

EFFICIENCY AND ECONOMY

IN

**THE IRRIGATION AND
POWER SECTOR**

**REPORT OF THE
STUDY GROUP
SET UP BY
THE MINISTRY OF IRRIGATION & POWER**

NEW DELHI

1956

Sir,

1. At a meeting held on 18.5.56 under your chairmanship, you had constituted a Study Group to make a study of the problems relating to efficiency and economy in the field of irrigation and power. We were instructed to consolidate and crystallise the thinking available for securing these aims and make recommendations. Our aim was to submit an "action document". The results of this attempt are in the enclosed report.

2. Soon after we started our discussions, we felt that a study in regard to efficiency and economy should be made through those who are directly involved in particular problems in order to bring in their thinking and also initiate a process of mutual education between the Study Group and those dealing with the problems. After framing an outline scheme of the report, we requested these officers to join the drafting committees for individual chapters. The composition of these Committees is given at Encl.

3. In fact, after our preliminary six meetings we realised that the Study Group cannot avoid dealing with the problems relating to "Organisation, Personnel and Attitudes". We, therefore, requested Sarvshri Kanwar Sain, Bahl, Ripudaman Singh, Kshetrapal, Hayath, Bhargava, Dhir

and Yadava Mohan to contribute to the study of the problems of Organisation, Personnel and Attitudes. This report is thus not the work of the members of the Study Group alone, but is in fact the result of coordination of the thinking of the officers in the Ministry, the C.W. & P.C. and the Planning Commission. Its informality was no hindrance to its work. In fact, the informal approach permitted us to stimulate thinking amongst ourselves as well as amongst officers concerned with individual problems. A Study-Group by definition, recognises only one status, i.e. the person who has given thought to the problems. The report has also brought in a good deal of coordination of thought and crystallisation secured through individual discussions with concerned officers.

4. Despite the valuable information obtained at the Irrigation & Power Seminars, we still felt the need for obtaining further thinking, analysis or views in regard to a number of issues from the projects to enable us either to see the problem little more clearly or in attempting a recommendation. We have thus had the benefit of the views and experience on various matters and problems from the Chiefs of the projects.

5. The same urge took three members of the Study

Group to Nangal in order to understand the place of work studies, cost accounting and cost control in river valley projects. A list of the notes and comments contributed for assisting the Study-Group is enclosed along with a set of notes.

6. A Study-Group's primary function is to be self-critical. By definition, our emphasis is, therefore, on "exposing" - what remains to be done, and we have hardly referred to the tremendous achievements in the Irrigation & Power Sector which are rightly the source of pride to the Nation.

7. We are most grateful for the opportunity to make the study which has been indeed a most stimulating experience. We hope it has led to a good deal of coordination of minds, thought and attitudes in the Ministry, CWPC, the Planning Commission and the Projects. We hope such Studies will be made periodically.

8. We recommend that this report should be discussed in the Irrigation and Power Seminar to be held in January 1957, at Hirakud. There should be a systematic follow-up of this report.

9. Shri Kolet feels that so far as the suggestions in the report for strengthening the arrangements are

concerned, each case will have to be specifically looked into. We agree with this view.

10. We shall like to record our appreciation of the assistance that was given to us by Shri Dhawan and later by Shri Venkatesan.

sd/-

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13.12.56.

L.P. Bhargava.
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S.S. Kumar.
14.12.56.

S.Venkataraman
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LIST OF THE OFFICERS WHO JOINED THE DRAFTING
COMMITTEES FOR INDIVIDUAL CHAPTERS.

Chapter I.

Shri George Oommen.	C.W. & P.C.
Shri S. Ranier.	Finance.

Chapter II.

Shri K.L. Vij.	C. W. & P.C.
Shri P.L. Chopra.	-do-

Chapter III.

Shri B.S. Kohli.	-do-
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Chapter IV.

Chapter V.

Shri V. Venugopalan.	C. W. & P.C.
Shri K. Ramesh Rao.	-do-

Chapter VI.

E F F I C I E N C Y A N D E C O N O M Y

I N

T H E I R R I G A T I O N A N D

P O W E R S E C T O R

R E P O R T O F T H E

~~S T U D Y~~ G R O U P

S E T U P B Y

T H E M I N I S T R Y O F I R R I G A T I O N & P O W E R

N E W D E L H I

1 9 5 6

C O N T E N T S.

<u>Chapter No.</u>	<u>Name of the Chapter</u>
I	Approach
II	Investigation, Designs & Estimation upto Pre-Construction Stage.
III	Construction Stage.
IV	Development of Irrigation and Power benefits.
V	Coordination of Knowledge and Experience, and improving the instruments of Control and Planning.
VI	Organisation, Personnel and Attitudes.

CHAPTER I.

A P P R O A C H .

1. ~~The irrigation and power sector of the Plan is, by and large, a monopolistic field.~~ The problem[@] of securing and assessing efficiency and economy, therefore, becomes more difficult and more important.

2. We believe that the concept of efficiency-(economy is a major function of efficiency) - may, for practical purposes be enunciated in the following manner:

Efficiency is compounded of two factors; (a) its success in giving government and the people the services and goods they want and (b) its success in providing such services and goods at the minimum cost.

In the application of this concept, the following questions arise:-

- 1) Is the Organisation making the best use of its capital resources and revenue returns (e.g. in the case of autonomous organisations) as well as conserving and making the best use of foreign exchange resources?

@ This problem has been subjected to analysis by contributors to the seminars organised by the Institute of Management in U.K., as well as by the Nationalised Industries in U.K. The Herbert Committee which reported on the organisation and efficiency of the nationalised Power Industry in U.K. seems to have used this analysis and have defined this concept more comprehensively. The concept enunciated in this Chapter has been adapted from this report.

- 2) Is the organisation making the best use of real resources?
- 3) Is the organisation providing services/goods to the Government or Public or to the consumers efficiently and at the lowest cost?
- 4) Is the organisation well adapted for securing the best use of capital manpower and physical resources and for ensuring efficiency and economic services to the Government/Public etc?
- 5) Is the organisation well adapted and the staff sufficiently capable to secure the same needs in the future?

Questions numbers 1 to 3 are concerned with ends and numbers 4 and 5 with means. The distinction between 4 & 5 is of significance - because the major factor in securing efficiency in large-scale-organisation in the 'Management of Time' (i.e. planning) and special ability required for anticipating and preparing concretely for the future. It follows that if the organisation is not given sufficient time, the expectations from the organisations will have to be modified.

3. It is not our intention to report in terms of all these criteria. We cannot do so. We shall, in the main, deal with the problem in terms of questions 1,2,4 & 5.

4. We feel that the problems & methods of securing efficiency and economy differ from stage to stage and may be considered separately for the pre-construction, construction and post construction (i.e. development of benefits and maintenance) stages.

The best use of capital resources.

5. It is our considered view that in irrigation and power field, maximum economies are dependent on long-term planning, building up of accurate realistic schedules of rates, standards, norms, etc. to service the planning authorities for the preparation of the estimates and for evaluating and promoting efficiency. The arrangements in regard to this stage are distinctly inadequate. Chapters 2 and 6 deal with this matter.

6. Decision in regard to construction plant lay out and purchase of machinery will also determine the best use of capital resources. This matter has been dealt with in Chapter 3.

7. A good part of the programme in the Irrigation and Power sector of the Plan will be executed through the contractors. The main scope for ensuring efficiency in the case of such schemes will depend primarily on the efficiency with which the investigations are performed and estimates prepared. This matter has been dealt in Chapters 2 & 3. We feel that it will be an advantage if experience in regard to drafting of tenders and agreements with the contractors is studied by the CWPC or in the alternative by the irrigation departments in the States, whose experiences can be coordinated by the

CWRC.^Q Other subjects for study may be:-

- a) the relative economics in the use of small v/s large contractors; and
- b) profits made by the contractors.

Construction Stage.

8.1 The present position is that:

- a) the existing arrangements generally disclose weaknesses long after the event;
- b) even where weaknesses may be suspected, it is not always possible to diagnose the cause or remedy the weakness;

Secondly, it is during this stage that the criterion number two (vide para 2) i.e. minimum use of vital resources has to be applied.

8.2 Efficiency and economy in this phase is dependent on:

- i. Getting-up of a planning organisation under an adequate Chief Engineer two to three years in advance of the start of the execution of work in full swing after the project has been sanctioned, (both in regard to construction to be executed departmentally or through contractors);
- ii(a) After the contracts have been placed, the main tasks before administration are vigilance in regard to the work of the contractors, as well as, cooperation with him.
- (b) In the case of departmental construction, the main tasks concern organisation, personnel, annual and seasonal scheduling of work, efficiency of workshop, maintenance and utilisation of machinery, organised attention to productivity and relations with labour, skilled workers and staff (conditions and incentives) and evaluation.

Foot Note .

@ In France, it is understood, a Committee for Research on Contracts was set up in 1948 and has done good work.

(c) Two factors which underline the entire arrangements are team spirit and right human relations (Chart in para 2 of Chapter III may be seen).

9. These matters have been dealt with in Chapter 3.

This Chapter deals with action taken on Machinery and Construction Committee Report and some of the recommendations made by the Rates & Costs Committee.

10. The search for efficiency and economy is a continuous process. It is not a negative or a post-mortem process.

The main instrument for improving efficiency is analysis of experience with a view to improving efficiency in regard to investigations, planning, designing, construction, maintenance and control. We have examined the techniques employed in evaluating and securing continuous increase of efficiency in the large-scale industrial enterprises in the U.S.A. in particular and have suggested that the Control Boards should consider developing the techniques of scheduling; work studies; cost control etc. and standards as instruments of control. Such a Control does not interfere in the day-to-day management, yet enables the management to secure increased efficiency and economy and also leads to improvement in the instruments for control, as well as, for planning. This subject has been dealt with in Chapter 5.

11.1 We have attempted to take a long-term view of the

responsibilities of the Government, as a whole, in regard to irrigation and power sector and have come to the conclusion that there has to be a programme for preparing fully investigated schemes costing Rs. 2,000 crores and preliminary investigations in regard to schemes for Rs. 3,000 crores during the first 4 years of the Second Five Year Plan. This is a tremendous task for which the country is definitely not prepared. This matter will demand most immediate and continuous follow-up at the highest levels. The conclusions (vide Encl.____) arrived in the inter-ministerial meeting held on 15-11-56 in Secretary (I&P)'s room are on the lines recommended by the Study Group in Chapter II paras 4 & 5, Chapter IV para one and Chapter VI paras one & two.

11.2 This matter as well as, the question of organisation (Control Boards versus corporation; relationship between the Ministry, CWFC, Planning Commission; relationship with Committee on Plan Projects; Organisation of the CWFC; Forward Manpower Planning; Provision of the experienced/quality engineering personnel) have been dealt with or referred to in Chapter VI. It is for consideration if it will not be advantageous to make available to the CWFC the talent of retired reputed construction and design engineers for either working on individual problems or for making basic scrutiny of project reports. They would be able to

give adequate time to the job.

12. Basically, the problem of efficiency and economy is a problem of attitudes in individuals who constitute the organisation. It will be pertinent for us to quote the experience of an organisation (General Motors) which has stood the test of competition for three decades and still holds the foremost position in the world for the production of automobiles. Mr. Harlow H Curtis, President of General Motors, summed up (1956) (a) the structure of the organisation and (b) the attitude of mind, as the two factors responsible for the success. In the words of Mr. Curtis:

"It (the attitude of mind) might be defined as bringing the research point of view to bear on all phases of the business. This involves i) assembling of the facts; ii) analysis where the fact appears to point and iii) courage to follow the trail indicated even if it leads to unfamiliar and unexplored territories. This point of view is never satisfied with things as they are, but assumes that everything and anything - whether it be products, process, method, procedure or social or human relations can be improved."

13. We commend this attitude to all the individuals in the irrigation and power field. We have dealt with the problem of attitudes and capacities in Chapter VI and

integrity in Chapter III. We feel that integration and cooperation between talents; an attitude of persistent search after efficiency and savings in costs; the development of personnel and their integrity are fundamental factors for securing efficiency and economy.

CHAPTER - II

SUBJECT:- INVESTIGATION DESIGNS AND ESTIMATIONS UPTO PRE-CONSTRUCTION STAGE.

I. Decisive importance of this stage.

1. Decisions which may result in maximum economy have to be taken in the pre-construction stage and depend upon the adequacy of investigations, suitable designs and estimates based on upto-date analysis of the rates/costs thrown up in actual practice. In the case of schemes to be executed through the contractors, the administration has no other occasion to secure economies. The capacity of the administration in this respect will determine the extent to which it can deal with contractors with confidence and for securing economy.

2. At this stage a nebulous idea of a project takes concrete shape. The ultimate picture depends on thoroughness of the investigations. Various alternatives of sites, types and size of a project including financial implications are studied in order to achieve the optimum utilization commensurate with cost. The present arrangements for this stage appear far from adequate. Out of 200 new irrigation schemes included in the Second Plan, project reports for only 80 had been received by

August, 1956, and out of these, 56 had been examined, and only 22 projects were found to be more or less satisfactorily investigated. On the Power side, out of 20 hydroelectric schemes included in the Second Plan, project reports for all have been received, out of which 16 have been found to be satisfactorily investigated.

3. Three conditions were laid down by the Planning Commission for inclusion of projects in the Plan viz. (i) the Project proposal should be properly investigated, (ii) accurately estimated and (iii) financial return should be based on adequate and reliable data. The examination of projects included in the Second Plan, shows that 40% of the total allocation of irrigation projects in the Second Plan is for projects which are not likely to give the prescribed return. Perhaps some of these projects, which do not give any adequate return, may be justified on the ground of regional development. The investigations should, however, ensure that the project selected is the most economical in that region.

4. In order that a project fits in an overall planning, a comprehensive basinwise survey of

natural resources of the country is most urgent. For a large country like India, it is recognised that it will take appreciable time to do this. But a beginning has to be made. It is, therefore, of utmost importance that the two processes, i.e.

- (i) overall planning of the river system
 - and (ii) survey to locate areas which need and can take irrigation economically
- should be attended to.

These two inter-related aims could be secured by the following arrangements:-

(a) by undertaking investigations and planning of development of river systems and investigations (including minor irrigation works) through the Irrigation & Power Ministry/C.W. & P.C./ State Irrigation Departments. Necessary high level arrangement should be added in the C.W. & P.C.

(b) Survey in regard to (ii) (including scope for dry farming) to be done with the cooperation of Agriculture Ministry/Agriculture/Revenue Departments of the State Governments.

(c) Development Boards in the States (as suggested in Chapter IV) for coordinating (i) & (ii), the corresponding coordination at the Centre to be

secured through Planning Commission.

5. In examining the question of the device to be adopted, the following considerations have to be kept in view:-

(a) Basically the job has to be done in the States, except in regard to inter-state rivers in which the main issues for coordination are; (i) share of each State, (ii) access to sites for dams, weirs, etc. (iii) soil-conservation measures.

(b) The pace at which investigations have to be done, will demand immediate establishment of the organisation for investigation and the State Boards for development of irrigation in the States.

6.1 In respect of estimating power potential, a preliminary hydro-electric survey of the entire country was undertaken by the Central Water and Power Commission in 1953. Four volumes on the hydro-electric survey covering most of the important regions of the country containing about 60% of the entire potential of the country and outlining concrete proposals for development of different river basins for power generation, have already been

published. The work on the other river basins is also fairly well advanced and will be completed ~~by June 1958.~~ Subsequent investigations carried out by various State Governments have confirmed the ~~soundness of the studies~~ conducted by the Central Water and Power Commission and recorded in the aforesaid reports. These projects have however to be confirmed and supported by reconnaissance field work.

6.2 We may refer here to the need for utilising the ~~specialised directorates of the Central Water and Power Commission (Power Wing)~~ by the State Governments in regard to system designs, hydro and thermal plant installations and transmission and ~~inter-connection~~ studies. At present, the services of the Commission are being utilised in respect of scrutiny of various power projects, under the Second Five Year Plan. The scope of this consultation may be extended to cover the following items as well:

(1) Scrutiny of power station specifications of capacities of 10,000 kW and above, and specifications for transmission lines and substations of 56 kV and above.

(ii) Consultation before awarding contracts for materials and equipments included in item (1) above.

(iii) Consultation in respect of major alterations, in the designs covering item (i) above.

7. In regard to the survey of the irrigation potential, however, the problem is more difficult. Similar estimation of irrigation potential was started about the same time. 1" to 1 mile 50' contour sheets are not available for the entire country. Nor have discharge observations been made at important key sites. Two circles for Ganga and Godavari-Krishna basins were started by Central Water and Power Commission in 1954 to collect the hydrological data of these river basins. In fact, the Central Water and Power Commission had asked for six Circles. Further steps have to be taken in cooperation with the Survey of India and the States to organise a speedy resource development survey involved in the assessment of irrigation potential of the country. The survey of India must complete the 50' contour maps for the portion not covered so far by such surveys. On the basis of the available topo sheets about 2/5th of the country has been covered. Where 1" to 1 mile sheets are not available smaller scale maps with scattered spot heights are being used. This work is expected to be completed by 1958 for the whole country. It is also necessary that this office work is followed by field

reconnaissance which should be organised in collaboration with State engineers and agricultural experts.

8. According to present tentative information, 76% of the schemes for power in the third Plan will belong to the category of hydro-power. The Power Wing has given a tentative list of probable schemes (at appendix I) and irrigation may also be possible, from tail race of some of these projects. The Water Wing is studying this data in order to frame a coordinated programme for investigations. On the irrigation side a broad idea of the schemes for the third Plan is also available to some extent, from the material received along with the draft of the Second Five Year Plan of the States.

9. Scope and extent of investigations:

Apart from ascertaining potential of the country, it is of immediate importance to complete investigations for schemes to be undertaken for the third plan and balance of schemes included in the Second Plan.

There is generally a lack of uniformity and inadequacy of investigations before project reports are prepared. The Irrigation and Power Seminar has

approved of the lines on which the manuals for investigations, preparation of estimates and project reports should be prepared. These are under preparation in the Central Water and Power Commission and are expected to be ready shortly. These should be completed on a high priority basis.

10. These manuals will serve three aims:-

(a) preparation of project reports with a view to achieve optimum utilization of water resources commensurate with cost,

(b) preparation of realistic estimates which are correct within a margin of $\pm 10\%$ and

(c) permit evaluation of experience and working in terms of rates and costs at the construction stage and for the preparation of upto-date rates and costs schedules for further planning. To secure this aim, as recommended by the Rates and Costs Committee, a uniform list of ingredients should be adopted in estimates.

11. We recommend for immediate implementation:-

(a) The manuals in draft form may be issued to the State Governments for compliance specially in view of the fact that Irrigation and Power Seminar has already approved the general lines

on which these have to be drafted.

(b) Each State Government should send their schedule for investigation of schemes for the Second Plan etc. to the Central Water & Power Commission. The investigations for the Schemes in the Second Plan, must be completed by 1958.

(c) The States should make adequate arrangements for investigations according to these schedules, and if necessary, request the Centre for help, so that the Central Water and Power Commission can be strengthened suitably.

(d) Necessary vigorous follow-up may be organised at the level of the Joint Secretary/concerned Member in the C.W. & P.C. and reports submitted to Secretary/Chairman, Central Water & Power Commission.

12. Preparation of Designs, detailed drawings and specifications.

12.1 Detailed studies, careful planning and preparation of designs are essential pre-requisites to satisfactory construction and this can be done only after the field data is obtained. Past experience shows that sufficient attention is not paid to the planning and designing stage of a project. Owing to the frantic hurry for obtaining sanction

and owing to the lack of a planning and designing organisation, very often rough sketches, sketchy designs and approximate and lump sum estimates are prepared to obtain sanction. The inadequacy of provisions and incongruity of proposals are not infrequently revealed during construction, resulting often in having to change the entire planning of the project. This results in public criticism, considerable delay in obtaining fresh sanctions and often unnecessary expenditure. These ends can be secured by organising planning and designing organisations in States which do not have them and strengthening wherever necessary the organisations in the States who have them. It is essential that right type of men and enough incentive should be provided.

In the western countries large organisations like the U.S.B.R., Army Corps of Engineers, Electricity Do Franca, devote considerable time on planning, detailed studies and preparation of designs of projects before undertaking them. They have been able to achieve results which are outstanding examples in the field of power, Irrigation, Flood Control and Navigation. Unless we form Designs Organisations in the States and Centre, we will not be in a position to plan, design and execute projects economically and efficiently on a large scale as visualised in our future plans.

12.2 In case of Thermal Power, major economies can be secured in designing and siting of Plant. We are impressed by the measures i.e. procedure and schedule adopted by the Central Authority for Electricity, U.K., for securing the best use of capital. According to the schedule, a power station to be commissioned in 1960, would be discussed in autumn of 1952, for the first time for inclusion in the programme followed by further scrutiny for three successive years. It may be possible to reduce this period, but it is necessary that long term realistic schedules should be worked out to secure the best use of capital.

12.3 Though the States have experience in the design of canals and structures, the development in the design of dams have not been caught up in all the States. Design of Dams requires specialised knowledge and engineers with the design experience have to be employed. Some specialists have to be maintained as it is very likely that projects in the States are not taken up continuously for a long period and it becomes difficult for a State to maintain full-fledged designs office with all the requisite experts. Therefore it becomes essential to build up a Central

~~Organisation like~~ the Central Water and Power Commission to get the best available personnel in the country for building up a designs organisation capable of dealing with all the design problems in the country. It is felt that the C.W. & P.C. should be enabled to obtain the services of personnel who acquire experience in specialised design work in the country (e.g. Bhakra). Otherwise this experience will be lost to the country. It is also essential that every State should prepare designs in the first instance based upon the data they have collected for the project. These designs should then be discussed with the Central Organisation for securing the benefit of their coordinated knowledge and experience while the project is still at the stage of planning and designs, when various alternatives have to be worked out and the most economical one selected.

12.4 The stage of designs is a stage at which considerable amount of saving can be effected in the projects. A book of specifications and designs should, therefore, be brought out. Deviations from this should preferably be made in consultation with central organisations.

12.5 Preparation of designs well before embarking

on the construction will result in speedy and methodical construction. Accurate estimates can also be prepared and the designs neatly made. In view of these advantages in the preparation of designs before undertaking construction, it is emphasised that in future all the major projects in the country costing more than 5 crores should finalise the broad designs (specification) before any work is started.

12.6 Along with the designs, specifications of the works must be prepared. This will specially help in ensuring proper inspection of quality control and seeing that all the work is done as per the original sanctions in the designs. Preparation of specifications and designs may be made by the State Engineers with or without the help of the C.W. & P.C., or by the CW&PC. They should, however, be scrutinised by the CW&PC, if prepared by the States in the first instance.

12.7 Next comes the stage for preparation of detailed drawings. These have to be done as construction proceeds but slightly ahead of it. This may be done by the State Engineers themselves.

12.8 Some of the State Engineers do not freely consult the Central Water and Power Commission as

they have to obtain the sanction of their finance for meeting debits of Central Water and Power Commission on this account. It is suggested that such technical advice should be given by Central Water and Power Commission as a part of the contribution of Ministry of Irrigation and Power.

12.9 In regard to canal system, economies can be obtained if the methods of designs and typical drawings of structures such as regulators and falls etc. are standardised and Manuals brought out for everyday use. This work may be done by the CW&PC in consultation with the State Chief Engineers. Similarly in the designs of dams and power systems, typical structures on designs have to be got printed in book forms to provide useful and quick reference for the Design Engineers in the various States.

13. The Central Water and Power Commission has been working on various manuals but as a result of pressure of day-to-day work, the manuals have not received enough priority. It is of utmost importance that the preparation of manuals suggested in this report is expedited. ^A programme of work should be immediately finalised for this purpose.

PLANNING FOR OPTIMUM UTILISATION.

14. The present arrangements are not satisfactory. The Revenue and Agricultural authorities in many cases are not brought into the picture early enough to supply reliable data for the project reports in regard to matters like water requirements of different crops suitable crop pattern, timely development of land for utilisation of waters, intensive work to prepare the people; credit facilities, etc. We have already suffered the arrangement in chapter IV for taking care of this problem.

15. Estimates:

Detailed, sound estimate is the major instrument for judging efficiency and securing economies. The past performance in this respect emphasises the necessity for carrying out the suggestions given below:

(a) The state Design Cell should collect the latest rate data of projects completed recently or under execution, so that complete break up of important rates involved in the estimates is readily available for application to the estimates of future projects.

(b) The Rates Section in the C.W. P.C. should be strengthened to carry further the work done by

the Rates & Costs Committee. These units should be equipped to function with adequate speed.

(c) Data in regard to experience of making lump sum allocations and those items of estimate wherein generally, excesses have occurred in the past, should be regularly analysed for making realistic estimates.

Such a detailed analysis of rates will always form a good guide for the construction engineers who may be different from the investigating staff.

(c) Provision in regard to some items such as maintenance, miscellaneous, preliminaries, establishment, T & P etc. have generally exceeded the estimated provision. The estimates for these items should be supported by experience of similar projects rather than on the individual judgment of officers preparing the estimates. This matter has been dealt with in detail in the Report of the Rates & Costs Committee.

(d) It is essential that basis for the estimates is given in each case, to the maximum extent possible.

ATTITUDE OF RESEARCH IN REGARD TO EFFICIENCY/ ECONOMY IN EACH INDIVIDUAL TEAM SPIRIT/HUMAN RELATIONS.

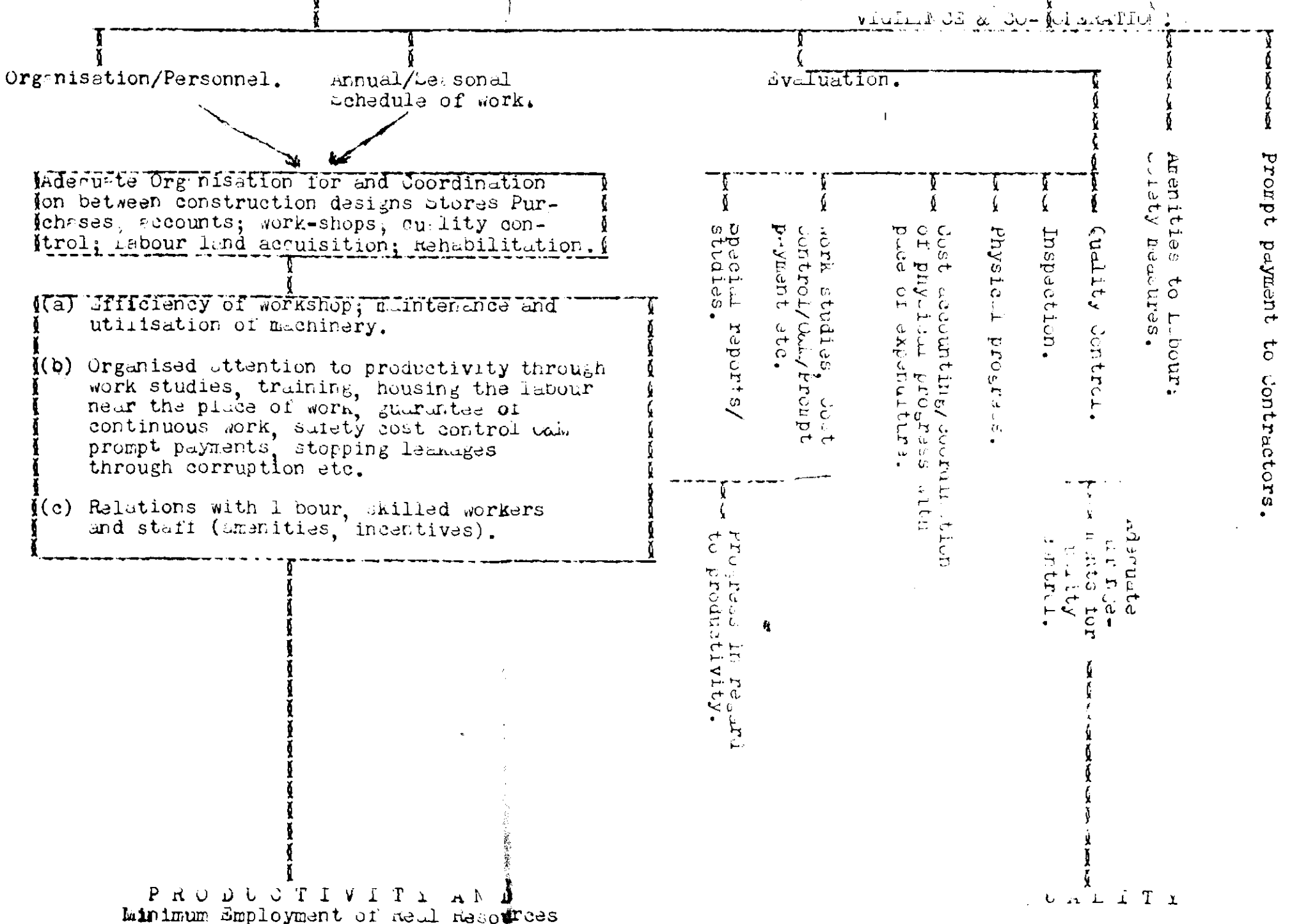
Control Board.
↓
Adequate Chief Engineer _____ Planning. | functions:
Organisation. |

To be set up 2-3 years in advance before the start of execution of work in full swing; for Planning of works with regard to design and execution of works after sanction of a project estimate. (and in case of power for generating plant step-up-stations, transmission sub-transmission lines, associated sub-stations etc.)

- A. Detailed designs, detailed drawings, detailed specifications (and in case of power for generating plant step-up-stations, transmission sub-transmission lines, associated sub-stations etc.)
Standardisation of designs of repetitive nature (not done already (e.g.) by C&P.C.)
Surveys for selecting easy sources of collection of stone; aggregates, sand & suitable borrow materials etc;
Survey in regard to availability of labour; (both skilled and unskilled)
Detailed estimates of costly works (dams, main canals, and branches, and big cross-drainage works, Estimate for Stores (not covered by B);
Schedule for awarding contracts or purchases;
- B. Construction Plant layout; preparation of specifications and _____ (May or may not) purchase of essential mechanical equipment;
(ii) Procurement of stores for early construction. _____ (lesser degree) Determine the dead line delivery dates for material equipment.
- C. Access and work facilities. _____ (lesser degree)
- D. Building up of key and other personnel for each stage of construction.
- E. Anticipation and removal of bottlenecks outside the control of the Chief engineer e.g. financial decisions, personnel, land acquisition; scarce materials, equipment and spares etc. to be imported. _____ (lesser degree)
- F. Arrange technical consultations. _____ (lesser degree)
- G. Overall schedule of construction. Analysis & review of the construction programmes prepared by Contractors to secure feasibility & adequacy of procedures.

Departmental Construction

Construction through contractors.



CHAPTER - III
C O N S T R U C T I O N

1. Productivity, employment of minimum real resources and quality are the three main aims to be secured at the construction stage.
2. The chart on the opposite page is an attempt to indicate the relationship between planning/organisation/personnel and methods with productivity, employment of minimum real resources and quality for construction programme both in the case of departmental construction as well as construction through contractors.
3. In regard to major projects, whether executed departmentally or through contractors, Control Boards have been set up to secure high level-decisions and control. Our views in regard to the suitability of the form of organisation in this respect, (Corporation or Control Board) are given in Chapter VI.
4. After a project estimate has been sanctioned, it is imperative that a planning organisation should be set up two to three years in advance of the start of execution of works in full swing. The chart above indicates the major functions to be performed at this stage. It will be noticed that this is necessary both in the case of departmental construction as well as for construction

through the contractors. The difference in responsibility is a matter of degree. A major cause of the difficulties and infructuous expenditure in the case of River Valley Projects could have been averted, if time had been available for allowing this build up. The schedules to be prescribed for inclusion of such projects in the Plan should take this factor into account. To ensure this build up in regard to projects in the Second Five Year Plan, is going to be a difficult proposition.

5. The Chief Engineers.

It is obvious that the selection of an adequate Chief Engineer is a major factor in the efficient execution of a River Valley Project. It is also necessary that he stays on the construction job till it is completed. Efficient execution of a big project demands an intimacy with the behaviour of the river as well as a sense of perspective, intimate command of key details and an understanding of the men on the job, which can only be secured, if the Chief Engineer stays on the job.

6. Construction through Contractors.

6.1 As indicated in the above chart, the award of a contract should be preceded by a good deal of planning - vide functions in group A in the above chart

~~by the initial planning organisation, which should be set up two to three years in advance before the start of execution of works in full swing.~~

6.2 In this connection, the functions performed by the Bureau of Reclamation U.S.A. would be of interest. A note analysing those function is at enclosure.

6.3 In obtaining tenders, the plans and specifications should be definite and should give the exact requirements of the item of work. The drawings should have all possible details to give a clear picture of the construction to be built. There should be no vague or indefinite terms in the specifications. The award of a contract should be scheduled to enable the contractor to make preliminary arrangement of labour, materials so that he can start the work from the commencement of the working season. The time limit for the completion of works should not be too narrow. The specifications should require the contractors to provide reasonable amenities for the labour, particularly in regard to living accommodation, pure drinking water, enough water for bathing and washing, sewage disposal, lighting arrangements in their colonies and around and medical aid.

In this connection, the following alternative

schedules are suggested for the consideration of the

Irrigation & Power Seminar:

	<u>Alternative -I</u>	<u>Alternative -II</u>
1. Works put to tender	beginning of April.	June
2. Receipt of tenders	- end of May	July
3. Decision on tenders	- July	August
4. Start of season	- beginning of October	

6.4 After the work has been awarded the main role of the administration would be cooperation and vigilance i.e. (a) inspection in regard to progress of work and for quality control; (b) prompt payments to contractors; (c) ensuring adequate provisions of amenities to labour and (d) combating corruption.

7. Departmental Construction.

In the case of departmental construction, the initial organisation has to attend to functions from (A) to (G) indicated in the chart by the Planning Organisation. Further steps for securing increased productivity and ensuring quality are indicated in the above chart.

Comments on individual aspects are given below:

8. Construction Plan layout.

8.1 Before the construction of a project is started it is essential to have a master plan showing

the plant layout of the project. Though this layout may be in-complete in its details it must bring out all the features of the project, including supply and transport of materials handling and placing of construction materials and with a real picture of the completed project on time schedule. This plan layout has necessarily to be prepared by competent men, men who have had considerable experience in the construction of similar projects. The Chief Engineer of the project must have a predominant voice in the choice of the plant as he is ultimately responsible for the successful execution of the project. In the preparation of this general plant layout, it is considered desirable that the Chief Engineer associates himself with two other engineers who have got real experience of the type of equipments that is to be used for construction. It is suggested that C.W.P.C. should keep records of all those officers who have got special experience in heavy construction and the lines in which they can give useful advice. The Engineers (not more than 3) should be selected out of this panel.

8.2 Preparation of detailed specifications and detailed working drawings for the plant layout are best done by a plant designs section of the project designs organisation. This section should be placed under the charge of a good

~~structural engineer conversant with the equipment for which designs have to be prepared.~~

Since close coordination and frequent field inspections are necessary, this organisation should have a field unit also attached to it. Specialised equipment specifications can be drawn up with the assistance of firms who deal with such equipment. It would sometimes be found useful and economical to engage specialists from firms on pay rolls for working out detailed designs and specifications, as such firms would have more specialised knowledge on the particular subject than the designs organisation.

8.3 The C.W. & P.C. should bring out a manual on construction plant layout. They should make available standard methods of use of construction plant. The data prepared should include details of such items as Belt Conveyors, Rail Road Tracks Locos and Cars, Cableways Trestles. Cranes, Batching Plant, Earthmoving machines, Drilling and Grouting machines, quarry equipment, etc.

8.4 The construction plant layout must be made with the idea of best utilization of the available machines from other projects. The list of available machines from other projects must be made up-to-date by the C.W. & P.C. by strengthening the P&M Directorate, if found necessary. The machines should be transferred only in working condition and, there-

fore, steps should be taken to overhaul the machines and keep them in working order.

9. Stores.

9.1 The stores constitute a major expenditure in river valley projects. In one major project, for instance, the cost of stores is 70% of the cost of the project. We feel, therefore, that in case of major river valley projects, the stores management should be centralised in a separate organisation in the project itself. As transport forms important part in the supply of stores, to the works, it should also be part of the same organisation. The problem of management of stores can be considered under the following sub-heads:

- (1) Proper appraisal of the requirements of the works and the timing of the procurement depending on the programme of execution of the work.
- (2) Procurement of stores & prompt payments.
- (3) Arrangements for their receipt, proper checking physically to tally the quantities against purchase orders and against the invoices submitted by the suppliers and also to inspect the stores for quality against specifications.
- (4) Proper storage of the stores and equipment.
- (5) Arrangements for security of the stores.
- (6) Arrangements for issues against indent from the executive officers.
- (7) Transport.

9.2 We have already recommended that the requirements in regard to major equipment should be made by Construction Plant Design Section (or in some cases by the Central Planning and Design Section) or by the Construction Plant Design Section in coordination with Central Planning and Design Section who would prepare detailed quantity estimates of various works involved. In regard to stores like iron, steel and cement which are controlled by the Government of India or which are scarce, the purchase organisation should plan ahead in consultation with various works engineers in order to secure such stores in time. A factor which has repeatedly delayed or upset schedules or work was non-availability of spare parts. We have not yet solved the problem of correct appraisal of the requirements of spare parts. Both overstocking and understocking of spares results in waste. It is suggested that estimates in regard to the requirements of spares for each category of equipment should be made on a proper analysis of the record of spare parts consumed by the machines in use on the project. This can be done by analysing the log books and service records of machines working in the projects, which may enable more accurate assessment of the requirements of different types of spare parts needed during various periods of the life of the machine. The Section operating and maintaining the plant and who are

~~responsible for making appraisal of the requirements of the spare parts should attend to this. This analysis may be pooled together by the C.W.P.C. for indicating standards to be observed in making purchase in regard to spares.~~

9.3 In order to speed up arrangements for making purchases required for the I & P sector for the whole country, the ~~Central Purchase Organisation may be set up with an experienced representative or representatives of the D.G.S & D. on this organisation.~~ This arrangement will speed up purchases and also make available to it the benefit of the experience and organisation of the D.G.S & D.

10. Procurement.

~~10.1~~ Scarce materials.

We have made a ~~preliminary examination of the arrangements for coordination in regard to the supply of scarce materials (cement and iron & steel).~~ We feel that the ~~handling of this problem~~ has to take into account.

a) the policy of distribution adopted by the ~~Ministry of Heavy Industries as well as a broad anticipation of availability;~~

b) the process and arrangement forecasting the demand for each project;

c) the role compilation and/or scrutiny & priorities to be played by the Ministry of I&P/CWPC.

It is also for consideration if this coordination

~~should concern all the I&P projects in the PLAN or some of them.~~

We have not completed our analysis of this problem & shall make a report in the next two weeks.

10.2 In regard to purchase of petrol, oil and lubricants, the system of purchases through the central purchase organisation of the Government of India has worked well. In the Hirakud Dam project, the project has entered into a contract on a long-term basis with one or two oil companies who have put up their depots and other installations at points convenient for the work without any expenditure to the project. Such contracts were stipulated on the basis of the contract price established by central purchase organisation. Such an arrangement may be adopted in other projects.

10.3 The experience of the application of the procedure and accounting prescribed in the PWD and accounting codes in regard to stores has not been found suitable for large works. The Rates and Costs Committee has dealt with this matter. Their recommendations in regard to the following should be implemented:

1. Classification and codification of stores.
2. Procurement of stores, formation of a S.P.C. for projects.
3. Accounting of receipts and issues.

4. ~~Standardisation of price of stores.~~

5. Stores Management.

11. Plant and Machinery.

~~11.1~~ We recommend implementation of the recommendations of the Construction Plant & Machinery Committee in regard to plant planning, ~~multi-shift working, equipment utilisation,~~ provision for ancilliary services, planning of annual budgets, life and depreciation of machinery, provision for spare parts, procurement of spare parts, proper upkeep for ~~machinery records,~~ opening of training centres, adoption of adequate emoluments and ~~pay-scales to attract suitable~~ personnel where necessary.

11.2 Standardisation.

As recommended by the ~~Construction Plant & Machinery~~ Committee, standardisation of machinery and equipment to be purchased for river valley projects could lead to substantial economies. The decisions of the Government of India in regard to standardisation should be immediately implemented.

12. Setting up of a central organisation under C.W.P.C. for coordination work.

12.1 A Plant & Machinery Directorate is already functioning in the CWPC to correlate the supply of and the demand for the surplus machinery. This Directorate is compiling ~~information relating to equipment declared surplus in~~

~~projects nearing completion~~ and their transfer to other projects. All the State Governments have been requested to furnish the necessary information as and when necessary. As soon as a qualified Scaling Engineer is appointed, the scaling wing of this Organisation also would begin to function. A "drill" to ensure the optimum utilisation by projects of serviceable surplus machinery is being finalised. The arrangements in this connection should be completed urgently.

12.2 A statement in regard to action taken on the recommendations of the Construction Plant & Machinery Committee is enclosed (Encl.2). It sums up the position as on August 31, 1956.

13. Accounting.

13.1 The necessity of drawing up a code of rules and procedures to suit the changed system of execution as well as accounts was considered by the Committee on River Valley Project Administration appointed by the Engineers Seminar at Roorkee. Both the majority & minority Committees have recommended that the CPWD and CPWA codes which were drafted to suit conditions^{is}/now completely out of date, should be re-examined and brought in accord with present conditions, and a high powered committee should be appointed without loss of time to go into this question in consultation with the Comptroller and Auditor General of India. We enclose a

copy of a tentative draft code worked out at Bhakra in this connection(not yet received from Bhakra).

13.2 The committee also considered the desirability of evolving the system of relieving the field engineers of the major part of administration and accounts and recorded the view with which we agree that even under the most extensive delegation, it is not possible to relieve them of certain fundamental duties and responsibilities such as general responsibility for moneys drawn, stores in custody and initial accounts in connection therewith together with rendering of accounts to a Central Accounting Authority. The extent to which further relaxation of the accounts procedure is possible should be further examined by the Irrigation & Power Ministry in consultation with the Comptroller and Auditor General of India in view of its importance and far-reaching character and the repercussions likely to ensue.

13.3 Apart from the basic problems referred to above, the position generally is that the accounting departments in the projects are not adequately staffed or trained. These defects have to be removed as a high priority. It is also necessary that arrangements for payments should be prompt. It is suggested that a systematic analysis of work load involved should be made for proper distribution of load of work and for preparing a time-table to be followed for

making payments. Watch should be kept on the actual working of the arrangements through fortnightly reports, which should go up to the Chief Engineer. The selection of pre-audit or post-concurrent audit method, should take into account the need for prompt payments.

14. Cost Control/Work Studies/Cost Accounting.

14.1 The Coordination Board of Ministers, in its meeting held on 5th October, 1955, approved the following recommendations of the Sub-Committee appointed by the Srinagar Seminar held in July, 1955.

(1) On sizable River Valley Projects which are to be carried out departmentally, it is necessary to have Cost Control Section. In this connection the recommendations made by the Rates & Costs Costs Committee in paragraph 13.17.2 as reproduced below are accepted:-

"To secure the best results, it is desirable that the cost organisation should work under a competent Cost Engineer assisted by trained staff. The Cost Engineer should be able to comment on (i) operations which are costing more than the estimates (ii) the possible avenues of saving and (iii) the total ultimate cost of the project. This organisation should be responsible to the Chief Executive of the Project, who should on the basis of the cost reports and comments, be able to take effective and timely measure to control the projects".

(2) It is essential that cost account/figures should tie up with the financial account figures, as far as the primary sub-classification of accounts are concerned. For

the purpose of cost control a more detailed classification may be necessary. The sub-classification will depend upon the set-up of the organisation, the agency of construction and process of manufacture. However, the broad classification (required for financial account) should be recommended similarly on all projects.

(3) For the purpose of costing unit rates for cost control, certain approximation will have to be made to apportion liabilities and distributive items. The financial figures should tie up monthly and the approximations should tie up periodically. We notice that there is no uniformity on various river valley projects in the matter of components making up the unit rates for finished items. This has created a certain amount of confusion in the comparison of rates from one project to another. This difficulty has arisen because the estimates on various projects have been prepared on different basis. We recommend that the definition of the unit rates should be uniform on the basis of the recommendations of the Rates & Costs Committee as finally accepted.

(4) The Sub-Committee feel that the Rates and Costs Committee recommendation on cost accounting requires to be examined in detail. The cost accountants should discuss the various forms with experienced project engineers and get them tried on one or two typical projects before finalizing

them.

14.2 So far, proper cost control presumably, has not been ~~introduced in any project~~. At Hirekud, F.A. & C.A.O. has introduced cost accounting as part of his responsibility for ~~coordinating physical~~ progress with pace of expenditure. At D.V.C. the work of the ~~cost engineering section~~ is not coordinated with the accounting side. At Bhakra, the present ~~arrangement is confined to~~ comparison of costs with the estimate for works above Rs. 15 lakhs. ~~Coordination with the~~ C.A.O. has not yet been effected.

~~According to the analysts, there are three basic systems of industrial production:~~

- (a) ~~unique product production (Building of battleship,~~
sky-scrapers, big turbines, dams);
- (b) ~~mass production (assembly of varied products out~~
of uniform and standardised parts and may include
earth work and concreting at the last stage);
- (c) process production (oil refineries, chemical
industries).

14.3 The ~~construction jobs are a mixture of the system~~ ~~unique-product production~~ and mass production. Under the ~~unique product production~~, the basic principle is organisation into homogeneous stages. This organisation is different from ~~craft organisation~~. The ~~unique product production does~~

not go by craft skill, but by stage skills, for which integrated teams are required. The basic principles for securing efficiency for such a system of production are:

- a) division of work into homogeneous stages;
- b) the systematic organisation of the work-groups for specific requirements of each stage; and
- c) the systematic training of large number of people to do all the work required within one stage.

We, therefore, feel that the system of cost control for the job which is a mixture of unique product and mass product production would involve work studies and training for the unique product part of the job and standard costing evolved after work studies in relation to mass production part of the job.

14.4 An informal discussion by some members of the Committee with Bhakra Dam Officers would suggest the following phasing and organisation:-

Phasing: (a) In the first stage, the supervisors have to train themselves and their workers in relation to specific jobs from time to time and build up skills;

To secure the best results, the primary need thus will be to train the supervisory personnel in work studies (method studies, time and motion studies) and the T.W.I. techniques for training workmen.

(b) Simultaneously, the accounting section should work out arrangements for relating costs to estimates. This will include preparation of a code as a part of the classification system of account.

(c) After the supervisory and work skills, as well as cost accounting, have been routinised, may come the stage for cost control, with a view to further improving efficiency.

14.5 Organisation: The cost control unit may start as a ~~work study-cum-cost accounting~~ unit and develop as a cost control unit. The skills to be required for this unit will be an experienced construction engineer with accounting-statistical bent; an accountant trained in cost accounting and control; expert in work studies in the initial stages; and computers. This unit should service the top-construction executive direct and its forms and reporting system should be approved by the Chief Engineer. Its work has to be coordinated with the accounting.

14.6 At the Centre, the Cost Control Cell should be able to:-

- a) advise on the organisation of cost units;
- b) advise on work studies;
- c) analyse and build up set or sets of standards on the basis of actual field experience, for control and planning;

d) present an assessment of -

- i) comparison between actual costs and estimated costs;
- ii) increase in efficiency or productivity of men and materials in the projects from time to time;

e) publish studies.

We recommend that the experiments mentioned in para 1 (iv) may be initiated on the basis of the advice of selected engineers/cost experts, immediately by the C.W.&P.C.

15. O & M.

The main problems for O & M study in a construction organisation will be; (a) delegation of powers; (b) co-ordination between departments; (c) work studies in relation to office work; in particular, for simplification of procedures and permitting the field officers to attend more and more to their field work; and (d) training of non-technical staff etc.

The Unit will be also responsible for checking on the speed with which the organisation and its departments function as a whole. We recommend establishment of a small unit for this purpose on major projects.

16. Inspection and Control.

16.1 For economy and efficiency the quality of work is more important than the quantity or out-turn. There is,

however, a tendency in projects to sacrifice quality for quantity, especially when keeping to schedule or going ahead of schedule is considered an achievement worthy of recognition. Quality is only a silent witness of good work and the benefits of quality is reflected only at a future date. Inspection and Quality Control Organisations are considered prerequisites to sound construction jobs throughout the world and yet such organisations are few in this country. (See also para 10.1 Chapter VI).

16.2 We recommend the formation of separate organisations under the Chief Engineer of every project in charge of inspection and quality control. This organisation would function satisfactorily only if it is vested with powers to control the work in all the phases where quality is affected. This organisation must check the work of the construction organisation and certify its correctness in following the design and materials and the specifications for work. They should make frequent and systematic tests of strengths of construction materials, placement moisture content and dry density in the case of earth embankments etc. A vigilant but cooperative inspection and control organisation should be an asset to every project.

17. Land Acquisition.

The two main problems in regard to acquisition of

~~land under the Land Acquisition Act of 1894~~ are: (a) time taken by the procedure prescribed under the Act; (b) rise in prices of land to be purchased by Government. We have ~~not examined this issue in sufficient detail~~. It is for consideration whether the use of section 4 of the Land Acquisition Act of 1894 and the cooperation of the Collector do not in practice secure possession of land even without settling the price and the claims. In the case of large projects it has been found advantageous to obtain the services of a senior revenue officer for the work.

18. Labour relations.

18.1 In the chart opposite para 2 we have indicated the crucial role, of human relations and the "Relations" with labour, skilled workers & staff. It should be clearly appreciated that the problem of labour relations is not to be treated as a law and order problem, but as a human problem. We have recommended in para 5.2 that the specifications should require the contractors to provide reasonable amenities. These should be standardised. In Chapter VI, para 18.3, we have admitted that practically, all have to learn how to handle the problems of labour & personnel.

18.2 It appears to us that the basic approach to this problem should be:

- a) Each individual, whether he is an unskilled, skilled, supervisory worker has to be respected.
- b) Each individual should have sense of participation on the great venture of developing the country.
- c) The test of any organisation - whether departmental or set up by the contractors - should be the increase in skills in productivity of each individual. This is the natural aim.
- d) The worker should have a due share in the increased productivity for which he is responsible. We may mention that in China the wages are raised on the principle "that increases are based on rising production and higher productivity of labour, always provided that wages rise more slowly than labour productivity".
- e) We have already referred to the question of amenities
- f) The labour organisations should take responsibility both for increasing productivity & discipline along with a fair deal for the labour.
- g) The organised public opinion and the Government should maintain the right balance between fair deal & discipline in order to secure productivity, which is the common aim of the organisation and the individual.

18.3 We further recommend:

- a) Each zone in the country should have proper coordination of labour forces so that labour surplus at one project should be easily absorbed elsewhere without being retained unnecessarily.
- b) There should be a committee of representatives of the labour on one side and the C.E. on the other to anticipate or resolve any disputes and grievences.
- c) Whenever large labour is employed, labour welfare officers of sufficient status should be appointed

on each project site to look after their interests and for implementing the labour policy of the Government of India.

19. Evaluation. We have dealt with the question of evaluation in Chapter V (para).

20. Public Cooperation.

For the successful completion of projects, a large measure of public cooperation is of fundamental importance. The average citizen is able to see vividly and contribute actively to work that lies near him, or touches his life and well-being intimately. Irrigation and flood control programmes provide a good opportunity for seeking the cooperation of the people and in this vital field of national development there is vast scope for voluntary effort. Works on which unskilled labour is entirely employed like the canal systems, should as a rule, be done by the villagers themselves and not through contractors and that in each village or group of villages, the villagers should be organised into cooperatives taking up the work in their own areas. The scope for people's participation is even greater in the 2nd Plan than in the First Plan as there are large numbers of medium projects spread all over the country and it is expected that such participation will be organised from the very commencement of the works. A provision of

Rs. 1 crore has been made for enlisting public cooperation on various projects.

21. Eradication of Corruption.

21.1 The opportunities for corruption in irrigation and power projects are analysed below:-

A. Under Departmental Construction.

- i) Purchase of machinery;
- ii) Purchase of stores/spares;
- iii) Machinery Operation;
 - a) Pilferage of P.O.L. through bogus entries in log books, vis-a-vis working hours, etc.
 - b) Bogus issues of spares.
- iv) Workcharged establishment - Inflation of Muster Rolls;
- v) Issue of Stores.

B. Under Contracts.

- i) Estimation -
 - a) Loose estimation by deliberate misrecording of basic data, vis-a-vis, levels, classification etc.
 - b) Liberal provision of stock issues for execution of works;
 - c) Under-estimation of salvaged stock required for construction.
- ii) Award of work -
This is manipulated by -

- a) Preparing incomplete tender notices;
- b) Drawing up sketchy specification.
- c) Deliberate under-estimation of low rates quantities in the estimate with a view to the overall cost of a work on basis of tenders received for the work.

iii) Measurements -

Fictitious measurements.

iv) Inflation of rates.

- a) Incorrect classification;
- b) Connivance at accepting standard work.

v) Delays.

vi) Pilferage of stock.

C. Misuse of the pressure of emergency.

Inflating rates; making fictitious measurements and record of work.

21.2 The routine established element of corruption may take the form of percentage share (Mamoli) of amount to be paid by the contractors, either for avoiding harassment or for obtaining payment for work not done or not done to specifications. The illegal payment may be extracted by delaying action at various stages.

21.3 There is reason to believe that corruption gets well-organised. Unlike some other spheres, corruption in this sector is almost entirely at the expense of the public

exchequer.

21.4 As stated above, a major scope for corruption may arise under ~~pressure of emergency~~ to secure the speed for achieving the targets. An examination of some preliminary data has disclosed that in emergent situations, delegation of powers, ~~without adequate inspection arrangements or spot supervision~~ may lead to the misuse of delegated authority and perhaps even lowering of quality. Straight-forward attitude for meeting the ~~emergent situations~~ may not be developed in the staff. Instead, misuse of discretion, ~~misreporting of facts~~ may be indulged in the name of speed and thus provide free scope to the corrupt. There is also prima-facie reason to believe that ~~accounting arrangements~~ are not adequate to the speed of execution, thereby ~~providing greater freedom~~ to the corrupt but lesser scope for supervision and ~~control~~. For instance, in a large-scale construction work, an ~~inspecting organisation~~ should be promptly fed with indicators for scrutiny (e.g. see item 1-9 in the enclosure) by the ~~accounting and cost control organisations, etc.~~ Inspection to be effective should be serviced by well organised intelligence.

21.5 We may refer here to a dilemma. Speed and efficiency/~~economy~~ cannot be secured without delegation on a large

scale for harnessing initiative in the interest of lowering costs and speed. On the other hand, discretion can be misused, unless we have speedy institutional arrangements to ensure that the neglect of the rule is in the interest of real savings in cost. This balance depends on the speed with which the organisation functions and the calibre of men available to the Chief Engineer. The arrangements will probably have to be tailor-made in terms of men available to him. But the delegated powers cannot be carried by men who have no adequate understanding of the cost implications. There is a good case for regular training in cost mindedness to all the engineers engaged in construction. The aim should be to stop misuse of discretion, preserve initiative and straight-forwarded relaxation of wasteful rule for lowering of real costs by the proper authority promptly.

21.6 A most potent instrument for controlling corruption is the preparation of sound detailed estimates after adequate investigations. We have referred to the arrangement in this connection in para 7.2 above. These arrangements will take care of leakage arising from B(i) and (ii) in para one.

21.7 In regard to A(i) and (ii), also the solution lies in adequate long-term planning and arrangements for

purchase. (see para 8.2 above).

21.8 As a substantial part of the programme is to be executed through the contractors, wastage on considerable scale may occur on account of loop-holes or inadequate drafting of the contracts. There may be advantage, therefore, in making a study into the failure of contracts in order to prepare improved drafting of contracts. This study may be made by a team consisting of an Engineer and a finance man. Ministry of I&P may sponsor this study.

21.9 The measures to combat corruption can be classified as follows:-

- a) administrative arrangements to prevent corruption or make offering of bribe unnecessary;
- b) measures to make corruption risky;
- c) measures to promote morale for combating corruption.

We have had the benefit of the reports of the Railway Corruption Enquiry Committee, the first and Second Five Year Plans and the Champhekar Committee'. These measures are given at enclosure A. Items 1 (12-15) can take care of corruption in regard to A(iv); items I(16-17), and II(3) in regard to B(iii) and (iv) and items I(8,9,18) in regard to B(v). We recommend this for consideration by the appropriate agency.

21.10 To ensure that these measures operate, it is necessary that there should be; a) will to combat; b) will to expose; and c) facilities and time for combating. Secondly, the

strategy and organisational arrangements employed for combating corruption - by prevention or by punishment - should function in a coordinated manner and with speed.

21.11 The "will to combat corruption" can be created and maintained by the example, determination and the priority given to it by the Minister, the Head of the Department and the Chief Engineer etc. If the will to combat is lacking in the Head of the Department or Head of the Unit, a good part of the measures will remain ineffective. The penal measures in particular, will also remain inoperative if the will to expose and facilities to expose are not encouraged with due caution. We recommend for adoption the measures listed under heading "for promoting morale for combating corruption" in the enclosure. A major instigating factor is the disparities in income and standards of living between various levels in the public administration and between public and private sectors. Lack of such disparities in China is presumably also a major factor in reducing corruption. The measures to be implemented departmentally are at enclosure 4, III - 4 & 5.

21.12 The adoption of measures recommended at item I (1-7), 10, II (2(a), (b), 10(a)) should provide organisational support to the Head of the Department/Chief Engineer. For identifying persons and areas for rigorous scrutiny, items II-1, I-19. II-4, 5(a), (b) may be adopted. These

arrangements will enable the Chief Engineer to take preventive, corrective measures on the one hand and speedy penal action on the other.

21.13 In the case of large construction works, particularly, when they are spread over a very wide field and where the apparatus for day-to-day quality and other controls cannot be made applicable, special arrangements for inspection will have to be organised. When a project is concerned with a number of States and is run by a Control Board, the responsibility for ensuring vigilance should be clearly placed.

A. Development of Benefits: Instances of lag between the availability of supplies and their utilisation are known. We recommend the implementation of the following suggestions.

1. a) Simultaneously with the establishment of arrangements for overall planning of the river-system, a survey in regard to areas which need and can take irrigation should be organised by the revenue/agricultural departments of the State Governments.

b) Development of land should be planned in advance and form an integral part of the Project Report. The report should include an assessment of the steps to be taken for timely development e.g. setting up of N.E. Organisation and demonstration centres ahead of availability of water, financial assistance, agricultural implements, fertilizers, live-stock, seeds. This should be a condition precedent to the acceptance of the project by the Planning Commission. It is recommended that the proposed Manual on 'Preparation of Project Reports' should contain a chapter dealing with this aspect.

c) Phasing of construction should promote maximum use of water even during construction e.g. lining of a canal may be deferred till need for full discharge is felt;

the height of a masonry dam can be restricted in the first stage to the offtake level of the canal and the storage required for development of irrigation. A programme of construction of distribution system may also be similarly phased.

For purpose of (a) & (b) i.e. for ensuring timely utilisation a Development Board consisting of representatives of irrigation, revenue & agricultural departments may be set up in each State.

d) As a measure for converting the outlook of the peasant for changing over to irrigation, it may be sometimes necessary to allow free irrigation for the first season or two.

2. The following suggestions may be adopted for securing maximum irrigation out of water:

- i) Water requirements should be based on results of experiments of agricultural farms with necessary allowance for variations and not on local practices of the farmers as the latter may be wasteful;
- ii) The tendency to utilise more water than necessary, can also be counteracted by construction of modules which ensure designed discharge,
- iii) Unitary control for irrigation supplies by the

Irrigation Departments is suggested in preference to the dual control system of Revenue and Irrigation departments now in vogue in some old States like Hyderabad.

3. In order to reduce the losses in percolation in unlined earth channels, which sometimes are as much high as 50%, it is recommended that economics of lining the canal system may be worked out in detail at the time of planning of a project. It is further recommended that research on cheaper methods of lining may be carried out.

B. Development of Power Benefits.

A study of the position on the power side reveals that since 1940, except in a few isolated cases, utilisation of power has been keeping pace with the expansion of power plant facilities. A certain amount of time lag is inevitable between plant installation and its full utilisation. It is not practicable to lay down hard and fast rules regarding the permissible limit of time lags. It is, however, very necessary to so plan the construction of transmission and sub-transmission lines and the distribution systems that immediately on the availability of power, it should be possible to distribute it to the areas covered in the Projects, for meeting the anticipated load demands:

Simultaneously, on the utilisation side also, the work should be coordinated to achieve this objective.

2. The various causes leading to delays in utilising power supply facilities are inter alia:

- (a) Improper assessment of the load conditions prior to the implementation of the scheme.
- (b) Major loads anticipated originally not materialising on completion of the power project.
- (c) Lack of coordination as between the development of industries and mineral resources and power expansion projects.
- (d) Failure to offer attractive or 'promotional' rates for power for different categories of consumers.
- (e) Lack of commercial propaganda on the use of electricity in undeveloped areas.
- (f) Lack of facilities for obtaining loans for purchasing the necessary power-consuming appliances and equipment.
- (g) Non-standardisation of sub-transmission and distribution lines, utilisation equipments, etc., leading to higher capital cost for distribution and utilisation resulting in correspondingly

higher power rates,

~~(h) Un-coordinated execution of works in respect of the procurement and erection of generating plant, transmission and sub-transmission systems, and distribution systems.~~

~~(i) Lack of coordination among the power project authorities, Central and State Government Departments dealing with large-scale and small-scale industries, Agricultural and Revenue Departments, Community Project Administrations, etc.~~

(j) Lack of specialisation in respect of system planning, hydro and thermal power station designs, high voltage transmission systems, inter-connection problems, etc., leading to uneconomical and un-coordinated power system layouts.

3. The following practical remedies are suggested so as to ensure the efficient and economical utilisation of power supply facilities;

(a) A proper assessment of the load potential in the area which is proposed to be covered by the Power Projects is the first essential for ensuring the efficient utilisation of power. The Central Water & Power Commission (Power

Wing) have nearly completed, with the cooperation of the State authorities concerned, a preliminary load survey of the entire country. This will be followed by a more detailed and systematic load survey. This work is programmed to be completed in the course of the next three years or so. Since the pattern of load growth and the relative priorities are likely to change from time to time depending on various factors, the State Electricity Department/Boards may be asked to keep CWPC informed of these changes by means of annual reports.

Before according sanction for the project, every care is taken to ensure that the major industries are definitely included in the corresponding Five-Year Plan.

In the case of industries coming within the private sector the load surveying party should ensure that the demand for power has a firm basis. The load surveying parties may, for instance, check as to whether the concerned parties have arranged for capital, placed orders for machinery, etc. The load parties or the authorities responsible for preparation of project reports should also consult information available in the Ministry of Commerce and Industry, Planning Commission, and other concerned

Ministries/Departments both at the time of the preparation of the project report and also during the construction period.

At present, the Ministry of I & P or the departments concerned with power in the States are not kept informed, in advance, of proposals which would involve demand for additional power. It is, therefore, suggested that the arrangements for regular availability of such information should be made. The application for obtaining licences for putting up new plants or expansion of existing industrial plants may ask for the following information against item 21 of the application Form "D" (under clause 7(2) of the Registration and Licensing of Industrial Undertakings Rules, 1952(as revised):

- (1) Anticipated maximum demands together with the corresponding load factor, yearwise.
- (2) In case own generating station is proposed, the firm generating capacity from year to year.
- (3) In case power is to be obtained from an Electricity Supply Undertaking/Project:
 - (i) Name of the Undertaking/Project.
 - (ii) Whether any agreement has been entered into with the Undertaking/Project, and if so, the power commitments, yearwise, as agreed to between the parties (subject to the licence being granted).

(iii) Degree of reliability of power supply required.

.It is further suggested that the Ministry of Heavy Industries may be requested to forward to the Ministry of Irrigation and Power and the concerned Electricity Departments in the States, copies of the proforma duly filled in for every industrial project for which they intend to grant the licence and also keep them informed of all modifications to the proposals involving the use of power so that power planning may also go side by side.

(c) As regards electrification projects in virgin areas, it is possible that in the first few years after the implementation of the project, there may be some reluctance on the part of the consumers to avail of the power supply facilities. The power tariff rate, should be so framed that it attracts new consumers and promotes greater use of electricity. In this connection, the services of the Central Water & Power Commission (Power Wing) should be utilised freely for advice and guidance.

(d) Arrangements must be made for informing the industrial associations and organisations in regard to the availability of power, quantity available and the rates at which it will be available, say two to three years in advance

of the production of power.

(e) The Power Wing of the C.&PC and the State Electricity Departments or State Electricity Boards should coordinate with the All India Boards, set up to stimulate development of small & village industries and the corresponding boards or departments in the States for;

- (i) establishment of rural cooperative societies;
- (ii) for providing loan for purchasing the power consuming equipment, such as pumping machines, plant for various cotton processing industries and may be even domestic electricity installations; or
- (iii) for hire purchase facilities for purchase of electrical plants and equipment.

(f) The evolution of standard designs and codes of practices in respect of sub-transmission and distribution lines system and power consuming equipment will accelerate speed of construction as well as utilisation of power and also lead to economies. So far as the main transmission lines are concerned, the designs and the practices have already been standardised. The Central Water & Power Commission has taken this work in hand, and is expected to be finalised in the course of a year. The Indian Standards Institute is also engaged on standardisation of electrical plants and equipment. As the main designs being evolved are based on

the availability of wood poles from indigenous sources, the benefits of research on standardization will depend on the speed with which arrangements for extracting more wood poles from existing forests and for planned afforestation programmes are made.

(g) After sanction is received for any major Power Project, a definite programme must be framed for the preparation of detailed estimates, detailed designs and specifications for generating plant, step-up stations, transmission and sub-transmission lines, associated substations etc., issue of tender specifications, placing of orders and erection schedules.

If the distribution system is owned by a separate department or agency, they must be asked to frame a similar programme for the procurement of materials and erection of distribution lines and equipments so as to coordinate with the above. The power system authorities must review these programmes once every six months and ensure that there is no time lag or avoidable delays in respect of items of work which may ultimately hold up the final completion of the entire project.

(h) Economies in a major scale can be secured if

arrangements for coordination at least between the States in each zone are made. It is recommended that a Coordination Committee consisting of the Chief Engineers for power, a representative of the power wing of the CWPC and Adviser (Programme Administration concerned with the particular zone), should be set up, to; (1) get studies made in regard to coordinated development of power within the zone (ii) suggest legislative or administrative measures required for bringing about coordinated development; (iii) advise on questions such as payment of royalty for utilising water resources, tariff rates and other matters which usually arise when power is obtained by one State from another.

(i) Maintenance Efficiency.

We believe that a periodic assessment of the efficiency of electricity supply undertakings would be helpful in reducing the overall cost of generation and distribution of electricity and in raising the standard of service to the consumers. The Central Electricity Authority has been requested to make arrangements for assessing the efficiency of electricity supply undertakings owned by the public sector from time to time. The cell to be set up by the authority would work in close collaboration of the power wing of the CWPC.

CHAPTER - V

COORDINATION OF KNOWLEDGE AND EXPERIENCE AND IMPROVING THE INSTRUMENTS OF CONTROL AND PLANNING.

Coordination of Experience and Knowledge.

1. In broad terms, the concept of efficiency has two aspects, technical and management. Coordination of knowledge, experience and research both technical and in regard to management is necessary to improve techniques for investigating, planning, designing, construction and control of I & P Projects.

Research.

2.1 The Central Board of Irrigation & Power is responsible for inter-State coordination and research. Great research in Hydraulics pertaining to river structures has been done and won for India a great name. The work in the recent years has to be analysed and reviewed. Member (Research), Central Water and Power Commission has been requested to send a report on the subject. On the other hand the research work on problems of general applicability is not being tackled due to lack of adequate funds and personnel. There seems to be some duplication of work in different research stations.

2.2 Practically, no attention has been given, so far to research in power. Minister for Irrigation and

Power set up a special committee to go into this question and the report has since been submitted. Rs. 3.0 crores have been provided in the Second Plan for this. The Planning Committee on Power Engineering Research appointed by the Government of India has recommended the setting up of a Central Power Research Organisation comprising the following divisions:

- i) Switchgear Testing Station.
- ii) High Voltage Engineering.
- iii) Electrical Engineering including the section dealing with Network Analyser studies.
- iv) Mechanical Engineering including Thermal Power Plant.
- v) Hydraulic Engineering.
- vi) Administration.

In pursuance of this the immediate programme is as under:-

- i) A switchgear testing station, a division of the Central Power Research Organisation should be established in Bhopal.
- ii) The other divisions of the Central Power Research Organisation are proposed to be located in Bangalore near the Indian Institute of Science.

Coordination of Knowledge & experience.

3.1 To quote the Bureau of Reclamation, U.S.A. "The Engineering Centre cannot be defined simply in terms of people and equipment. Special mention must be made of the wealth of knowledge and experience accumulated in its files and records which it contains. Here are

assembled the histories of experiments, ventures and successes of the past. These records represent the background of experience that has made possible the success of Reclamation to date, and the confident attack on the increasingly complex and challenging problems represented by reclamation engineering of the present and the future."

"It is also the centre repository of the past experience the storehouse of clinical records - which is the basis for sound engineering judgement and the guide to progressive improvement in engineering practice".

"The responsibilities of the engineering centre... normally include the establishment of basic criteria and method definition and standards of accuracy and quality, surveillance of work in progress and review of work completed."

3.2 The two main instruments for coordination of knowledge and experience, are - the Central Water and Power Commission, Central Board of Irrigation and Power and the Irrigation and Power Seminar. The I&P Seminars which have been held on an average once a year are intended to coordinate the experience and knowledge on the construction and administration side. The experience of these seminars and the functioning of the Coordination

Board of Ministers has been reviewed in Chapter VI.

3.3 Primary function of the Central Water & Power Commission is to coordinate knowledge, experience, research in regard to irrigation and power in the country and the rest of the world for securing technical efficiency. It has to function as a sort of staff organisation concerned primarily with setting up of standards in regard to investigation, designing, estimation preparation of project reports, rates and costs, and various matters connected with machinery, equipment, etc., and keep these standards in continuous review on the basis of actual experience in the field.

The adequate discharge of these functions would depend on

- (a) cooperation of project authorities/State Governments etc
- (b) prompt arrangement for analysis, extension and application of new ideas.

3.4 In the country, new thinking in regard to technical matters may emerge (a) in the investigation stage; (b) in the designing process, (c) at research stations (concerned with technical problems as well as study of materials etc) (d) in the advice given by the consultants engaged by various project authorities for obtaining advice on specific technical problems etc. during construction.

3.5 The C.W. & P.C. is also required to build up the rates costs analysis for all the significant projects throughout the country, and coordinate experience in regard to purchasing, maintenance, utilization of machinery and equipment and running of workshops. A great deal of spade work has been done by the Construction Plant and Machinery Committee, as well as the Rates & Costs Committee in regard to some of the items mentioned above. There should be regular arrangement in the Central Water and Power Commission to keep the work of these committees up-to-date as well as fill up the gaps which can only be filled up by a proper system of reporting and special studies.

3.6 It will be also necessary that the material for the preparation of completion reports, (which should highlight new methods of design and construction resulting in increased technical efficiency and economy), should be prepared side by side, as the construction proceeds. The completion reports should be ready soon after the completion of projects. One way to secure this object is to introduce in the progress report a section where special development (including the advice given by Consultants/Experts) and experience are reported, say, every quarter or six months. (See also para 4.5).

3.7 Similarly, either as a special feature of the progress report or in some other way, all the project authorities should report to the Central Water and Power Commission for information any new features in design which may have been developed during the process of designing particular structures.

3.8 The Central Water & Power Commission should also coordinate experience in regard to organisation and methods relating to stores, workshop.

Control

4.1 We enclose here a note on techniques employed for control and planning in the large-scale industrial enterprises in the U.S.A. What is applicable to industrial enterprises is not necessarily applicable to constructional enterprises. On the otherhand, while the detailed methods applicable may be different, the broad approach and techniques can be adopted to suit constructional enterprise (which is essentially a production enterprise). In some degree, these methods are being evolved, (See also Chapter III heading cost control etc). It is suggested that the Control Boards should arrange to develop arrangements in regard to preparation of detailed realistic schedules, cost accounting, cost control and standards as instruments of control without day to day interference and for securing

increased efficiency and economy, if necessary, with the assistance of the C.W.&P.C.

4.2 These arrangements should function as an integrated mechanism which services all the executive levels down to the foreman, as well as, the management levels, i.e. upto the policy makers. (See Chart at the end of the enclosure I in regard to the integrated mechanism evolved for industrial enterprises).

4.3 In regard to irrigation and power sector, progress reports, quality control, cost control, inspection, special studies, reports of experts and consultants are the chief instruments of control. We give below some suggestions in regard to reporting.

Progress Reports:

4.4 Standard proforma for reporting progress on the projects were approved by the Coordination Board of I & P Ministers. If properly filled, these proformas would relate physical progress to its targets, expenditure to physical progress and estimates. The reports would also give the picture in regard to the health of the organisation(in regard to labour, machinery, equipment, stores etc.). In practice these progress reports are not being filled up with the attention that they require. When progress falls short of programme, reasons for the shortfall are not given. When

the actual rate exceeds the rate in the estimate the factors that have resulted in increased costs are not indicated. The labour reports do not indicate whether the strength employed is adequate or not to complete the work within the prescribed time.

4.5 The following additional information should be given in the narrative report:-

- (i) Availability of construction material.
- (ii) Value of stores in hand, whether it is more than the requirements of the projects and steps taken to dispose surplus stores.
- (iii) Whether sanction to estimates is being received in time or whether any work is held up for want of sanction,
- (iv) Whether timely payments are made to the contractors (Details about the prescribed schedules may be given).
- (v) The number of machines working, number at site as standby and number in the stores (to give an indication as to whether large number of machinery is being kept in store or idle).
- (vi) Results of cost control studies; detailed comparison of the estimates with the actuals; the advice given by Consultants/Experts (at suitable intervals). We feel that the Progress Report should further reflect conscious drive for efficiency and economy (i.e. new methods under application or proved methods for securing efficiency/economy).

5. We have referred to the question of cost control, inspection and quality control in Chapters 3 & 6.

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CHAPTER VI.

ORGANISATION, PERSONNEL AND ATTITUDES.

1.1 We have tried to visualise, in broad terms, the size of the future task during the Second Five Year Plan, both for carrying out the current Plan as well as for servicing the preparation of the third Plan. In regard to investigations, adequate arrangements have to be made (a) for investigating schemes included in the Second Five Year Plan (b) schemes for Third Plan.

1.2 Para 18 of the Chapter I of the Second Plan gives a projected picture of development in the next 15 years. If we apply the second Plan ratios in regard to investment (a) between ~~private~~ and public sectors and (b) for irrigation and power in relation to the rest of the Plan in the public sector, the possible expenditure in the third, fourth and fifth five year plans would be of the order of Rs.1500, 2000 and 3000 crores. Taking into account the need for power and irrigation for servicing industrialisation and agriculture Rs.1500 crores, mentioned for the third Five Year Plan, would be inadequate. As a result of the discussions on this Chapter, Planning Commission has issued a letter (Encl.1) to the State Governments, indicating that the size of the Irrigation & Power Sector in the third Plan may exceed Rs.1500 crores.

1.3 We feel that the arrangements for investigations for projects should ensure availability of fully investigated schemes for irrigation and power worth Rs.2,000 crores by the fourth year of the 2nd Plan in order to permit adequate pre-^{and} preparation of the third Plan for obtaining the best value for capital resources. This implies Preliminary investigations of schemes worth Rs.3000 crores at least.

2.1 According to the Technical Committee on Irrigation and Power, the present condition in most States is that the existing organisation is fully utilised on the execution of various sanctioned schemes with the result that the essential work of investigations and survey is being neglected. Some of the States are reluctant to invest on investigation of schemes not to be taken up immediately. Unless this attitude is changed and immediate action taken, it will be physically impossible to carry out this basic task, on which primarily depends the best use of our capital. Even now, perhaps, we may be behind time by three to four years.

2.2 We recommend the following course of action:-

(a) The C.W.&P.C. should examine the implications of the task in regard to investigations in terms of organisation, personnel and finances and report in 3 months;

(b) State Governments should be requested to send their programme and make arrangements for investigation of schemes

to be implemented in the Second Plan urgently. Assurance must be given to the States that the funds(as loan) required for investigation of schemes would be made available.

(c) A preliminary discussion in regard to organisation for investigation of schemes for the third Five Year Plan should be held on the basis of a paper to be prepared by the CWPC at the Symposium at C.B.I. annual meeting at Bombay.

The Symposium should specifically examine the suggestion made by the Planning Commission that special arrangements for planning, investigation and preparation of project reports may be immediately made.

2.3 Our suggestions in para 2.2 have been elaborated in Chapter on Investigations.

3.1 The present arrangements.

3.1 The responsibility of the Centre or the State or both, under the Constitution, in regard to irrigation and power, is given below:-

- | | |
|---|--|
| (1) Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest. | Responsibility of the Union (item 56 of List I - Union List). |
| (2) Water, that is to say water supplies, irrigation and canals drainage and embankments, water storage and water power subject | Responsibility of the State Govts.(item 17 of List II - State List). |

to the provisions of entry 56 of List I.

- | | | |
|-----|--|--|
| (3) | Taxes on the consumption or sale of electricity. | Responsibility of the State Government. Item 53 of List II - State List - Concurrent responsibility. |
| (4) | Electricity. | Item 38 of List III - Concurrent List. |

3.2 The broad structure of organisation in regard to various functions relating to Irrigation & Power in the country is analysed below:-

Organisation in the field (investigation, survey, construction, maintenance & utilisation).

Organisation at the State Level:-

- (a) Departments (Planning, Design, Estimation, Project Reports, Supervision, Control, Administration of I&P legislation).
- (b) Secretariat/Planning Organisations.
- (c) Control Board in the case of major projects.

Organisation at inter-state-level:

Corporation/Control Board/River Commission.

Organisation at the Centre:

Ministry of I&P/CWPC/Ministry of Finance.
(in coordination with the Ministries concerned with the industries, agriculture, supply).

Arrangements for settling inter-state disputes:

Ministry of I&P/CWPC/Planning Commission.

- a) Organisation in regard to inter-state projects; Control Boards v/s Corporation;
- b) Are the arrangements for implementation in terms of agreed thinking emerging from the I&F Seminars/Boards of Ministers functioning effectively?
- c)
 - (i) The role of the CWPC/I&F Ministry in regard to the work of the Committee on Plan Projects;
 - (ii) The relationship between the committee on Plan Projects with the Coordination Board of Ministers;
 - (iii) The relationship between the committee on Plan Projects and the Control Boards/State Governments;
- d) Is the CWPC adequately equipped for its tasks?

An illustrative list of the increased loads as well as a new load on the C.W.&P.C. is given below:-

- Broad determination of the potential for overall planning of river basins; investigations (where called upon) Laboratory assistance for investigations of construction materials.
- Man-power planning;
- Prompt upto date analysis of rates/costs (in estimates and actual) all over the country;
- Scrutiny of schemes submitted for inclusion in the Plan;
- Construction Plant layout;
- Cost Control;
- Representation on the Control Boards; scrutiny of estimates/designs presented to the Control Boards;
- Quality Control;
- Technical advice and assistance to the Ministries;
- Analysis of experience in regard to organisation of

workshop, use and maintenance of machinery for establishing and reviewing standards suitable to Indian conditions;

- Assessment of the progress of the Plan.

- (e) Coordination between I&P Ministry, CWPC & Planning Commission.
- (f) Does the CWPC get prompt cooperation it needs from the State Governments?
- (g) Provision of internal and independent financial advice in the Ministry of I&P and in the large projects;
- (h) Are the State Governments equipped for investigation, planning, designing, estimating, preparation of project reports, and evaluation of the progress of construction?

5. Delegation of Powers.

Before commenting on some of the matters in the above para, it will be appropriate to mention that the experience of the first Plan has confirmed that the system of delegation of powers (vide Encl.2a) combined with the emergency procedure (vide encl.2b) adopted by the Bhakra Control Board to the Chief Engineer may be adequate for the scale and speed of operations, provided limit is placed on the time to be consumed by the emergency procedure.@

6. Suitable form of organisation for inter-state Projects.

This subject was remitted by the Irrigation and Power

@An interesting feature of the 'control' system adopted in France in regard to public enterprise is the prescription of time-limit, by which the officers representing the Govt. must obtain the counter-orders of the Govt., in regard to particular decisions of the board of Directors, which they don't accept.

Seminar to a committee on River Valley Projects Administration two years ago. We have examined the majority and minority reports, and would like to offer the following comments:-

a) There seems to be some misunderstanding as to the object for which the suitable pattern of organisation has to be settled. The search is for an organisation for construction, maintenance and utilisation of benefits of river valley projects and not for the overall development of an area which is the function of the State Governments or (may be) the Centre. The comparison with the T.V.A. is, therefore, not valid.

b) A comparative analysis of the arrangement at various levels shows:-

- i) Control Boards, as distinguished from the D.V.C., are either ministerial or near ministerial level committees. They are far more high-powered than the D.V.C. and also ensure coordination at higher levels. The DVC has to supplement its less high-poweredness through the inter-state Advisory Committee. Its capacity for coordination with and between the States is presumably less speedier than in the case of the Control Boards.
- ii) In regard to personnel, the corporation is in a position of crucial, if not decisive, disadvantage because there is not much reserve for recruitment of personnel experienced in irrigation and power work in the open market; and secondly, because the corporation may not be in a position to plan personnel needs on a long-term and permanent basis.

iii) The main issue for consideration is, whether for the construction job, an organisation with one man at the head (General Manager/Chief Engineer) better than three whole-time members in a Board supported by a Secretary (who in the case of the D.V.C. was transformed from the Chief Executive of the Corporation to a Secretariat Officer) and a Chief Engineer. Secondly, is there enough policy load justifying three whole-time members at the top above the Chief Engineer? The Rau Committee had recommended that the DVC should concern itself with policy matters and broad features of general administration, execution and coordination. Prima-facie there is not enough policy work for three-whole-time members in an engineering project. Another question is: Is there need for three men board in order to effectively handle personnel, supervision, legal, labour matters and for dealing with participating Governments. So far as coordination with the participating Governments is concerned, the Control Boards present a speedier mechanism. It is our view that the Chief Engineer/General Manager can perform the remaining functions effectively. It is agreed that the powers to take decisions in regard to important matters of purchase should be given either to a Committee at the same or higher level. For the rest, departmental assistance for personnel, labour and purchase under the General Manager/Chief Engineer, will be adequate. In balance, the Control Boards (subject to our observations below) is a better arrangement.

7. On the other hand, we appreciate the need for a statutory organisation for maintenance of the dam etc. and for regulating the distribution of benefits in the case of inter-state projects under one man, (with adequate staff). The person in-charge could be placed under the control of a Committee representing the State Governments and may be also the Centre.

CONTROL BOARDS.

8.1 Structurally, the Control Boards, being high-powered and high level bodies of part-time busy members may function as an okaying body. Its membership leaves little scope for supervision etc. of its work. Some of the Boards have dealt with the question of delays by prescribing emergency procedures. They have been able to provide initiative occasionally in addition to coordination, on the strength of their experience gained by them in other control boards. On the other hand, we feel that the problem of the scrutiny of estimates, designs, construction plant layout and phasing placed before the Control Boards for sanction has to be further considered. There is also need for personal contact with the work in the field.

8.2 The designs in the case of major projects are done by established designs offices in India and in some cases abroad. For the sake of ensuring adoption of standards and sound practices suitable to our country, it is necessary that the specification - designs should be scrutinised by the Central Organisation. This will, in addition, enable the Control Boards to get prompt advice from the CWFC in regard to detailed designs later.

• At present, copies of the estimates to be submitted to the Control Boards are sent to the C.W.&F.C. and the

representative of the finance, who are members of the Control Board. There is need for strengthening the arrangements for scrutiny in the CWPC, in this respect. It will be useful to have a Standing Committee of the Control Board which could examine in detail the estimates submitted to them and report in time for the next meeting of the Control Board.

9.1 The Committee on Plan Projects has decided that teams should be organised to examine the functioning of certain irrigation and power projects.

9.2 Will this examination cover the functions of the Control Boards/Government Departments or the organisation under the Chief Engineer alone?

9.3 The composition of the teams will be dependent on whether the examination has to be made in regard to both these levels or in regard to organisation of the Chief Engineer alone. We are recommending below(para 11) analytical study in regard to the working of the Control Boards in the first instance.

9.4 In regard to examination of the organisation under the Chief Engineer, we would like to draw attention to the chart opposite para 2 of Chapter III on Construction. This chart brings out the relationship between various factors at different stages and productivity, minimum use of real

resources and quality. These three aims sum up the content of efficiency and economy.

9.5 The examination of a construction project may be concerned with: a) planning; b) organisation and personnel; c) bottlenecks and delays; d) organised attention to productivity e) quality control. Detailed examination through specialists could also be organised in regard to working of the individual departments or aspects of the project administration. It will be, therefore, essential for the teams to be assisted by specialised personnel. Panels of such experts should be maintained.

9.6 In the first instance, we recommend study, and not inspection, of three types of projects; 1) project in a preliminary stage, e.g. Nagarjunasagar and Koyna and Rihand; 2) Projects in somewhat advanced stage of construction e.g. Chambal and Bhakra Dam; 3) Projects nearing completion like Hirakud and Maithon. The aim of this study should be to work out a paper in consultation with the Chief Engineers in regard to what to inspect and how to inspect. The team, should, in particular, study the methods and organisational arrangements evolved by the Chief Engineers for assessment, reporting as well as continuous improvement in the working of organisation and methods. The study should concentrate on positive aspects and may not deal with the past, in the

first instance, except to draw conclusions for improving organisation and methods in the future.

9.7 After this preliminary study done many inspection teams may be organised. Such teams may be set up by the Control Board. The terms of reference and the membership of the teams may be put up to the Committee on Plan Projects for approval.

9.8 We further recommend that inspections should not be made for say more than once in two years.

10.1 We may at this stage refer to the problem of quality control. The need for an effective organisation for quality control suitable to the requirement of the project is unquestioned, more so, in view of the increased speed of construction. The construction man, interested in the pace of progress and costs, may be disinclined to give weight to quality. Arrangements for quality control in regard to work done through the contractors have to be made, in any case, independently of the contractors. In regard to departmental construction, it is also necessary that a separate set of officers solely employed on inspections and quality control are appointed. These arrangements (strength, qualifications of personnel, equipment) and the manner of functioning (procedures for record and follow-up action) should be prescribed by a quality control manual to be prepared by the

C.W. & P.C. This Unit should function under the Chief Engineer of the Project.

10.2 It will help greater coordination and exchange of information between projects, if a quality control unit is maintained at the centre also. This unit will collect the information from different projects; analyse and bring any important observations to the notice of the Chief Engineers concerned.

10.3 It is also for consideration if a quality control squad should be set up in the CW&PC to supplement the quality control efforts and the State organisations in regard to medium projects at the request of the State Governments.

Shri E. Kolet feels that Quality Control work can be left to the Projects themselves.

11. Being high level, the Control Boards should equip themselves for self criticism in regard to their own working. Some of the Control Boards have been functioning for a number of years. A great deal has been learnt by trial and error. No study has been made in regard to the functioning of Control Boards as such. It is suggested that the Ministry of I&P may organise a study of (a) the manner in which the Control Boards have performed their functions; (b) exercised their powers and (c) the manner in which they have dealt at their level with specific problems and factors, (sanction of estimates, corruption, quality control, evaluation of work, arrangement for scrutiny of estimates, speed of functioning, prompt

payments to contractors, building up of personnel; team spirit and so on), essential for securing efficiency and economy. Another practical question for consideration is how many Control Boards should be serviced by a single officer? In the first instance this study may be only fact-finding and analytical in its scope.

Coordination Board of Ministers.

12. In regard to implementation of agreed thinking emerging from the I&P Seminars/Coordination Board of Ministers, we feel that the decision making process is slow and the decisions are not implemented promptly or adequately. The solution seems to be that (a) the Coordination Board of Ministers should meet more frequently, and (b) the Board should authorise the C.W.&F.C. to follow-up the recommendations on its behalf. We also feel that a suitable drill in regard to the actual functioning of the Seminars should be worked out for making adequate use of time and talent brought together.

13.1 COMMITTEE ON PLAN PROJECTS.

The functions of the Committee on Plan Projects are:

- (i) to organise investigations, including inspection in the field of important projects both at the centre and in the States, through specially selected teams;
- (ii) to initiate studies with the object of evolving suitable forms of organisation, methods, standards and techniques for achieving economy, avoiding

waste and ensuring efficient execution of projects;

- (iii) to promote the development of suitable machinery for continuous efficiency audit in individual projects and in agencies responsible for their execution;
- (iv) to secure the implementation of suggestions made in reports submitted to the Committee on Plan Projects and to make the results of studies and investigations generally available; and
- (v) to undertake such other tasks as the National Development Council may propose for the promotion of economy and efficiency in the execution of the Second Five Year Plan.

13.2 These functions are being looked after already, at present, in some degree or the other. The two new elements in the arrangements are: (1) provision of a cooperative sanction for the performance of the above functions in regard to the schemes of the Central and State Governments and (2) arrangement for an overall organised follow-up of the objective of efficiency and economy.

13.3 A note examining the relationship between the Committee on plan projects and the Ministry/Control Boards/State Governments, is at enclosure - 3. We suggest that in regard to irrigation and power sector, the implementation of term of reference number 1, should be done through the Ministry of Irrigation & Power/Control Boards. In regard to function numbers 2 & 3, the Committee on Plan Projects may ensure that the arrangements are installed where they are lacking

and where necessary, provide support and sanction any improvement to existing arrangements.

The CW&PC/Ministry of I&P/Planning Commission.

14. The questions listed at (d) and (e) in para 4 are being dealt with separately.

Cooperation from the State Governments.

15. The main causes for the inability of the State Governments/Project authorities etc., in providing information are:

- a) lack of organisation or system for feeding the Chief Engineer of project for systematic continuous assessment of the progress of the work and health of the organisation;
- b) lack of uniform definitions/concepts (e.g. in regard to the ingredients which make up the estimates) or systems (e.g. in regard to log-books etc. for machinery or stores) as reported by the Rates and Costs Committee;
- c) the Ministry/CWPC/Planning Commission may not ask for information in a coordinated manner from the State Government;

Occasionally, there is reluctance also to give information.

These problems have been dealt with in Chapter V.

Personnel: Forward Manpower Planning.

16.1 Valuable foundation work was done by the I & P Manpower Committee in regard to this matter. The recommendations of the Engineering Personnel Committee has led to the setting up of a Manpower Coordination Organisation. I. organising work in

regard to manpower planning (for I&P Sector), the arrangements should take care of four aims:

a) to provide feed for the coordination between demand and supply in regard to each category of personnel in the country;

b) to make timely arrangements for meeting specific skills for specific jobs;

c) to provide feed for statistical overall assessment of the occupational structure in the country; and

d) to coordinate specific demands for personnel with specific surpluses in individual projects from time to time.

16.2 Ministry of I&P has already made arrangements to attend to (d) and has set up a Central Coordinating Section and Exchanges at major Projects.

16.3 We suggest that Ministry of I&P through the CW&PC, should immediately attend to (a), (b) & (c) in regard to I&P sector of the Plan.

16.4 The enclosed proforma (Encl. 4a,b) which has been tested and found, by and large, adequate to meet the needs at (a), (b) and (c) may be considered and adapted for issue to all the State Governments etc. The estimates of personnel in the I&P Sector are related to the decisions in regard to (a) mechanisation of construction and (b) the agency (departmental, petty contractor, big contractor) to be employed. These

decisions, to start with, can only be tentative. The information to be provided by each project authority, therefore, should indicate the assumptions on which the estimates have been based. This information should be collected once in five years. A study of this information, while serving the three aims at (a), (b) & (c) will also enable working out of coefficients for anticipating the requirements of the future plans. This latter task may be taken during 1957.

Provision of experienced/quality engineering personnel.

17.1 The need for obtaining experienced/quality engineering personnel may arise:

- (a) where an administration, Central or State requires experienced/quality personnel from another administration which has a pool or cadre;
- (b) where a Government institution, for education or research or both, needs experienced/quality personnel and also facilities for building up personnel:
 - i) from an administration - Central or State, or
 - ii) from the private sector.

17.2 The experience of the working of the arrangements for deputation from State to Centre or from State to State is that generally, unwanted personnel are released and the need for building up personnel is not taken care of.

17.3 We suggest that where the administration or

institution in need, has to draw upon an authority or an organisation having a reservoir or expandable source, co-operative arrangements can be made after estimating the needs of experienced quality personnel and of mobility on the following lines:-

- a) the supplying source may add supernumerary posts at the lowest or at any other level at the cost of the needy party, and provide for facilities for building up of personnel.
- b) the party in need will be allowed to locate personnel interested in being built up without hurting the needs of the supplying organisation to the extent possible. In cases where special building up may not be necessary the needy party may be allowed to draw up at least the second best personnel.
- c) the interest of the personnel drawn will not be allowed to suffer.

This may be discussed at the Seminar/Coordination Board of Ministers.

17.4 It is understood that in the States, the main shortages are in regard to superintending engineers and overseers. It is, therefore, suggested that information in regard to Superintending Engineers and the work they are engaged from year to year may be maintained in order to deploy them in the interest of the country as a whole under the auspices of the Coordination Board of Ministers. The exchanges being set up(vide para 16.2) could be associated with this work.

17.5 We are of the considered view that problem of

provision of experienced personnel for technical institutions deserves to be attended to immediately. The need for regular persistent, build up of personnel, if they have to succeed as teachers seems to be established. For efficient teaching, the ideal combination may be theorist with adequate field experience and specialisation in one branch of that field.

17.6 It is suggested, as a practical solution that (i) where the same administration has an executive cadre and also some educational institutions and is responsible for research - there should be a joint cadre for teachers etc. who are not required to stay for continuity or specialisation. Such an arrangement will take care of the problem of the incentive in the salary and promotional opportunities and also ensure regular interchange between the executive and educational institutions every 3 to 5 years. The controlling authority, however, should include representatives of the concerned interests.

17.7 It will be necessary to supplement this arrangement in order to provide for continuity and specialisation in the educational institutions and more particularly in the research organisations. It is suggested that in order to attract right quality of personnel for research, the pay scale at the lowest level should be made higher than the scale provided for

executive work though further promotions should be made on selection basis after the recruit has been given an opportunity to show himself up as a fellow after some years work. The aim should be to select research minded young-men with good academic records, give them adequate facilities for research and living (e.g. education of their children). It is understood that in some foreign countries, professors are given a year's leave with pay plus some additional out of pocket expenses for maintaining two establishments so that they could work in executive capacities. Secondly, technical people on the executive side are given leave up to six months for serving as visiting professors or lecturers from time to time. This problem is being taken care of by Member, Education of the Planning Commission.

Attitudes.

18. We give below an illustrative sample of generally felt attitudes/capacities. It does not mean that these are prevalent everywhere. In fact, they are not. At places individuals whether as administrators or engineers or finance men, have risen above these sectional attitudes. Yet, these attitudes do prevail:

- i) Members of the Corporation or a Committee or a Chief Engineer may feel that the real power for decision making, lies with the Finance Man, who - thus has power without responsibility

or may lead to the suggestion that the finance man should be a colleague.

- ii) The corporation or a Committee or an engineer may be uncertain of his powers or decisions and may let authority for decision-making slip to the finance man.
- iii) The finance man will object, in the first instance and ultimately agree in most cases. Anticipating that the Finance man must be given the satisfaction of having played his part by cutting down the demands, the Administrator/Engineer may present inflated demands.
- iv) The finance man may agree in a meeting, yet let his office scrutinise and object later.
- v) The finance man/accounts-man may forget the real cost implications and functions under the protective shield of rules for servicing the audit.
- vi) The engineer may get irritated because the authority and advice given by the finance man/accounts man comes in the way of his speed. He deems it none of his business to take decisions, which even under pressure of speed, have to be justified in terms of real costs. He may not appreciate the balancing required for determining the implications of his decisions in terms of real costs.
- vii) An engineer may regard his accounting responsibility as waste of his talent and testing of the decisions on the cost criteria as a nuisance and disincentive. The "Engineer must go to the field and not sit at the desk" confuses the issues. He, of course, should go to the field but should know how to control accounts without wasting time on the table. The organisation, procedure and training should balance these two essential functions of an engineer.
- viii) An engineer may not be experienced or re-orientated in regard to the management problems in their complex forms, nor trained in cost control or have experience in administration;

- ix) An engineer may delegate powers in terms which may be misused because there may not be supervision or inspection or he may not attach adequate importance to this aspect of his job in his concern for speed;
- x) The generalist administrator may start acting as boss rather than as a coordinator of complex talents and as the agent whose main function is to provide arrangements to get the best out of experts. His own role is also creative but not basically that of a boss. He may not be able to develop capacity for judicious stepping in and for carrying the organisation in the direction of the objectives. He has to learn the cost of building up men through delegation of persons and guidance.
- xi) Neither an engineer nor an administrator may be experienced in handling personnel problems or labour problems.

18.2 These attitudes are, in part, a heritage of attitudes of static regulatory administration; in part of defensive inhibitions of a specialist who may not always appreciate the new complexities which he has to manage and the need to keep himself under constant re-orientation. A Chief Engineer is not a specialist merely; he is an Organizer of a complex production assignment. The same is the case with the finance man.

18.3 The crux of the problem of attitudes lies in the fact that very often individuals (and the system) have not taken care to develop themselves (or the system) for the scale and the speed with which complex jobs have to be done. The finance man has to function with a production/cost outlook

rather than audit outlook. The engineer has to be trained to be cost-minded and should learn modern methods of management. The administrator has got to appreciate his role. Practically, all have to learn the problems of handling personnel and labour. That each public servant must spend Government funds as prudently as he would his own is a fundamental principle for constant application and guidance.

19. Integration of and cooperation between talents; an attitude of persistent search after efficiency and savings in cost; and the development of personnel, are the fundamental factors for securing efficiency and economy.

20. Specifically, we suggest;

a) Engineers at all levels must be given courses in cost control, industrial engineering and the senior amongst the profession should re-orient themselves in the methods of management, through seminars, personal visits, contacts and selected reading.

b) Training in industrial management should be a part of the syllabus of graduate courses.

c) Experienced middle level finance men with administrative experience be sent to large-scale projects in the country and even to large-scale industrial-cum-commercial organisations abroad to see in actual practice the approach and methods functioning on large-scale enterprises with speed.

No successful enterprise, whether in the public or private sector, can afford to ignore the arrangement for financial control. Yet, in large-scale enterprise outside the country, the managements have worked out a balance between delegation and supervision and control which permits over 90% of decision-making at the operational level.

d) The Ministry of Irrigation and Power has been equipped with internal yet independent financial advice as a first step towards the adoption of U.K. arrangements (which include a device for obtaining assessment of finance-mindedness of the administrative Secretary before the Prime Minister). We feel that the arrangement as in U.K. should be fully adopted, as soon as practicable.

and e) Similarly, the Chief Engineers in large projects should be provided with financial assistance and advice under them. The Finance Men's independence of course, will have to be preserved.