

# Revised Action Programme for Irrigated Agriculture in Pakistan

By

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## ABSTRACT

After a three and a half year effort, a long term plan for the development of the water resources for irrigated agriculture has been formulated recently for Pakistan. This has been termed as the Revised Action Programme - a follow-up of an earlier 'Action Programme'.

The preparation of the Revised Action Programme (RAP) was initiated by the IBRD and was supported by the Government of Pakistan. In the absence of any existing centralized water sector planning organization, the preparation of the RAP was entrusted to the Master Planning & Review Division of the Water & Power Development Authority (WAPDA) - a Semi-autonomous Organization responsible for major works in the Water Sector.

For the preparation of RAP detailed field surveys were undertaken to gather micro-level data for establishing agriculture constraints and potentials. Identified projects were subjected to technical and economic analysis. Different strategies for development were followed for drawing up alternative Investment Schedules, the evaluation of which resulted in the selection of the recommended programme.

Policies in support of the RAP, both financial and water-related, were recommended alongwith the required Institutional Frame-work. The requirements for the implementation of the Programme were also brought out.

The RAP, while it has served as a guide in Water Sector planning, has not been accepted in all its aspects by the Government. A number of the policy recommendations have been implemented while others require further deliberation. Resource constraints have also come in the way in achieving the recommended investment levels. For deriving the fullest utility of a planning exercise, such as this, it is therefore considered desirable that follow-up actions should be set in motion which would help to keep the long term plan in focus, while making allowances for the changing conditions.

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## INTRODUCTION

Water Resources Planning for the country was taken up in Pakistan in the early sixties, and a Master Plan of Water & Power Development was formulated in 1964 by the Semi-autonomous - Water and Powers Development Authority (WAPDA) under its charter. This presented an initial Development Programme upto 1975. This programme was superceded in 1967 by an Action Programme which was developed by the IBRD Indus Special Study Group under Dr. Pieter Lieftinck. The need of the Indus Special Study by the IBRD, soon after the formulation of the WAPDA Master Plan, was occasioned due to the concern in the Bank about the viability and the role of the major infra-structure development in the Water and Power Sectors represented by the Tarbela Dam.

The implementation of the IBRD Action Programme was seriously constrained on account of several factors, and it slipped behind by several years. In addition, the economic, technological, and political factors involved in planning the development of irrigated agriculture on a national scale changed substantially since the Action Programme was prepared. It was, therefore, felt necessary to develop a Revised Action Programme taking into account the prevailing policies on regional balance factors and income distribution objectives, implementation capabilities, economic priorities, and technological changes. This need was highlighted by an Irrigation and Drainage Review Mission of the IBRD, which interacted with Government of Pakistan in 1974.

In the light of this need, a Project was prepared by WAPDA in early 1975 that provided for the preparation of a Revised Action Programme and a Perspective Plan for Irrigated Agriculture and Reclamation in Pakistan. This Project, which was formulated in close collaboration with the IBRD, was approved by the Government of Pakistan. For implementing the proposed Project an Agreement was executed with the United Nation Development Programme (UNDP) in August 1975, for the provision of: 1) services of a Consultant to guide, advise and coordinate the activities, surveys and special studies as defined in the Project, 2) Foreign Training facilities for the Project staff, and 3) Supplies and Equipment. Under the Agreement the IBRD assumed the role of the Executing Agency for the UNDP.

This paper presents the approach which was followed in the formulation of the Revised Action Programme (RAP), representing an exercise in country-wide Water Resources Planning. The lessons which have been learnt from the exercise and the problems associated with the implementation of a long-term plan of development have also been brought out.

## REVISED ACTION PROGRAMME

### Objectives:

The long term objective of the Project, which was termed as the Indus Basin Planning Project, was stated to be the realization of 'the full agricultural potentials of the irrigated lands and to fully utilize the water resources of the Nation'.

The Short Term objective of the Project was to provide a sound basis for long-term planning and implementation of Government's investment programme in the fields of irrigation, drainage, saline soil reclamation, and flood protection. The Project also had the objectives of further developing capabilities within WAPDA and other Federal and Provincial agencies for the independent continuation of planning in these fields.

The Project was to result in the production by WAPDA of a Revised Action programme, acceptable to the parties for the planning, preparation and implementation of irrigation, surface storage and related hydro-electric generation, drainage, reclamation and flood protection schemes during the next fifteen years. The Project components were to consist of the following:

- (a) An evaluation of the implementation accomplishments in relation to the original Action Programme and subsequent modifications, as a base for future projections of construction

- capacity and incremental agricultural production, determining the constraints to be taken into account, remedial measures, and time schedules for their removal;
- (b) The compilation of updated basic data relevant to agriculture and water planning in the Indus Basin;
  - (c) The study of present irrigation practices and technical issues affecting design and implementation of key components of irrigation, drainage, reclamation and flood protection projects, with a view to resolving these issues;
  - (d) The provision of technical and economic bases for operational decision-making regarding storage releases, surface and groundwater distribution and use;
  - (e) A review and updating of existing plans and projects prepared to feasibility grade in collaboration with the Provincial Governments, as components of a national water resource plan, with emphasis on the inter-relationship of individual projects and the disposal of saline water effluent;
  - (f) The formulation of a Revised Action Programme for the planning, field investigation, detailed preparation and implementation of irrigated farming development, drainage, reclamation, surface water storage and related hydro-electric generation, flood protection and associated projects within the next fifteen years, and Perspective Plan period, responsive to the economic and social objectives of the Government and consistent with realistic funding and rates of implementation, including:
    - (i) The probable range of incremental output of agricultural products arising from the Revised Action Programme;
    - (ii) The phasing of required investment, in both local and foreign currency, for projects in the Revised Action Programme, and the identification of associated investments in other sectors; and
    - (iii) The staffing and training requirements (formal in-service and overseas) for project implementation, operation and maintenance, and for intensified agricultural supporting services.
  - (g) The provision of in-service training for national staff, in the processes of reviewing and updating the Action Programme;
  - (h) The establishment and activation of an irrigated agriculture planning organization within WAPDA with appropriate procedures and capacity for continuing the planning process.

### **Institutional Arrangements**

The preparation of the RAP was entrusted to WAPDA which is administratively under the Federal Ministry of Water and Power (formerly Ministry of Fuel, Power and Natural Resources). This decision was based on the consideration that WAPDA had earlier developed a Master Plan, and in the Water Sector had formulated two Regional Plans of development for the Northern and Southern Zones. WAPDA also had a pool of experienced professional talent, and as a semi-autonomous organization enjoyed a great degree of freedom in its administrative actions.

Within WAPDA a nucleus Master Planning Organization was greatly expanded to undertake the Indus Basin Planning Project and the required staff in the various disciplines was secured through intern...

adjustments and by recruitment from outside. Attempts were made to include staff on secondment from the Provinces but these did not prove very successful. Most of the positions were filled by local staff but there were some difficulties. In particular, the services of the Chief Economist had to be provided by the IBRD. The organization chart of the Master Planning Organization for the preparation of RAP is given in Annex-1.

The WAPDA Planning Organization was assisted by a team of Expatriate Advisors under a part-time Project Manager and full-time Chief Planner, and consisted of specialists in the fields of irrigation engineering, systems analysis, geo-hydrology, development economics, agricultural economics, soil science, agronomy and field surveys. The role of Expatriate Advisors was to provide professional advice and guidance to WAPDA in carrying out the different activities.

It was stipulated that WAPDA Planning Organization would be supported by the concerned Federal Ministries and relevant Provincial Departments; in particular, the Federal Ministry responsible for planning was to assist the planning programme in providing basic policy inputs, production targets, socio-economic priorities and perspective financial allocations for the Sector. To provide for the maximum coordination and support of the Project with the future integrated planning of the agriculture, power and other related Sectors a National Board for Irrigation Agriculture Planning and Development was established under the Federal Secretary of the Ministry of Water and Power. This Board was composed of representatives from the concerned Federal Ministries, Provinces and from the Private Sector. The Federal Ministries concerned on the Board were: Planning, Food & Agriculture, and Fuel Power and Natural Resources. The Provincial Governments were represented by the Secretaries responsible for Planning and Development, whereas the Private Sector membership consisted of the representatives of the farmers from each of the four provinces. Representation of Board was also provided to the Commercial Banks and to the Credit and Investment Corporation. WAPDA provided the Secretariat of the Board and was also represented by a Member.

For more effective coordination with the provinces, Provincial Coordination Committees were constituted to inter-act with the WAPDA Planning Organization at the working level. These Coordination Committees were headed by the Chief Economists of the Provincial Government with representatives from the Departments of Irrigation and Agriculture.

The above insitutional arrangements were intended to bring about coordination with the concerned Federal and Provincial Agencies in the process of plan formulation and were fairly effective. It was however felt that the input from the provinces was not as substantial as could be expected considering that Water is a provincial subject. This was due to the fact that no planning cells exist in the provinces for the development of water resources.

### **Information Systems**

A great deal of information and data pertaining to land and water resources and agriculture existed for Pakistan and was made use of in the preparation of the RAP. Reconnaissance Level soil surveys were available for the country and information about the water resources was quite reliable. Long term records of the flows of the Indus river and its tributaries, which provide the mainstay of the agricultural economy of the country, were available and the results of extensive investigations had established the major potentials of groundwater. A part from the annual statistics of crop acreages, crop yields and agricultural production, the results of two agricultural Censuses, and an Agricultural Mechanization Survey were available. However, available information about the extent and severity of soil salinity, a major constraint for agricultural production, was not quite upto date and micro-level data on irrigation water use and agro-economic factors of agricultural production were not available under variable conditions. For filling these information gaps the Project provided for two extensive field surveys. In addition, as the planning progressed other more limited field surveys were carried out for generating the required information. These activities are briefly described below.

## Salinity Survey

Because of its great relevance to agricultural production in the Indus Plains, a soils and salinity survey was provided in the Project for 20 million acres of representative areas (This survey was subsequently extended to cover all the 42 million acres of the irrigated areas of the Indus Plain). The objective of this survey was to provide a basis for planning reclamation needs and establishing production potentials as well as to indicate changes in salinity/alkalinity since the previous surveys in the early 1960's. For field use in the survey and mapping, a fresh aerial photography was arranged using panchromatic and infra-red black and white film and covered 50 million acres. Aerial photos on a scale of 1:30,000 were used in the field for demarcating sampling locations and areal delineation of features for subsequent transfer to standard topographic maps. The salinity appraisal was based on detailed chemical analysis of depth-differentiated soil samples collected on a one-mile grid. This survey also resulted in the delineation of surface salinity classes, land use and soil textures. Determinations were also made of the quality of the ground-water below the root zone where encountered at shallow depth. The information derived from this survey was used to establish reclaimability classes and the production potentials under future programmes of reclamation.

## Water Use and Agro-Economic Survey

This survey, as defined in the Project was intended to derive micro-level information, through direct measurement and observation, from 60 selected farm areas representative of the different farming conditions. The area irrigated from the canal outlet called the 'chak' and measuring 250-500 acres, was selected as the sampling unit and in each 'chak' three farms were selected for farm-level data collection. Maps were prepared for all the 61 selected 'chaks' showing the farm locations, topography and water distribution system. The Soil Salinity/Alkalinity status in the 'chaks' was determined through intensive soil sampling and chemical analysis. Socio-economic conditions were established through directed interviews. The appraisal of water-use was undertaken through mobile teams and involved i) measurement of conveyance losses, ii) water applications to each field in the selected farms and iii) application efficiency determinations. For the selected 183 farms information on all farming operations (by individual fields where relevant) was recorded by resident staff for two consecutive crop seasons by personal observation or measurement. For handling the massive data for subsequent processing it was coded and transferred to computer tapes. The information derived from this survey was utilised to determine the efficacy of farming operations and resource use, the binding constraints and the levels of production that could be achieved under different conditions and through various policy interventions.

## Expanded Agricultural Economics Survey

The Planning Organization was entrusted with an expanded agricultural economics survey by the Development Research Centre of the World Bank in order to provide a strong representative data base for the linear programming models which were being developed for the Indus Basin and were intended to assist in investment planning. Under this survey, agro-economic data was collected from 2000 farms in 400 'chaks'. The information derived from the survey was also utilized for plan formulation.

## Other Surveys

A number of less extensive surveys were also carried out. A leading farmer survey of 168 farmers was conducted to evaluate cultural and management practices and to establish crop yields by different sizes of farms. A private tubewell survey of 521 tubewell owners/non-owners was conducted under an assignment from the Federal Planning Division. A reclamation survey of reclamation practices and accomplishment was conducted under different geographic conditions. Another survey was undertaken in respect of farm mechanization and tractor usage.

## **Data Handling and Models**

Massive data was generated from the field surveys noted above. In addition, there was data available from other sources which had to be taken into consideration. For handling all this data and for carrying out various analyses computerized techniques were employed. A number of existing models and programmes were employed for various purposes and a few new programmes were developed. These aspects are briefly described below:

All the data which was generated through the field surveys was directly coded on prescribed forms. This data was subjected to field checks before it was transmitted to the Computer Centre for transferring to computer tapes. Data listing produced from the tapes were sent out to the field for checking, and corrections if any were made. This required 2 to 3 phases before 'clean' data tapes were prepared. For processing of the data and ease of analysis data files were prepared as required by the users.

For the various analyses and studies available programmes were used. In particular for the bulk of the analysis the Statistical Package for Social Sciences (SPSS) was extensively used, for descriptive statistics, cross tabulation, establishing co-relations etc. The models and programmes specific to the preparation of the RAP are described below.

### **Indus Basin Irrigation System Model (COMSYM)**

A comprehensive Model of the Irrigation System or the COMSYM had been developed earlier and it was adopted for use with the IBM-370 Computer. COMSYM is a simulation model of the Indus Basin System which distributes the surface water supplies through all the canal commands so as to meet the crop water requirements conjunctively with the use of groundwater following specified surface water distribution criteria and reservoir operating rules. Results from the model bring out, on a monthly basis, the anticipated water shortages, the groundwater pumpage requirements and the power generation at the reservoirs. This model was utilized to evaluate the conditions that can be anticipated under future conditions of water resources development including the impact of additional storage.

### **Crop Water Requirements**

For determining the crop water requirements, as an input to COMSYM and for other purposes, a programme was developed termed as DELTA. This programme determines the irrigation water requirements for specified cropped acreages and cropping pattern using the modified U.S. Weather Bureau method for estimating the consumptive use.

### **Farm Budgeting**

For farm budgeting to be used in the economic evaluation of projects the World Bank programme called AGPROJ was extensively used. It proved particularly helpful as a large number of projects had to be evaluated during the course of the work.

### **Investment Planning Model**

The Development Research Centre of the World Bank had taken up the development of a sophisticated Indus Basin Planning Model simultaneously with the preparation of the RAP. This model was intended to bring together, in an analytical frame-work, the irrigation systems network and the groundwater availability in conjunction with agricultural production as influenced by economic factors. This model however could not be developed to the stage where it could be tested and used for the formulation of the RAP. It is however understood that the DRC has now developed this model to stage where it can be used as a Planning tool.

## Plan Formulation

For the preparation of the RAP a number of activities had been defined in the Project and intermediate stages had been set for putting up Interim Reports. These activities are given in Annex 2. In the evolution of the RAP, however, it became necessary to broaden the scope of some while narrowing the scope of other activities. The Project Document tended to emphasize projects, investments and the resultant input requirements, (labour, equipment, materials, O&M, power etc) which were considered too specific in the context of a 15 year Master Plan. These details are necessary for planning specific projects since actual decisions have to be made to commit or not to commit resources to the Project. In a 15-year Master Plan, on the other hand, the principal issues relate to strategy, institutions and policies, and broad decisions about the relative emphasis of alternative modes of development (surface reservoirs, drainage, canal remodelling, water conservation, ground water development) are required. Actual project choices, involving formal commitment of resources, are made later in the framework of the relative model emphasis defined by the Master Plan and only after a thorough technical and economic appraisal. Consequently, it was decided to give greater emphasis to the consideration of the important features of development including such aspects as institutions, policies and project review procedures. This meant putting the short term objectives in the context of the long term objective of "realizing the full agricultural potential of the irrigable lands and to fully utilize the water resources of the Nation". This shift of context did not materially alter the composition of the tasks as defined by the Project Document; it merely shifted the focus of the planning effort to providing a sound basis for planning the development of "irrigated agriculture". Throughout the planning process, an effort was made to maintain a balance in emphasis between water resource development and agricultural development. The framework for this was provided by the present status of agricultural development in Pakistan.

The context for the preparation of the RAP was the Agriculture Sector which is the largest and most important single sector of Pakistan's economy. Despite its importance, the level and growth of agricultural production had remained far short of potentials available with current in-country technology. Pakistan had been unable to become self sufficient in food although, even at yields considered modest by world standards, it should have been a major food and fibre exporter. The rate of growth of agricultural production during the 1970's had been less than two percent, while the population growth has averaged about three percent. The country covering, 197 million acres had a population of about 75 million people. In the Indus Basin, the largest inter-connected irrigation system of the world had been developed with a gross commanded area of about 40 million acres, accounting for about 72 percent of Pakistan's cultivated acreage, and for over 85 percent of its agricultural production. Irrigated agriculture in the Indus Basin thus constituted the mainstay of Pakistan's agricultural sector. Substantial investments, primarily water related, had been made in the past two decades, but returns had been below expectations. Investment emphasis, in the past had been on construction of major reservoirs for increasing irrigation water supply and on public tubewell projects - SCARPs - for irrigation water supply and drainage. Most of the direct expenditure in the agriculture sector had been for subsidies on fertilizer, pesticides and other inputs. Failure to achieve growth in agricultural production through these public investments and expenditures had become increasingly apparent.

As a first step in the preparation of the RAP a review of the Action Programme was undertaken and the results were presented in the first Interim Report entitled "Review of Irrigated Agriculture Planning for Pakistan in the Last Decade". The review of the past performance in agriculture was however continued in the planning process particularly in respect of those past developments in which a change of direction was indicated. This review also covered consideration of past policy.

Simultaneously with the review of the past performance, a portfolio of projects was developed covering projects which had been identified or planned and by identifying additional new projects. The projects which had been prepared to the feasibility stage were subjected to technical and economical review for formulating an Interim Investment Programme. The results of this work were presented in the second interim report entitled "Review of On-going and High Priority Irrigation and Drainage

Projects".

One of the important activities during the process of plan formulation consisted in the technical and economic evaluation of the various modes of development and the establishment of potential represented by them for agricultural development. The alternative and/or complementary modes of agricultural development included: i) modes for water supply expansion, ii) modes for land supply expansion, and iii) modes for improving resources base utilization.

Before the formulation of the Investment Schedule of the RAP a 'sketch plan' or an initial conceptual view of the Master Plan was prepared. This was called "An Initial View of Water and Associated Power Developments for the Revised Action Programme and Perspective Plan". This 'sketch plan' was intended for review and comments which could be taken in to consideration for the final planning phase. The main feature in the 'sketch plan' consisted of the agricultural production response of a long term water development programme.

Following the preparation of the sketch plan and prior to the formulation of RAP, three alternative investment schedules were developed in the context of the national objective expressed in the Fifth Five Year Plan. For developing these alternatives, three polar objectives were proposed; each objective had a corresponding plan alternative comprising an aggregate of projects. The choice of polar objectives was deliberate as polarity permits clear distinctions between the implications of alternatives. The raw material from which alternative plans were developed was the portfolio of projects and programmes; each alternative plan represented a subset from this portfolio and the choice about the composition of the subset was a function of the under-lying plan's objective. The three polar objectives were:

- i) Principal focus on the growth of output value during 1980-90 in order to acquire domestic capability for financing a reasonable portion of Pakistan's capital needs after 1990;
- ii) Focus on improving control (through construction of Surface reservoirs and investments in Drainage Systems) over Basin resources to facilitate efficient and integrated utilization of Pakistan's land and water resources; and
- iii) Concentrate investments in relatively depressed regions and sub-regions in order to reduce agricultural productivity disparities among the irrigated regions of the Provinces.

The first objective emphasized economic efficiency in the medium run; the second emphasized economic efficiency in the long run; and the third emphasized income distribution. It may be noted that even though only the third objective was explicitly distribution oriented, the other objectives would also imply income distribution effects.

For the achievement of the above objectives the following strategies were proposed:

#### Objective-I

- Implement policies and channel resources, on a high priority basis, to improve the utilization of existing capacity and capital (public ground water capacity; Reservoir operation; integrated and conjunctive use of surface and ground water;
- Choose projects and programmes which primarily utilize simple and low cost technologies and local materials;
- Focus on an Area-basis for implementing public sector projects; that is, not spread public resources thinly;



- Concentrate public resources only for those projects in which private sector is unlikely to invest; and
- Use pricing and other policies to improve the efficiency of resource use and to generate public income.

#### Objective II

- Expand infrastructural capacity for both the water and power sectors;
- Concentrate resources to improve public sector capacity to manage the existing "reservoirs-canal-barrages-groundwater" system; and
- Use strong: fiscal means to increase public income; also significantly increase borrowing from abroad.

#### Objective III

- Concentrate resources in depressed regions including depressed Canal Command within regions;
- Increase the catalytic role (Technical Assistance; Provision of Credit; improving access to technology; ) of the public sector;
- Concentrate on projects and technologies which have low costs per beneficiary so that these projects may be replicated; and
- Use subsidization to distribute income and to improve access to public facilities.

The evaluation of the alternative investment schedules resulted in the selection of the recommend RAP.

The strategy for the RAP was adopted in line with the Fifth Five Years Plan and was a composite of those considered in evolving the alternative investment schedules but with the primary emphasize on output growth in the short-term through high-return investments early in the period with major infrastructure investments deferred to later in the period. Basically the procedure used in the formulation of the plan was to:

- i) Choose specific relevant strategy;
- ii) Broadly formulate the Plan using aggregate modes of developments;
- iii) Replace the aggregate modes of developments with the specific programmes and projects; and
- iv) Schedule investments considering resources and resource generation, and physical interdependence of complementary activities.

The estimates resource availability, for drawing up the RAP Investment Schedule, were based on two assumptions of GNP growth, one corresponding to the Fifth Plan target of 7 percent and the other at a lower growth rate of 5 percent. Foreign inflows were assumed at a fixed level and the share of Agriculture and Water Sectors in the total investment was maintained as in the Fifth Five Year Plan, but with the adjustment that the share of the Private Investment was gradually increased from 26 percent to 35 percent. These assumptions gave a range of the resource availability and corresponded to the figure which was indicated by the Federal Planning Division.

The RAP taken together comprised of the following four components:

- i) Recommended Policies
- ii) Recommended Programmes and Projects
- iii) Recommended Institutional Requirements, and
- iv) Implementation Requirements of the Plan.

## **POLICIES, INSTITUTIONS AND IMPLEMENTATION**

### **Policies**

The crucial policies underpinning the Plan were subdivided into two major categories: Water related Policies; and Financial Policies. These crucial policies were:

#### **Water Related Policies**

Provision of "controlled" and/or "guaranteed" water supplies is the key to improving the production environment of the farmer. To the extent possible, irrigated water supply should be made available to match crop water needs in quantity and time. This can best be accomplished by the farmer having as much individual control of his water supply as possible. The set of recommended policies listed below is addressed to these objectives:

- (1) All future development of usable ground water should be entrusted to the private sector, but with the assistance of the public sector in the form of supervised credit, technology supply, and information;
- (2) Present SCARP tubewells in usable ground water areas would be gradually phased out and replaced by private tubewells;
- (3) Basin wide water management would be a major objective of the Government through the integrated use of rivers and reservoirs, conjunctive use of surface and ground water, and advance crop planning to accomplish the above.

#### **Financial Policies**

Financial policies are addressed to the creation of an economic environment that will provide incentives for increased production, and to implement the strategy of increased mobilization of domestic savings to finance further investment.

- (1) The subsidies for private tubewell installation and fertilizer should be phased out, and replaced by programme of supervised credit;
- (2) Present water charges should be increased to be adequate for covering operation, maintenance, and rehabilitation cost of irrigation and drainage facilities - about three times present level over the next five years;
- (3) Public investments in watercourse lining should be fully recovered from beneficiaries;

- (4) Capital investments in irrigation and drainage infrastructures should be partially recovered from the beneficiaries, but the development charges would not exceed 35 percent of the incremental income from the investments.

### **Recommended Institutional Requirements**

The recommended institutional framework for the Plan had been developed on the principle of "filling the existing gaps in the institutions presently serving agriculture". The principal new institutional recommendations are described below.

#### **Commission for Agriculture Policy and Planning (CAP)**

A Commission for Agricultural Policy and Planning to fill the institutional gap at the Federal level in coordinated policy formulation for agricultural production and for demand-supply management, including export/import policies.

#### **Provincial Additional Chief Secretary for Agricultural Production**

To maintain liaison with the Federal CAP and to coordinate and direct the Provincial Agriculture and Irrigation Departments, and all other public agencies that deal with input supply.

#### **Command Area Management - I (Project)**

The CAM-I for Water Sector infrastructure projects would be responsible for integrated and conjunctive use of water supplies in project areas upto 500,000 acres and ensuring the timeliness and adequacy of supplies of non-water inputs and extension advice.

#### **Command Area Management-II (Non-Project)**

CAM-II would coordinate needs of agricultural areas of 100,000 to 300,000 acres where projects are not planned or are scheduled for implementation at a future time, for articulating the needs of the farmers so as to demand the attention of public and private suppliers of inputs and information.

#### **Autonomous Provincial Minor Works Corporation**

The Provincial Autonomous Minor Works Corporations would be responsible for: (1) executing the watercourse lining programme; (2) facilitating the installation of private tubewells, including stimulation of domestic production of fractional cusec tubewell components; and (3) managing the transition of the SCARPs from the public to the private sector.

#### **Strengthening of Provincial Irrigation and Agriculture Departments**

The functional objective of these departments to be reoriented to "satisfying the needs of modern irrigated agriculture" through proper system maintenance and management, an expanded Extension Service, by creating a parallel "Water Management and Reclamation Extension" service.

#### **National Institute of Agricultural Mechanization**

To sort out the badly neglected technology aspects of appropriate mechanization for Pakistan's agrarian base.

## Implementation Requirements

The implementation requirements for the RAP were specified as under:

- (1) Getting the recommendations of the Plan accepted by the Government;
- (2) Managing the Evolution of the Plan under the conditions of the 1980's as they unfold;
- (3) Ensuring through incentives and training the availability and effective performance of the personnel required for accomplishing the above managerial tasks.

It was recognized that the acceptance and implementation by the Government of the various recommendations in the RAP would require further work particularly in so far as the policies and institutional arrangements are concerned. It was stipulated that policy papers in this regard should be drawn up by the concerned agencies. The implementation of the RAP also required that the process of project preparation and selection should be re-oriented and the review process by strengthened including the prescription of guidelines for project evaluation at pre-feasibility and feasibility levels. For managing the evaluation of the RAP three sets of inter-connected activities were proposed: 1) Managing resources to maximize agricultural production, 2) Reformulating future projects and reorienting existing projects to enable an increasingly efficient management of resources, 3) Introducing and managing the programmes recommended in the Plan to generate returns for financing future capital formation. Also, with the implementation of RAP the future course of the irrigated agriculture sector was to be based on continued studies and evaluations providing a feed-back.

## Conclusion

The preparation of the RAP and its follow-up has provided an opportunity of examine the issues which have particular significance in Water Resources Planning. These are presented herein to serve as a feed-back in so far as they may be applicable under similar conditions.

The initiation of the RAP Planning Project and its implementation was greatly assisted by the active interest of the World Bank, and the association of the World Bank as the Executing Agency ensured the availability of professional expertise from the Bank and also from other quarters. This association also provided the assurance that the plan as developed would have the support of the World Bank and other financing agencies.

The institutional arrangement, whereby the planning was undertaken by an in-country organization had a great advantage as the local personnel had a fairly intimate knowledge of the local conditions and did not require for familiarization any period of time as is taken by expatriates.

For planning in a Federal-Provincial context, coordination assumes considerable importance. For the RAP the Coordinating Committees were quite helpful, but it is felt that the various planning activities would have been greatly facilitated if, in the absence of any Provincial Water Resources Planning Cells, small provincial planning groups working in consort with the Central Planning Organization could be created.

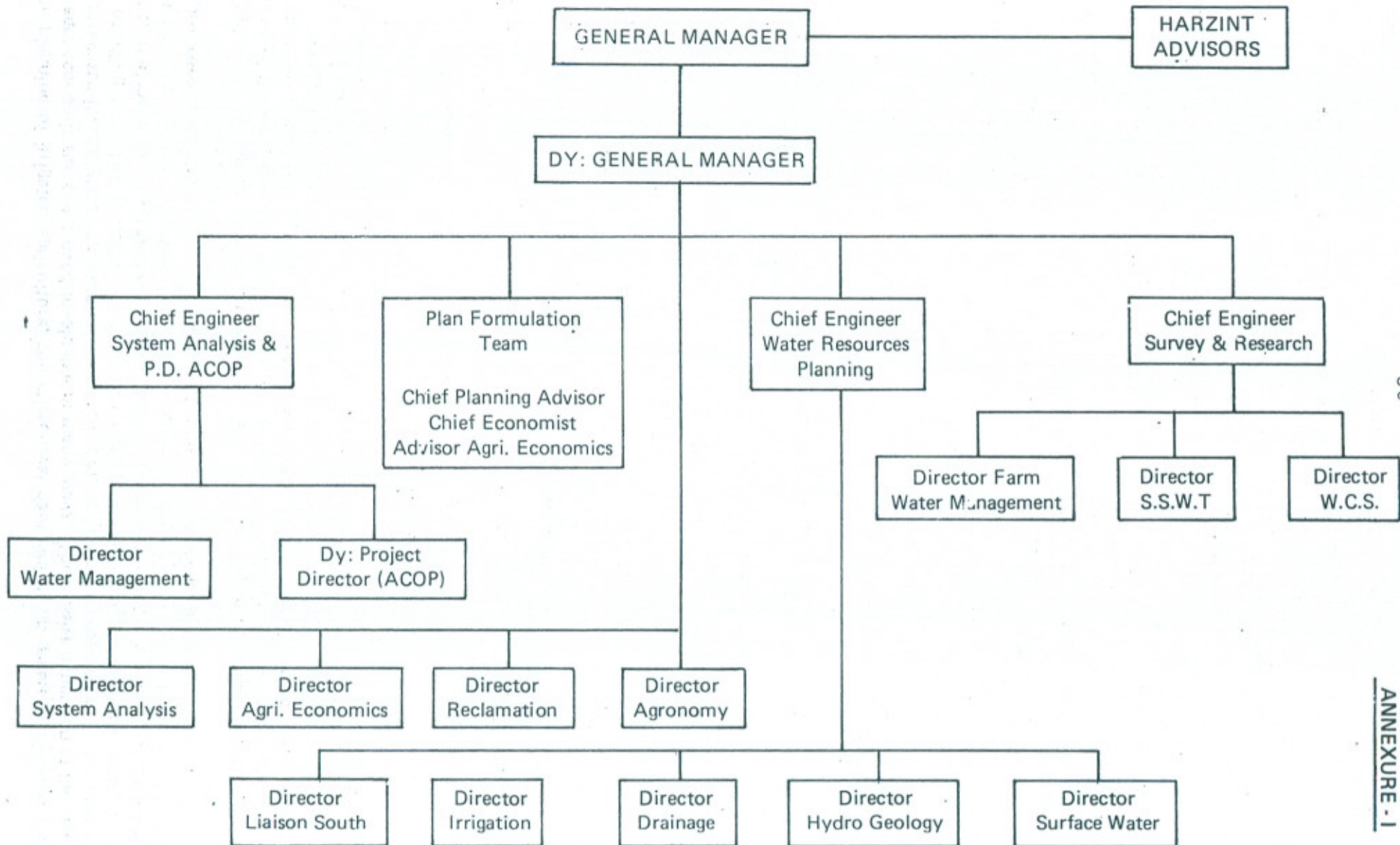
The association of expatriate professional staff in the capacity of advisors was helpful in the adoption of new methods and techniques, but in the plan formulation process their lack of appreciation of the local conditions, could not result in a more meaningful contribution. The advisory role of such staff also limited direct input by them.

For the planning of irrigated agriculture, the micro-level data which was generated through the water-use and agro-economic surveys proved invaluable in many ways. The massive dimension of the data base however prevented its complete processing the available time for all other possible uses. The system of field data handling consisted of coding the primary observations/information, with all subsequent processing left to the computer. By this system, the 'feel' for the data is lost to the field personnel and inconsistencies can arise. It was felt that it would have been more advantageous if some kinds of field data was manually processed, checked for rationality and then transferred to computer tapes.

For handling the complex problems using massive data pertaining to the interconnected water resources systems of Pakistan, the use of computer-based models proved very effective. While the simulation model was a great help in planning, the development of optimizing models would have provided a better means for deciding such issues as water allocations.

The past experience in Pakistan has indicated that although Master Plans for Water Resources Development have been formulated, they could not be followed for any length of time, and soon become out-dated. This is to be expected as conditions continue to change; the changed conditions provided the rationale for the formulation of RAP. What the RAP has been able to accomplish is the evaluation of the past performance and based on this feed-back to set a course for the future. The important requirement therefore seems to be that instead of formulating Master Plans from time to time, a plan once formulated should be kept in adjustment with the changing conditions through continuous feed-back. This can be accomplished through a continuing planning organization which regularly carries out monitoring and evaluation of policies, programmes and projects and prepares and presents formal policy and position papers for precipitating decisions by the decision makers on all important issues.

**ORGANIZATIONAL CHART  
OF  
MASTER PLANNING AND REVIEW DIVISION  
WAPDA**



## DEFINED PROJECT ACTIVITIES

1. Prepare a first interim report for presentation to the Executing Agency within 5 months of the start of the Project to include: "releases and distribution of surface water from reservoirs, at barrages and canals heads of links and canal commands, through December 1975; and proposed by the Federal and Provincial Governments after January 1976; evaluation of agricultural results of projects already implemented compared to projected benefits and costs in the ISS Action Programme, including SCARPs; effects of the above projects thus far on water distribution and agricultural production; constraints remaining to be resolved, and implications for the Revised Action Programme".
2. Organize project work programme, determine task assignments and status of related investigations; prepare plans for field investigations and surveys; assemble personnel equipment and facilities.
3. Assemble and compile data on general level of agricultural development in canal commands, surface and groundwater hydrology; irrigation and drainage infrastructure developments and use, including surface water storage use.
4. Review implementation of original and subsequently modified Action Programme as a basis for projections, and define implementation and planning constraints and capabilities.
5. Record and/or review sector development objectives, policies and priorities of Federal and Provincial Government, planned financial allocations and water distribution decisions.
6. Review status of existing proposals for agricultural and associated sector projects and their level of planning and preparation; identify types of and actual projects (including irrigated farming developments, drainage, reclamation, storage, flood control and other associated projects) which would be needed to meet development objectives and priorities.
7. Review surface water hydrology data and departmental survey procedures and programmes; determine surface water storage needs in relation to demand, alternatives, costs and reservoir project sequence.
8. Review, select and operate systems analysis programmes and models to determine irrigation, drainage and power parameters for various development alternatives and schedules, and to provide data for evaluation of projects.
9. Formulate preliminary, alternative agriculture sector development programmes in line with the Government's development objectives as a basis for formulation of alternative interim programmes for high-priority projects.
10. Prepare second interim report for presentation to the Executing Agency within 12 months of the start of the Project to include: a comprehensive review of (1) on-going projects, (2) preparation of high-priority projects, (3) implementation programme for these high priority projects to be started during the first three years of the Fifth 5-Year Plan, including: estimates of annual costs and benefits, the design criteria, the power requirements, and the surface and groundwater distribution requirements.
11. Conduct special studies of planning and design criteria for appropriate soil and groundwater chemical relationships, tubewell planning and design, and canal seepage reduction.

12. Conduct surveys and field investigations of soil salinity/alkalinity and shallow groundwater quality.
13. Conduct comprehensive surveys and field investigations of selected farmed areas or "chaks" served by irrigated water courses, considering socio-economic factors, land quality and leveling, water availability and use, crop varieties and yields, livestock farm production and management, and farming practices, Conduct special studies of farm level activities, farmer response to external conditions, farm input and commodity price policy decisions for use in the analysis referred to in (14) below.
14. Conduct socio-economic analysis using data from the watercourse-chak survey, and incorporating alternative farming approaches to estimate the effects of existing policies and expenditure on farm productivity.
15. Carry out preliminary feasibility-level evaluations of projects for inclusion in the Revised Action Programme, using updated data and projections. Define and update project concepts and estimate costs, performance, and benefits.
16. Compile present agricultural power loads, scheduled generation expansion, and projections of future power needs for agricultural water operations.
17. Determine requirements for flood management and control, and indentify projects, with priorities.
18. Third Interim Report: To be presented to the Executing Agency within 22 months of the start of the Project, comprising a comprehensive report on the progress of the Project to date and setting forth the proposed structure and content of the final report and the schedule for completion of the Project.
19. Formulate alternative project construction and investment schedule; derive expected ranges of increased agricultural production; determine expertise and staff capacity requirements for projects preparation and implementation; the need for stored water; the associated investment requirements and organizational changes required in this and in other related sectors, to achieve the planned benefits over the next fifteen years, and during the long-term Perspective Plan period; and evaluate the present and possible future constraints.
20. Prepare final report for presentation to the Executing Agency within three years of the start of the Project to include; the Revised Action Programme for the Government's Fifth, Sixth and Seventh 5-Year Plans and a Perspective Plan to the year 2000. The Revised Action Programme will include: existing and proposed project descriptions, investment and implementation schedules, production targets, labour, equipment and material requirements, economic costs and benefits, annual operating costs, inputs required from other sectors and their associated investment needs, rural employment and demographic effects, electric power requirement, surface and groundwater distribution requirements.