrology, soil science, farm machinery, etc.

Multi-disciplinary action research is action research wherein researchers bring in knowledge as well as experience covering a wide variety of disciplines.

Chapter 3

PAST RESEARCH ACCOMPLISHMENTS AND GAPS

3.1. Accomplishments

3.1.1. *General*

THE GOVERNMENT HAS recently been placing increasing emphasis on improving the productivity of existing irrigation systems through cost-effective system rehabilitation, crop diversification, improved management, and greater farmer responsibility in operation and maintenance through self- and joint-management of irrigation systems. Hitherto, the emphasis has been on rice production to achieve self-sufficiency in rice. Increased rice production, mainly as a result of increased irrigated areas and higher yields obtained by farmers through the adoption of HYV technology combined with higher input use, brought Sri Lanka close to self-sufficiency in rice in the mid-1980s. However, the rice yield has, to put in graphical terms, reached a plateau at about three tons/ha and the average cropping intensity of the country's major irrigation systems remains at an estimated 136 per cent with only a few exceeding 160 per cent.

The major constraint to increasing cropping intensity appears to be the limited water availability during the dry season as well as inefficient management of the existing water resources. Therefore, it has become necessary to investigate and field-test crop options other than high water-demanding irrigated rice and a variety of management practices. The need for research information and ways of reaching out to farmers in the area of crop diversification were felt by the late 1960s. Significant progress has been registered in the field of diversified cropping both in major and minor irrigation schemes over the last two decades.

Following are some of the major research establishments with their research contribution:

3.1.2. *Department of Agriculture*

THE RESEARCH DIVISION of the Department of Agriculture (DOA) is responsible for the development and dissemination of new technology in respect of food and some cash crops. The DOA is also responsible for the formulation of the national research

strategy for food crops, including the establishment of priorities, and providing facilities including staff. The organization for research involves nine regional research centres based on agro-ecological regions of the country and three special units, one each for land and water management research, plant genetic resources conservation and the central rice breeding station.

The DOA has a strong capacity to undertake research relating to on-farm water management, crops and agronomical aspects, and agricultural machinery. The research units have been conducting research on crop water requirements, irrigation methods, scheduling for various crops, efficacy of drip and sprinkler irrigation, crop types and cropping patterns, and a variety of designs of farm machinery to perform a wide spectrum of agricultural activities. The department has also collected a wealth of information on cost of production of agricultural crops and farmers' profitability.

Research programmes are formulated at the regional level within broadly defined operational objectives. Close linkages have been established with extension services and farmers through the regional technical working groups which meet twice a year. The overall programme of the research division is considered by divisional committees and later at meetings of Division Heads chaired by the Director of the DOA.

For funding research, a consolidated budget is forwarded through the Secretary of the Ministry of Agricultural Research and Development (MADR) to the Ministry of Finance. Allocations are made to MADR under separate headings such as research, extension, etc. The present allotment is roughly 0.7 per cent of the Agricultural Gross Domestic Product (AGDP).

Although a great many disciplinary-oriented research studies relating to irrigated crop farming are being carried out by the DOA, the research efforts in these fields are fragmented and dispersed between two or three outreach regional research centres. The research results are not effectively integrated in the planning, design and construction by the implementing agencies such as the Irrigation Department (ID) and the Mahaweli Authority of Sri Lanka (MASL). Many research information data have also been generated by the Mahaweli Research Committee which existed during the 1970s. Lack of effective coordination between the DOA and the implementing agencies such as the ID and the MASL in utilizing the research results and lack of diffusion and feedback of technology from the implementing agencies to the researchers are the shortcomings of this activity.

3.1.3. Agrarian Research and Training Institute

THE AGRARIAN RESEARCH and Training Institute (AR&TI) was established under the MADR to carry out research into agrarian and rural development areas and to undertake the requisite training. This is an autonomous institute established by an

Act of Parliament and is governed by a Board represented by all agencies dealing with irrigation and agriculture. It was the first institute in the country to establish a water management division with inter-disciplinary staff and to carry out water management research. Its involvement in and contribution to water management research through the Gal Oya Project, the Tank Irrigation Modernization Project (TIMP), the Village Irrigation Rehabilitation Project (VIRP), and the evaluation of Integrated Management of Irrigation Systems (INMAS) projects are worth noting. One of the apparent weaknesses noticed in some research work conducted by AR&TI is the non-involvement of the implementing agencies directly in the conduct of research so that when the recommendations are provided, there will be no institutionalized mechanism for implementing the recommendations. In its future directions, institutionalized arrangements have to be established to work with the project management staff.

3.1.4. Irrigation Agencies

THE DOA CARRIES out investigations in two areas: designing of irrigation water supply and distribution structures, and land capability surveys including land-use planning. It has quasi-research divisions of Hydrology, Hydraulics, Soil Mechanics and Geology, Designs and Land-Use which are service-oriented units. They primarily collect data, analyze and interpret them to provide information on parameters to designers without concerted effort to use the data in applied research. Divisions such as O&M and Hydrology gather operational data. However, no systematic analysis of these data is attempted in order to improve performance of management efforts. Also, there has been pilot-testing of downstream control systems technology without much success. Contrary to irrigation technology, on-farm technology has not progressed satisfactorily in spite of the DOA and the Land-Use Division of the ID having conducted much research on various on-farm methods of irrigating other field crops and having achieved some successful results. Presently, not much research related to irrigation management is being carried out either in the ID or in the Irrigation Management Division, except in the Irrigation Systems Management Project.

3.1.5. Universities

THE POST-GRADUATE INSTITUTE of Agriculture at Peradeniya which is under the Ministry of Higher Education was established in 1975, in order to meet part of the requirements of post-graduate trained personnel, who are needed primarily in the agriculture sector, and secondarily in other sectors of the country. During the first 15 years, its research students have completed 16 theses in the area of water management related to irrigation, and 5 research studies in hydrology; currently 9 research studies are being carried out in the same fields of study. Many studies have been completed in the north-west dry zone and in the Mahaweli Systems. Other

departments of various universities have also conducted research relating to irrigated agriculture. While a pool of knowledge has been built up, many of the findings have not been followed up by user agencies. One reason for this may be that the results are not communicated effectively; another is the weakness of the linkages between university researchers and operating agencies.

3.1.6. *The Private Sector*

THE PRIVATE SECTOR has not done, or supported, very much research on irrigated agriculture to date. A few private sector firms have done "research" as consultancies for clients. There are a few cases of commercial firms doing some applied adaptive research to field-test crops and micro-irrigation technologies. There is much scope for further research by the private sector in these areas.

3.2. Research Gaps

- i. MUCH OF THE irrigated agricultural research conducted in the past is disciplinary in nature, primarily meant to satisfy the design and operational requirements of the line agencies; the research has not addressed the issues faced by the irrigation systems in a holistic manner;
- ii. Research has to solve practical problems of both farmers and the implementing agencies; unless research is seen as responsive to clients' problems, it soon loses its credibility among both farmers and agency staff. If it is to become more responsive, researchers have to recognize that social and economic aspects of the problems as well as institutional aspects are as essential as technological ones; these perceptions and related research activities are minimal and need to be reinforced;
- iii. The linkages and channels of communication among policy makers, implementing agencies, researchers and farmers are weak and inadequate; there exists no forum to identify, develop and prioritize national irrigation research needs and to assist in the coordination and implementation of research that could benefit from the participation of more than one research institution (multi-disciplinary research);
- iv. The need to strengthen research that will assist in improved system performance is well-recognized both at the operating and at the policy levels; however, this recognition has to be institutionalized with consistent and sustained funding. New improved operating and research management procedures have to be introduced with changes in staff incentives, training and career development; and
- v. There is a significant gap, firstly in identifying what research is required and secondly, in conducting research on identified issues relating to irrigated agriculture.

Chapter 4

RESEARCH NEEDS AND PRIORITIES

4.1. Overview of Current and Future Investment Trends and Policies

THE NEW POLICY of the government in irrigation development investments is directed away from construction of new major schemes and is focussed more toward cost-effective rehabilitation and management improvement programmes. Therefore, the area under irrigation would not be significantly expanded, but cropping intensities would increase. The present low water use efficiencies significantly account for the low cropping intensities. The low efficiencies are due to various factors including system flaws, lack of proper control structures, improper water management and the absence of adequate institutional arrangements for system O&M. In recognition of these deficiencies, the government is increasingly trying to improve water management and overall irrigation system management, through a participatory approach.

Since the mid-1960s, concerns about limited water supply for rice production, inefficient use of water in areas with soils not suited to rice production, and the low income of farmers have led the government to embark upon a policy of diversification into the production of other food crops in irrigation systems during the dry season. The efficient management of irrigation systems for crop diversification is thus a high priority in the agricultural development strategy of the government.

Recently, there has also been a shift in emphasis to institutional development and policy review in the irrigated agriculture sector. To realize the benefits of these innovations, the Government of Sri Lanka will have to put more effort into research and development, policy review, and institutional-strengthening.

4.2. Rationale for Research and Development

THE IMPSA VISION paper foresees transformation of Sri Lankan irrigated agriculture into a modern, diversified, productive sector of the economy. This will require strong research programmes and supporting institutions for research and development. It will also require continuation and intensification of experimentation that have characterized irrigation management research for a decade, and the diffusion of new findings to the farmer majority. Further, the government must strengthen existing national educational and research institutions by streamlining institutional mechanisms, adequately funding research,

providing incentives for researchers through rewards for outputs, and building excellent training programmes linked to both research and practical realities. The irrigation management institutions in association with farmers' organizations must develop considerable capacity for identifying research problems, getting the research done, and interpreting and adapting the results for improving performance.

This will require major investments in research and development to improve the research capacities of national organizations, including private firms, to develop technology and management packages for immediate gains in the profitability of irrigated agriculture.

The overall goal of irrigated agricultural research must be to produce practices that can be adopted in the field, leading to greater crop productivity, farmers' profitability and sustainability without causing environmental degradation. The research results must be useful to all connected with irrigated agriculture: the farmers, operators of irrigation systems, designers, consultants, policy makers, investors and consumers.

The growing competitive pressures on the resource base stress the need for appropriate research and development that could be used to improve policies and strategies for proper water resource use and investment priorities.

4.3. Characteristics of Irrigation Research

- i. RESEARCH, INCLUDING IRRIGATION research is characterized by a building process, with new understanding growing from past experience. Therefore, it has to be carried out in close collaboration with planners, designers, implementors and operators of irrigation systems including farmers;
- ii. Irrigation is not a purely technical field; it is a socio-economic process as much as or more than it is a technical process. Therefore, irrigation research must encompass socio-economic, institutional and technical aspects of irrigated agriculture;
- iii. Increased competition for the limited water resources and efficient use of water to improve productivity have necessitated that research must concentrate on creating more efficient irrigation systems and management practices designed to improve production efficiency with social justice and preventing environmental degradation;
- iv. Increasing technical, social and economic efficiency in the use of water in irrigated agriculture in achieving high productivity is dependent on all the other agricultural practices (variety choice, fertilizer, crop protection, tillage, management, etc.) being optimized. The technological packages to do this which are crucial to cropping systems need refining; there is also limited testing of information available with the experimental stations under farmers' conditions, and not all experimental stations conduct research on issues and questions raised by farmers in regard to attaining higher yields;

- v. An important task in irrigation research is to identify key issues for research since problems tend to get defined in discipline-specific terms. It is necessary to cut across disciplinary boundaries in order to be able to identify and prioritize research issues; and
- vi. It is desirable that research on irrigation is also carried out in terms of participatory action research. Under this, a pilot action programme involving experiments and interventions which a research team helps to design, is implemented with agency staff and farmer beneficiaries and monitored with a view to subsequent replication of the approach on a larger scale if field tests show it to be viable.

4.4. Research Needs

4.4.1. Basis for Research

IRRIGATION RESEARCH IS being conducted by various agencies in relative isolation with insufficient coordination. There is an urgent need to develop a coherent medium- and long-term research programme with clearly identified priorities and to develop mechanisms to coordinate the various research and implementing agencies to achieve better results.

The identification of research needs should be related to food security; improving crop yields and farmers' profitability; crop diversification in rice-based irrigation systems; improving system performance through institutional transformation; participatory system management; resource mobilization for O&M; introduction of cost-effective rehabilitation and modernization technologies; introduction of appropriate technologies to meet the present requirements and environmental management to ameliorate adverse effects.

4.4.2. Research Areas

THE FOLLOWING BROAD areas of research are proposed as having very high priority. These are explained and justified in greater detail in SWP 6.1.

- i.* Development and strengthening of irrigation institutions;
- ii.* Irrigation system management and performance;
- iii.* Rehabilitation and modernization of irrigation systems;
- iv.* Irrigation technologies;
- v.* Agricultural technologies;
- vi.* Resource management; and
- vii.* Environmental issues of irrigation.

4.5. Guidelines for Prioritizing Research

AMONG AND WITHIN the above broad areas, research priorities should be defined with reference to the national needs and farmers' needs. Research programmes, therefore, have to be formulated on the basis of these priorities. The following broad approaches are suggested for prioritizing research needs:

- i. Define research priorities with reference to the national needs and farmers' needs and formulate research programmes on the basis of these priorities;
- ii. Treat the irrigation systems (watershed, reservoir, command area, farmers and institutions) as the basic unit of analysis to identify research issues, employ a system perspective to study these fundamental units and make system performance the primary concern in choosing the research issues;
- iii. Understand the socio-political and economic changes that the research results might bring about in established practices and procedures of irrigation system planning, design, operation, maintenance and management before research is undertaken; and
- iv. Aim to provide research results to a wider audience, i.e., including the Ministries concerned with Planning, Finance, Agriculture and Irrigation, and irrigation professionals and farmers.

Chapter 5

DIFFUSION OF TECHNOLOGY

5.1. Present Arrangements

VARIOUS AGENCIES INVOLVED in irrigated agriculture have made use of different strategies and approaches to disseminate research findings. Among them, the following agencies and approaches must be highlighted.

The DOA has an extension division responsible for the synthesis of materials into implementable packages and translating such knowledge into a language which can easily be understood by farmers. In this connection, the division has prepared leaflets and other extension materials for distribution among farmers and has also utilized mass media such as the radio, the television and the press. One important function assigned to the staff placed in the district is to disseminate information and facilitate its adoption by the farmer. Various approaches have been used in the diffusion of research findings in the past. Among them are the individual contacts and the training and visit methods. At present, research is a central function while extension and training are devolved to Provincial Councils. The Provincial Councils are expected to evolve programmes to undertake appropriate extension methods to suit actual requirements. This is in the process of being developed.

The quasi-research done by the ID has been diffused through its staff placed in the ranges. It has also made use of the Galgamuwa Irrigation Training Institute to train farmers and officials on matters dealing with irrigation. The ID, however, has not made use of mass media such as the radio, the television and extension teaching materials to disseminate its research findings.

The MASL utilizes the resident field staff to disseminate research findings among farmers. It also makes use of the mass media such as the radio and the television; however, leaflets and other extension teaching materials have not been made use of adequately.

Research findings of the AF&TI are disseminated mainly through reports, magazines, and mass media such as the newspapers and the radio. Its involvement in various national committees has also helped in the dissemination of knowledge generated through research. The diffusion of findings through the line agencies represented at its Board has not been effective, but this must be encouraged in the future.

There is no proper mechanism to disseminate the knowledge generated by other agencies (universities, private firms, individual researchers, etc.).

5.2. Diffusion Gap

IT IS NOTED that considerable knowledge has been generated by various research agencies, which is yet to be disseminated to its final user, the farmer. As a result, there is a significant gap in yields between the potential and what the farmers actually obtain in the field. Similarly, some agricultural technologies such as conservation farming to conserve soil and water resources has not been disseminated to the farmer due to lack of awareness and the non-availability of materials and facilities for adopting the technology in the field. There is no proper mechanism to synthesize knowledge which is generated by various agencies and to disseminate this among officials involved in extension and among the farmers. Therefore, a national strategy is required to synthesize research results, translate knowledge into a user-friendly guide and a mechanism to disseminate it among the farmers.

It is suggested that the agricultural and irrigation agencies develop appropriate arrangements to synthesize research material and institute proper arrangements to disseminate knowledge. The agencies should also help strengthen the Provincial Councils to undertake these tasks. It is best that the knowledge be channelled through farmers' organizations for field adoption. Appropriate institutional arrangements should be worked out to facilitate this. It is also suggested that research knowledge be diffused among officers through various training programmes. However, the national approach to extension, which is in the process of evolution, is that the implementation of extension should basically be through farmers' organizations.

Chapter 6

INSTITUTIONAL ARRANGEMENTS

6.1. Research Investment

IT IS RECOMMENDED that 2 per cent of funds of the country's irrigation-related Agricultural Gross Domestic Product (AGDP) be allocated to irrigated agricultural research. Out of this 2 percent, it is recommended that 30, 50 and 20 per cent be used for irrigation research, agricultural and agro-based industrial research, and research on socio-economic aspects of irrigated agriculture, respectively.

The funds for irrigated agricultural research primarily come from the government. In addition, loans, grant funds and bilateral assistance funds will be used. Funds from international organizations and/or from the private sector can also be used for this purpose.

The budget allocation for irrigation and socio-economic research, on recommendation of the proposed Joint Research-Committee (JRC), would be approved by the Ministry of Finance and released to the Director, Irrigation Department who would, in turn, place the funds at the disposal of the proposed Research Management Unit (RMU) for programme implementation and diffusion of research findings.

At project level, the Project Management Committee (PMC) will be responsible for identifying and prioritizing research issues. This activity will be undertaken by the PMC in close collaboration with representatives of farmers' organizations and agency officials working in the project. At the provincial level, this exercise will be carried out by officials from the Provincial Irrigation Department. At each province, the RMU would hold a programme planning workshop to prioritize the research issues. These prioritized issues at provincial level will form the basis for an annual programme of research. The work plan and budget will be further discussed with the Joint-Research Committee to finalize an annual national research programme with an allotted budget. The principles enunciated for prioritizing research needs under section 4.5 will be utilized to arrive at an accepted proposal. The approved document will then be implemented by the RMU.

6.2. Joint-Research Committee (JRC)

A WELL-DEFINED ORGANIZATIONAL structure is necessary to provide the institutional framework that links research with its social, political and economic environment. It will

also define the system governance, its autonomy of decision making, the degree of centralization and other factors that make it function.

The previous discussion reiterated the necessity for the irrigation management agency — primarily the ID in this case — to develop a capacity for prioritizing research needs, getting the research done, interpreting, communicating and utilizing the research results. This will be done through the establishment of a Research Management Unit (RMU) within the Department (described in the next section). For guiding the RMU and coordinating its activities a Joint-Research Committee (JRC) will be established.

The JRC will guide and coordinate the activities of the RMU and ensure that it develops and implements an integrated research programme. There is presently a serious gap in linkages between research groups and policy makers and planners at the Ministry level. The JRC should take up the responsibility of ensuring two-way transfer of information, so that research can contribute effectively to highlighting development opportunities, and solving development problems. The JRC would also be the main channel on research to communicate with the National Planning Division.

The JRC as proposed in Policy Paper No. 2 will be a sub-committee of the Central Coordinating Committee constituted for implementing the irrigation management policies. This will be a high-level committee which will be chaired by the Secretary, Ministry of Lands, Irrigation and Mahaweli Development with representation from the ID, the MASL, the DOA, the IMD, the DAS, AR&TI, Council for Agricultural Research Policy (CARP), universities, the private sector, two distinguished irrigation management scientists, and the Heads of the RMU and Planning and Monitoring Unit (PMU) of the ID. Further details on the functions and working arrangements are given in SWP 6.2.

The main functions of this committee will be to:

- i. Guide and facilitate the RMU in its working including planning, prioritizing, coordinating and implementing programmes and budgets;
- ii. Review and recommend the research strategy, annual programme, work plan and budget prepared by the RMU, to the Director of the ID for his approval;
- iii. Help the RMU to liaise with national and international irrigation organizations involved in irrigated agricultural research for collaboration and coordination.
- iv. Liaise with Ministries for research policy review and mobilizing resources;
- v. Recommend establishing a coordination/implementation committee for each of the projects under implementation and monitor the project progress through these committees;

- vi. Review and suggest corrective measures, if needed, for the working of the RMU based on evaluation reports received from the Planning and Monitoring Unit (PMU) of the ID; and
- vii. Help strengthen the RMU and all other institutions involved in irrigation through fellowships for research and training; awards for best research and monetary and non-monetary incentives and rewards.

6.3. Research Management Unit (RMU)

THE PROPOSED RMU is essentially a research-based service unit dedicated to improving the crop productivity and farmers' profitability of irrigated agriculture through technological and management research as well as through the dissemination of such knowledge among the relevant officers and farmers. It will support and backstop advisory service to implementing agencies and farmers, and help disseminate research results through publications, the radio, the television, training, demonstration, field-visits, workshops, seminars and conferences.

The RMU will have a multi-disciplinary team which will address a wide spectrum of research issues in respect of irrigated agriculture. This will be established in the ID. Among the disciplines represented in the staff of the RMU are engineering and management, agriculture, and social sciences.

The RMU will be headed by an officer in the rank of a Senior Deputy Director from any one of the disciplines represented in this Unit. For building effective participatory systems, the requirements for leadership of the RMU are quite different from those traditionally expected of a leader in hierarchically designed organizations. The leader should be able to project a vision of the unit's mission and then guide and facilitate the changes necessary to advance toward that vision. He must be a person with a broad background, considerable experience in conducting multi-disciplinary irrigation management research and have experience in managing and implementing research projects.

The main objective of the RMU is to strengthen the institutional capacity of irrigation agencies including FOs, in carrying out field-oriented action research to improve crop productivity, farmers' profitability and their welfare.

The specific objectives of the RMU are:

- i. To identify and prioritize research needs, obtain approval from the JRC for its programme and budget, contract for research with research organizations, get the research done, evaluate research results, and adopt them for implementation;
- ii. To support a research programme which would yield results of immediate interest to the irrigated agriculture sector and provide a training ground for the RMU staff;

- iii. To work in partnership with other research institutions both national and international, including domestic private sector firms involved in irrigated agricultural research, as well as with the implementing agencies;
- iv. To act as an advisor to the implementing agencies; and assist agencies/organizations, on a long-term basis, in their efforts to strengthen the organizational and management capacity of their research systems;
- v. To ensure that policy review, innovation and decision making in irrigation management are well-supported by research;
- vi. To contribute to the quality of planning and implementation through well-tested field research results; and
- vii. To synthesize research findings, translate them into user-friendly guides and disseminate them among the officials and farmers through the agency network and farmers' organizations.

To improve the quality and level of working of the RMU, the following are suggested:

- i. Professionals passing out of the educational and training institutions at present do not have sufficient knowledge and skills to undertake multi-disciplinary irrigation management research straight away; those who are recruited for the RMU must go through a well-planned training programme in irrigation technology and management research in one of the institutes where such facilities exist. This training must be given at a relatively early stage in their career;
- ii. A systematic programme through the provision of post-graduate fellowships for training and research in irrigation management should be instituted for in-service personnel in the irrigation agencies and administered by the JRC to produce a sufficient number of personnel trained at the post-graduate level;
- iii. A field-based action research programme requires adequate supporting staff to effectively implement the programme. At least two technical support staff per senior scientist should be provided initially;
- iv. Improved transport and travelling allowances are essential if researchers are to travel to farmers' fields, and to interact with farmers and implementing agencies;
- v. Reward and promotion procedures for research staff must reflect performance in research and not merely seniority and administrative responsibilities; monetary and non-monetary incentives, awards for best work, attendance in training, attending national and international conferences, need to be considered;

- vi. The Head of the RMU must be given full responsibility and powers to manage the programme and budget, with guidance from the JRC. A flexible financial and administrative arrangement should be introduced; and
- vii. Linkages and communications between the RMU and other servicing units within the ID, especially with the training and HRD units, have to be strengthened; mechanisms for interaction among different units of the ID need to be developed.

6.4. Implementing Strategy

THE STRATEGY PROPOSED to implement the Research and Development policy and diffusion arrangements can be shown under the following steps:

- i. The first important step is to constitute the Joint-Research Committee. The terms of reference for this Committee must be framed and a small secretariat established in the ID. The responsibility for this activity rests with the Director of the ID but it may be delegated to the Head of the Irrigation Management Sub-Department (see Policy Paper No.4). The JRC will assist the RMU to identify and help implementing the research projects, facilitate inter-departmental collaboration on research, and also to make appropriate arrangements to diffuse the knowledge;
- ii. The National Irrigation Rehabilitation Project (NIRP) will be used as a vehicle to develop the RMU within the ID;
- iii. Initially, the RMU will cater to the needs of the ID, the IMD and the DAS. It will interact with the research units proposed to be set up under the MASL and other organizations and provide research guidance and assistance;
- iv. The RMU will initiate and identify research issues and contract, implement and adopt research results. It will work closely with the DOA, AR&TI, the irrigation agencies, the relevant faculties and departments in the universities, and interested private firms with necessary expertise and interest;
- v. The following institutional requirements will be developed by the ID and approved by the JRC:
 - * a mandate for the RMU and a strategic plan for the next five years;
 - * an organizational structure and staffing policy followed by recruitment, orientation and training of personnel; and
 - * a work plan that includes a strong monitoring and evaluation component;
- vi. The RMU will develop and implement a research programme through the following steps, in consultation with the relevant agencies and farmers' organizations:

- * undertake rapid-assessment surveys, particularly to obtain preliminary data and prioritize research issues;
 - * carry out adaptive research to test institutional innovations, water control innovations and testing of crop diversification recommendations;
 - * monitor and evaluate improvements implemented, to ascertain their acceptance, benefits and costs, and the long-term sustainability; and
 - * measure the cost-effectiveness of the innovations identified by the research programme;
- vii. Based on the lessons learned during the first phase of implementation with the NIRP, the RMU will be expanded and strengthened to carry out irrigation management and technological research;
- viii. The research divisions of the ID, the DOA, AR&TI and other related agencies will be strengthened to undertake the expanded research activities pertaining to the irrigated sector;
- ix. The RMU will develop an inter-institutional network with national and international centres including farmers' organizations interested in irrigation management research to stimulate learning through the flow of information and ideas; and
- x. The RMU will collaborate with training units of appropriate agencies and develop a strategy to integrate and synthesize research findings, and institutional arrangements for the dissemination of knowledge. Sufficient financial allocation will be set apart to diffuse necessary knowledge through publicity, production of teaching materials, curricula development, extension, etc. Accordingly, the diffusion arm of the appropriate agencies, including the Provincial Councils, will be strengthened.

Chapter 7

SUMMARY OF RECOMMENDATIONS

7.1. Research Goal

THE OVERALL GOAL of irrigated agricultural research must be the production of research results that can significantly influence actual practices in the field leading to greater productivity, profitability and sustainability without causing environmental degradation. The research results must be useful to all connected with irrigated agriculture: farmers, managers and designers of irrigation systems, consultants, policy makers, donors and consumers.

7.2. Research Areas

IN ORDER TO achieve the vision envisioned in Policy Paper No. 1, the following broad areas are identified for research:

- i. Institutions for irrigation management;
- ii. Improving irrigation system performance and management;
- iii. Rehabilitation and modernization of irrigation systems;
- iv. Irrigation and drainage technologies;
- v. Agricultural technologies;
- vi. Resource management; and
- vii. Irrigation and environment.

7.3. Investment in Research and Development

IT IS RECOMMENDED that at least 2 per cent of the irrigation-related Agricultural Gross Domestic Product (AGDP) be set apart for irrigated agricultural research. Out of this 2 per cent, 30 per cent must be for irrigation research, 50 per cent for agricultural research and 20 per cent for socio-economic and institutional research related to irrigated agriculture.

7.4. Irrigation Research Design

IRRIGATION RESEARCH HAS to be carried out in close collaboration with planners, designers, implementors, and operators of irrigation systems including the farmers. There are more problems affecting irrigated agriculture than there are issues which warrant research; one important task in irrigation research is to identify key issues for research which must evolve mainly from farmers, and the planning, implementing and operating agencies. This exercise has to be done using the participatory action approach.

7.5. Prioritizing Irrigation Research

FOLLOWING ARE THE main considerations for prioritizing irrigation research:

- i. Define research priorities with reference to the needs of the main clients (farmers) and formulate research programmes on the basis of these priorities;
- ii. Treat the irrigation system as the basic unit of analysis to identify research issues, employ a systems perspective to study these units and make system performance the primary concern in choosing research issues;
- iii. Aim to provide research results to a wider audience including the Ministries concerned with planning, finance, agriculture and irrigation, Provincial Councils and local authorities, and irrigation professionals and farmers;
- iv. Understand the socio-political and economic changes that the research results would bring about in established practices and procedures of irrigation system planning, design, operation, maintenance and management before research is undertaken; and
- v. Match the research programme as closely as possible with the research facilities and resources (both man-power and budget) available to achieve the desired results.

7.6. Diffusion of Technology

THE RESEARCH FINDINGS should be integrated and synthesized, translated into a language which can be easily understood, and disseminated among the final users including the farmers. An appropriate institutional mechanism and arrangement should be established. Funds should be set apart for production of teaching materials, diffusion of technology and for facilitation of its adoption by the farmer.

7.7. Implementing Institutions

ESTABLISH A RESEARCH Management Unit (RMU) under the Director of the ID and a Joint-Research Committee (JRC) chaired by the Secretary, Ministry of Lands, Irrigation and Mahaweli Development.

- i. The main objective of the RMU is to strengthen the institutional capacity of irrigation agencies including FOs in carrying out field-oriented action research and to facilitate

diffusion of the results to improve crop productivity, farmers' profitability and their welfare; and

- ii. The RMU will have a multi-disciplinary team with a client-centred problem-solving orientation, and established in the Irrigation Department. Engineering and management, agriculture and agronomy, and economics and social sciences will be among the disciplines represented in the staff of the RMU.

The working of the RMU will be guided and coordinated by the Joint-Research Committee (JRC). The JRC will be a formal mechanism to ensure that an integrated research programme is developed by the RMU for implementation by the relevant agencies. The JRC will also have linkages with CARP and Ministries relating to irrigated agriculture including finance.

The JRC will be a sub-committee of the Central Coordinating Committee for Irrigation Management constituted for planning, coordination of implementation, and review of the irrigation management policies. The JRC will be a high-level committee with representatives of the ID, the MASL, the DOA, the IMD, the DAS, AR&TI, CARP, universities, and the private sector. Two distinguished irrigation management scientists, and the Head of the RMU will also serve on this Committee.

7.8. Implementing Strategy

THE NIRP WILL be used as a vehicle to develop the JRC and the RMU. The JRC and RMU will thereafter be responsible for implementing the proposals contained in this document.