

**GOVERNMENT OF INDIA  
PLANNING COMMISSION**



**MANAGEMENT PLANNING  
IN PUBLIC ENTERPRISES**

**MANAGEMENT GROUP  
COMMITTEE ON PLAN PROJECTS**

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## INTRODUCTION

THE MANAGEMENT Group of the Management and Development Administration Division of the Committee on Plan Projects (Planning Commission) has recently been engaged in case studies of a few selected public sector projects. These studies have drawn attention to problems encountered by many of the projects during their construction phase as well as after production has commenced. Analysis of these problems indicates the lines along which action could be taken by project authorities. In general, the essential point is that in each phase of a project scientific management should be introduced. This involves identification of existing weaknesses; secondly, adaptation of modern techniques of management and control to various operations (differing according to the nature of an enterprise); thirdly, training, organization and motivation of personnel in an enterprise to apply the techniques and develop them into an integral and continuing part of the scheme of management; and, finally, a system of management information and reporting which will enable the management to plan, anticipate difficulties and undertake such replanning as may be necessary to attain their objectives.

The purpose of this paper is to present such conclusions and recommendations as have emerged from the studies carried out over the past several months. These are intended to stimulate greater interest in management techniques which are now being widely adopted in advanced countries and would have considerable value under Indian conditions as well. They may also suggest some of the directions in which responsible managerial and technical personnel in our enterprises may test their current practices, experiment with new techniques and approaches, seek more information where necessary and create enthusiasm among their fellow-workers for a forward-looking and innovating approach to problems of management, organization and motivation. The burdens they carry are indeed heavy, and their tasks onerous, but challenging.

### I

#### THE MANAGEMENT FUNCTION

"Management" has been variously defined; and one definition is that it is "the art of arranging things". There is reason to believe that until recently the management function has not been given its true place in the scheme of development. It has been somewhat implicitly assumed; sometimes it has been thought of as a routine which those

concerned would evolve. Its elements have been left undefined. The criteria to be met have not been specified; therefore, their fulfilment or otherwise has sometimes come to light too late for action. The tasks entrusted to the managements of public enterprises have been no doubt enormous in scale, the tools at their disposal frequently inadequate. Yet, the fact remains that, on a general review, the situation thus far in the public sector, specially in the relatively new area of industrial and mineral development, would suggest that:

- (1) the majority of public sector projects have taken longer to complete than was initially estimated;
- (2) the benefits from them have come in later than expected;
- (3) the majority of projects have cost the country more than was originally estimated, and
- (4) the returns on capital involved are/have been frequently smaller than was estimated when the projects were approved.

If these propositions are substantially correct in terms of the experience of public sector projects over several years, it follows that by every means available to us and as rapidly as possible our management capability must be greatly improved. It is a vital national interest—not the least from the angle of private industry itself—that the public sector should succeed in the tasks entrusted to it. By far the most difficult parts of the long-term and basic programmes of industrial development are being undertaken by public sector corporations and companies. If we consider the capital resources invested in them and the large numbers employed in industrial units, there is little doubt that public sector corporations are immense undertakings and each of them will become even larger. Thus, as a country we are committed to a policy of achieving a considerable part of our industrial and economic development by means of public sector corporations, and, each Five Year Plan will increase their significance in the economy and add to their potential for growth. Now, it goes without saying that we are a poor country; and every rupee put into the development of our resources has to pay off; we cannot afford to waste or lose money. It is not enough to recover interest charges or to reckon depreciation reserves as surpluses available for new investment. We must expect public sector corporations therefore, not only to perform their function of developing the country's industrial capacity but to *earn a profit* on our investment for us. This is how new capital is created; dividends from these companies paid to the Government on its stock ownership at the end of the Third Plan *ought* to give us substantial new resources to put back into the development of the country.

Now the fact is that hitherto we have been getting too little return on our investments; our public sector companies, by and large, have not produced profits in any adequate degree. It is not enough to be able to say "We have started with large handicaps, experienced personnel are not available, in due course the projects will pay." We can hardly forget that in a war, civilians-made-soldiers have to learn new skills very quickly, or be defeated. Ours is a struggle no less urgent, no less difficult. So we have no choice but to succeed and succeed quickly.

Before examining some of the steps necessary to get better results and returns—from our investment, and capital employment, it may be useful to consider what is involved in project development. Broadly speaking, a "Project" has to pass through three phases. The first, or the *pre-construction* phase, ends when the scope, dimensions, location, and other broad features of the project are decided on. *Construction* represents the second phase, and *production* or *operation* the third phase. Often the second and third phases are planned to overlap in order to initiate production at the earliest time. In each of these three areas, there are several steps to be taken to avoid past errors.

## II

### THE PLANNING OR PRECONSTRUCTION PHASE

There is an intimate connection between the quality of preparation that goes into this first phase, and the efficiency of management planning and control "downstream" in the construction and production phases. It is therefore necessary to stress the need for effective management techniques in this initial period. By the thorough use of advanced project analysis and planning procedures, ways have been devised to avoid many costly mistakes not only in the construction and operation of the project but even in the decision to go ahead with a project. In defence development projects in the U.S., for instance, the key has been a very thorough preliminary analysis or "Project Definition". Thus, before it is decided to build a new weapons system, or take up some very large project, an extensive analysis of the cost vs. the effectiveness of the new weapon, the weapons it will replace, what the development difficulties are apt to be, what the schedule is to be, how the project is to be managed, etc., are all gone into in great detail.

This kind of careful planning was always essential, and becomes even more so with the larger investment plans envisaged in the Fourth Plan. The cost of inadequate planning in the pre-construction phase has been indeed heavy. The Management Group of the Committee on Plan Projects is, therefore, trying to develop for use for

all projects carried over from the Third Plan and new projects proposed for the Fourth Plan, a standard "preliminary project description format". This is intended to serve as a check-list for the ministries, their technical planners or the public sector companies presenting projects. This will ensure that all important aspects of a project—the market analysis, transport, raw materials, costs, eventual foreign exchange savings, etc.—are considered in some detail. Experience confirms that this is a necessary discipline in planning. This preliminary report should also indicate information sources, so that the validity of the preliminary data and estimates can be considered. In the second place the Management Group expects to develop a standard outline for feasibility studies similar to the scheme of project definition, mentioned above, for projects which have been initially approved. It is necessary to define clearly what must be included and how best to undertake such studies of project feasibility, and to lay down guidelines for each of the elements in the report. Detailed project reports and feasibility studies may not be required for smaller projects; but on longer or high priority projects, they must be henceforth a part of our scheme of work under the Five Year Plan. In the past, lack of such detailed project planning has contributed to schedule slippages, cost overruns, and contractual difficulties.

### III

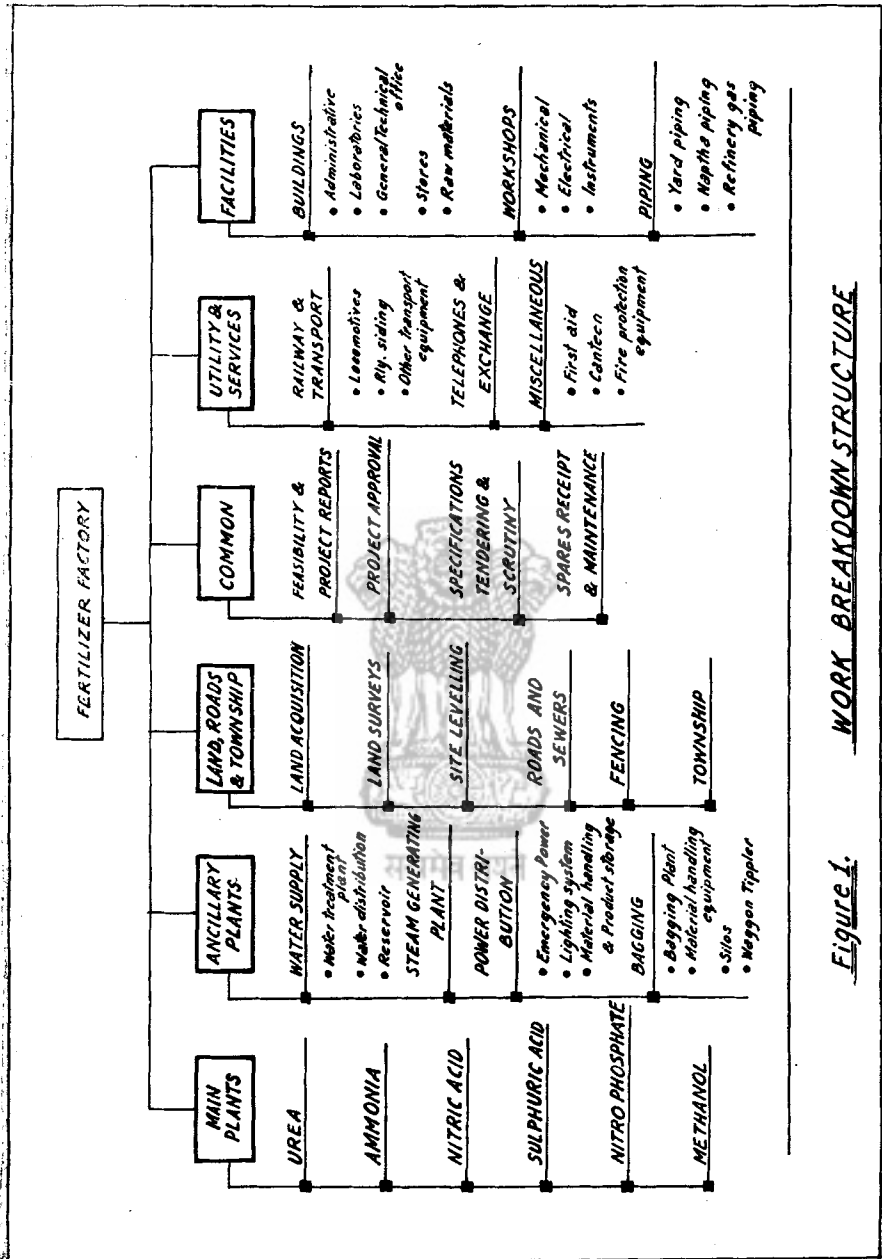
#### THE SECOND PHASE: CONSTRUCTION

After it has been decided to go ahead with a project, on the basis of the studies noted above, careful planning for the next phase of construction becomes extremely important. At this point capital funds are being committed and each commitment in turn involves other commitments.

The first step in such planning is the preparation of a Work Breakdown Structure. This begins at the highest level of the project with the identification of major work items and tasks required to attain the project and objectives. These major items are then divided into their components, and the components are further subdivided into more detailed units. Usually the subdivision in the Work Breakdown Structure is continued to successively lower levels reducing the complexity of work at each level, until it reaches the level where work can be subdivided into "manageable units".

This produces a graphic representation of the programme structure, and establishes a common framework for the accomplishment of all the work to be performed (Fig. 1).

Once the programme objectives are identified and translated into the Work Breakdown Structure, a plan of work for achieving each



**Figure 1. WORK BREAKDOWN STRUCTURE**

objective or item of work in the most desirable manner must be developed. Since not all the work and activities can begin simultaneously due to technical constraints and resource limitations, they must be put in some sequence and scheduled accordingly. This is done by what has come to be known as "Network" technique, "PERT", or "CPM".

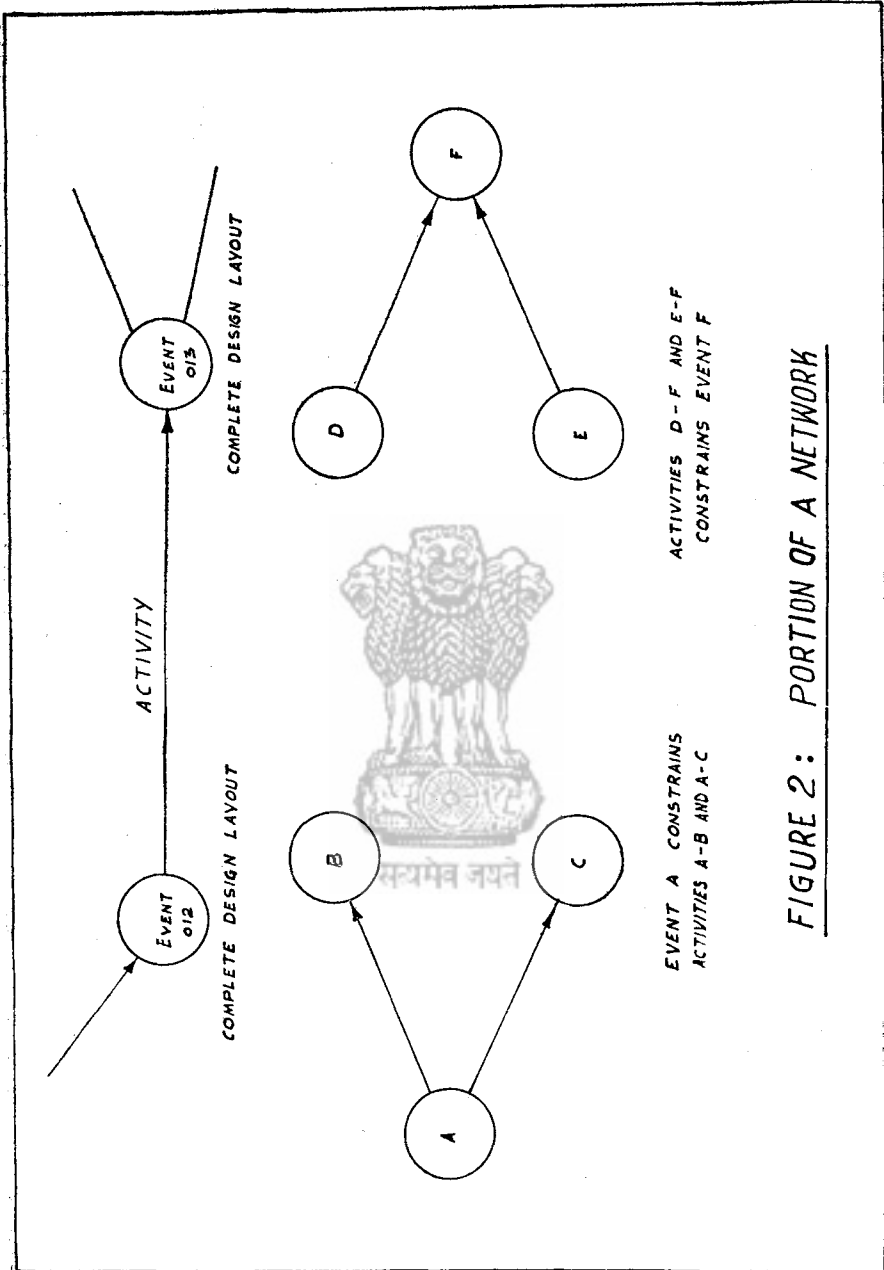
As is well known, PERT (Programme Evaluation and Review Technique), or CPM (Critical Path Method) were planning techniques originally developed a few years ago by E. I. Dupont for scheduling maintenance of large industrial projects, and by the U.S. Navy for scheduling research and development on the Polaris Missile. Both of these techniques describe the work of the entire project in the form of a Network showing the interdependence between the various activities. Although PERT and CPM started as two different techniques, they have now, over the passage of time, grown very similar and can generally be described under the title "Network Planning". In addition to maintenance scheduling and weapon systems development, it can be applied to the planning of any single project which has a definable end objective. Perhaps the most extensive application outside the two mentioned above, has been in the field of construction project scheduling.

A Network shows in graphical form the mutual dependence and interrelations that exist between the items of work on the project. Each item of work or activity is represented by an arrow and begin and ends in an event (represented by circles in Figure 2).

Construction of a Network is simplified by the preparation of the Work Breakdown Structure in which the project is divided into individual definable tasks. The Network can then be organized along the lines of the Work Breakdown Structure, thus ensuring that all items are included in the overall project schedule. In addition, the necessity for logical and detailed planning of the various tasks in a project that is required by this technique is, in itself, of considerable assistance in achieving the comprehensive planning required at the outset of a project.

A Network which has been completed, with the time entered for each job, is a preliminary work sheet for establishing a time schedule for the whole project. By adding time durations along the various paths through the Network, from start to finishing point it will be found that there is one limiting path which leads to the completion of the project. This "Critical Path" determines the time required to complete the project. If any time is to be saved on the overall project, it





must be saved on the activities which fall on the Critical Path (Figure 3).

Since all the paths, other than the Critical Path, require less time to complete the project, they have some amount of slack or free time. Thus we can recognize where to divert resources from non-critical paths (which have some slack) to critical paths and reduce the total project duration. In this way the project can be brought within a desired date of completion by application of a given measure of material and manpower resources. Indiscriminate expediting, which is purposeless and expensive, can be avoided; and selective use of resources on really worthwhile tasks can be ensured. Knowledge of the Critical Path can be used profitably in a number of other ways. At the outset of the project it permits management accurately to predict the completion date of the project. Secondly, it permits management to focus attention on the more important items in the total project. Further, Networks introduce an easily understood and common language of planning to all levels of the staff, and can be a very effective medium of communication. They also help management in co-ordinating the related efforts of different participants, including contractors, since they establish the relations of the participants among themselves and to the project as a whole.

This is a consistent and logical way to go about project construction planning and control. Its possibilities may be illustrated by citing a public sector project which used different and less sophisticated systems, both in the original planning and in the construction phase. The study of this project has led not only to recognition of the importance of the better project planning and scheduling methods, but has also revealed other difficulties which are commonly experienced in the construction phase. Some of the highlights may be briefly stated. In the instance studied, the following aspects are worth noticing:

- (1) The decision to proceed with the project in terms of a certain product mix was taken by Government on the basis of a committee report which laid down, in general terms, the scope and cost of the project, the pattern and production and a time schedule.
- (2) After global tenders came in, it was established that a particular country would provide the foreign exchange. The tenders had then to be submitted solely to suppliers in that country.
- (3) After work had started on the construction of the project, it was decided to increase the scope of the project and its product mix. This called for the installation of one additional plant, and the extension of another plant already partly constructed.

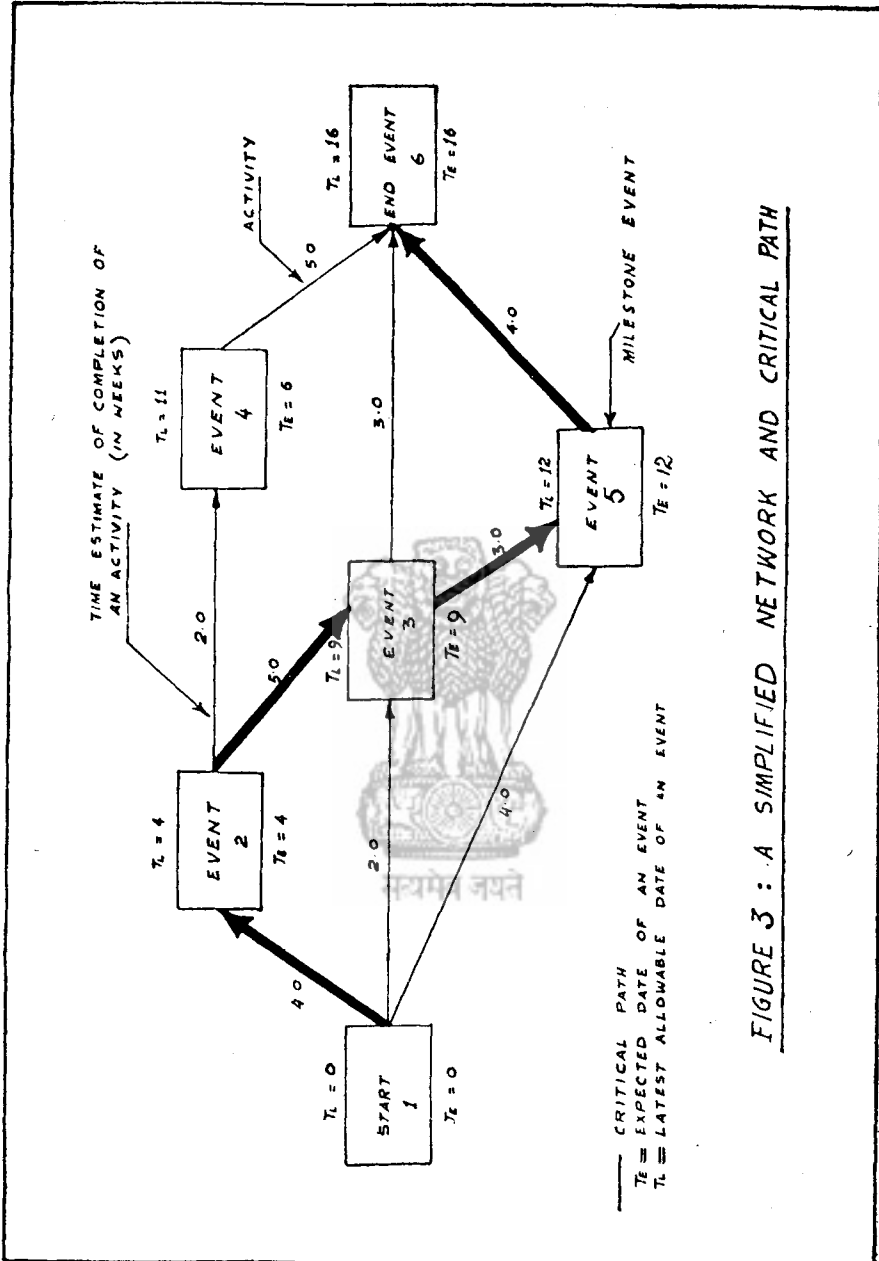


FIGURE 3 : A SIMPLIFIED NETWORK AND CRITICAL PATH

- (4) Further changes in layout and scope not originally envisaged, added to the difficulties under which the project was working.
- (5) The time required for completion is likely to be about 50 per cent more and the cost some 40 per cent more than originally visualised. A significant part of the increase in costs was due to changes in the scope of the project; a part due to the higher costs in the count in which orders were finally placed; another part to factors such as higher land prices, customs duties, financing charges etc., than had been anticipated earlier.

The principal lesson to be learned was that in this case the project planning had been inadequate. For a project of this size, feasibility and "project definition" studies should have been undertaken ahead of time. But there were also certain other lessons which may be less obvious. These may be listed.

#### (1) *Contracting and Contract Planning*

(a) In the contractual area, the enterprise was working with five equipment contractors and a civil works contractor. Before the contracts were let, certain periods were originally allowed for tendering for different plants. These periods were not long enough and had to be extended. A contractor who does not have sufficient time to prepare a complete and careful tender tends to weight his estimate to cover items which he has not had time to work out in detail. The cost eventually falls on the project.

(b) In selecting contractors the lowest bid generally appeared to be the ruling criterion. This practice often does not ensure that the most suitable contractor is chosen. In the case of two contractors on the project the low bid was much less than the immediately higher group of bids and yet the low bid of two contractors who were not suitable for a project of this size was chosen. Many of the later project delays could be traced to this initial decision. Extremely low bids need to be carefully scrutinized, as well as the ability of the low bidder to execute satisfactorily a contract of the size and nature proposed.

(c) Too long a time seems to have been taken over scrutiny of the contract tenders. Generally about twice the time allowed for tender preparation was taken to decide on the successful contractor. As this delay must extend the time for the plant to come into operation, it is essential that the decision on the successful contractor be arrived at as early as possible, consistent with a thorough analysis of the various proposals.

# Master Milestone Report

## FERTILIZER FACTORY.

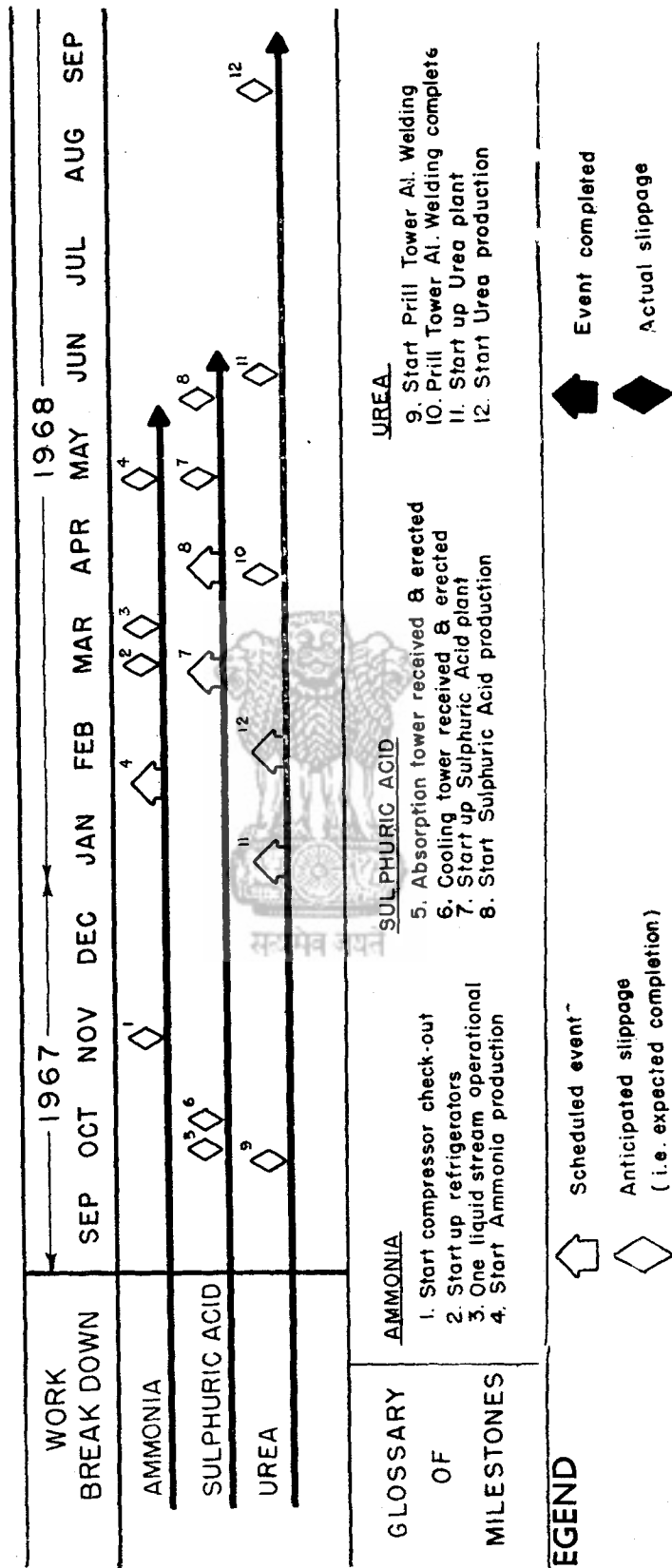


FIGURE-4

(d) Time from issue of the letter of intent to contract signing range from 3 months to 11 months. These delays seem to produce the following results:

- (1) In the case of foreign contractors, it delays payment and therefore commencement of work and its completion.
- (2) Once the contractor has a letter of intent, he knows he will get the job, and thus becomes a much harder man in negotiations on contract specifications.
- (3) Since specifications are not closely established in a letter of intent, project directors have, in this period, a minimal control over the contractors.

It is worth considering whether letters of intent need be used and whether fairly standard contracts cannot be developed, the proposed form for which can be issued with the tender. This would have speeded the signing of the contract.

(e) Finally, in the contracting area, much more attention must be given to contract preparation, and the controls inserted in the contract; as the control and co-ordination the project can assert over its contractors are directly related to the prior planning of contract conditions. It is extremely important that instead of relying too much on penalty clauses which usually are difficult to enforce, the emphasis be on better scheduling of the contract target dates. In addition, the inter-relation of the contractors must be planned and indicated in contract specification elements; in this case one contractor could not proceed without the drawings of another; equipment was delivered some months before buildings were ready, and so forth. The answer lies in better overall project scheduling, which identifies dates at which plant suppliers are to supply scope drawings, production of detailed drawings from the civil engineering consultant, the construction and erection of major plant elements, etc. These then can be identified as "milestones" in each contract, and related to payment clauses (Figure 4). The development of such schedules requires detailed planning of the project, and it is essential that the necessary time to undertake the planning be allowed. Also involved is monitoring, during the construction phase, to insure that the contract plan is being followed, or to make optimum adjustments, to assure the least overall slippage which affects the critical path.

## *(2) Construction Phase: Organization and Management*

A significant and vital feature during the construction phase is the "Management Plan". The engineers needed to design and construct a technical plant require different sets of skills than those who

operate the plant. It therefore does not seem to be sufficient to establish the entire departmental organization of the proposed company, with some extra staffing in the engineering functions, and hope that all will go well. Besides, not all departments need to be staffed during the construction phase. Indeed, the training and phasing of department staff is an important element of a carefully prepared management plan.

It does not seem to be efficient, therefore, to begin complex new industrial projects each time, with eager but inexperienced personnel, who may repeat many errors that could be avoided. This phase requires highly skilled technical personnel. This talent is still in short supply in India; so the best use of this talent needs to be made. It may well be that, in industrial project construction, we should employ the experienced personnel—those who have acquired knowledge of the construction phase problem of a given industry—and consider them as specialists in this field. Our past tendency has been to find jobs for these people in the project, once the construction phase is substantially complete. One question is whether this kind of talent and experience is not better employed in the next new project to be constructed, and the next, within the industry.

### (3) *Reporting Systems*

Timely and accurate information is essential for the efficient operation of any organization. Without it a manager must rely on the uncertainty of opinions and verbal reporting. Without timely reporting serious schedule slippages or cost overruns may come to management attention only after the opportunity for corrective action has been lost. The ideal reporting system identifies and ranks project problems, and assesses their possible effects, in time to plan the best possible course of remedial action.

A good reporting system must also supply information in a form which is most useful to the manager. Thus, targets must be established for each item of cost and time, and management reports must identify potential slippage by comparing performance with those targets.

Information required in the construction phase must provide this comparison between *plans* and *actual* performance.

Although construction reports on existing projects are prepared in great detail, the ability to compare plans and actuals is frequently lost. For example:

Projects frequently report progress in percentages such as "steel 20 per cent erected" or "building 80 per cent complete". These reports do not explain whether these rates of execution are satisfactory or if the job is on schedule.

Project cost reports often consist of a "monthly review of capital expenditure", and a "monthly statement of ways and means". These reports, however, do not supply a firm base for comparison such as the original project cost estimate; instead they provide a short-term control such as "current year's budget" or "borrowings and expenditure", and the picture of progress vs. original plan is not projected.

It is, therefore, important that the project cost estimate and the major project target dates be used as the basis for comparison in top level management reports.

Management reports must also have a predictive capability which can identify both funding and physical requirements. Since the major expenditures on a construction job are contractor progress payments, management reports should forecast the funds required to meet these payments. Thus the contract schedule must be precise enough to identify the work to be completed in each time period, and consequently the payments required. Only then can an accurate budget forecast be made. With such predictive reporting, responsive to changes in project schedules, it is possible to establish a sound financial plan for each contract, and consequently for the total project.

In summary then, the management reports needed during the construction phase should be timely, predictive, and based upon long term targets and cost estimates.

#### IV

#### THE THIRD PHASE : OPERATIONS

Some of the areas of difficulty which have been identified through studies of operating public sector companies include the following:

- Production planning and control;
- Financial control;
- Cost control;
- Materials management;
- Management information.

As an example, some of the shortcomings can be illustrated by reference to one large public sector industry which has been studied. It is worthwhile going into some detail, because analysis techniques for problem identification are as important as logical approaches and problem solutions. Also to be noted is the need to establish projects,



and schedule them, to ensure that the solutions agreed upon are put into effect. In the industry studied, the problem areas seemed to be:

*(1) Production Planning and Scheduling*

- (a) The production planning was done in an insufficiently systematic way by individual departments rather than through an integrated system. Consequently, production planning in different departments was not co-ordinated.
- (b) There seemed to be a real need for longer term planning, brought up-to-date every quarter on a formal basis, in this case a production and materials planning schedule of at least eight quarters.
- (c) Materials planning was decentralized and handled by individual departments, each according to its own system, thus resulting both in excess inventories, as well as shortages.
- (d) No standards for performance and costs of basic operations had been set to permit comparison against actuals, determine differences and analyse reasons for discrepancies.
- (e) Labour productivity was unacceptably low.
- (f) There was considerable room for improvement in communications between management and labour.

*(2) Financial and Cost Area*

- (a) A projected ways and means budget is not an efficient substitute for a regular, monthly cash flow (money expected to be paid from accounts due and other sources, against payroll, bills due, and other cash outlays the company must make).
- (b) A comprehensive budget for income and expenditure is not prepared, with the result that comparisons of actuals with pre-determined estimates can be made periodically and product-wise.
- (c) Township costs are mixed up with operating costs and other activity cost because they are indirect costs (fire protection, water supply, etc.). There should be a clearer separation of township expenditure as against company operating expenses, in order to get a more refined analysis of costs of operation.
- (d) Costing procedures need careful re-examination.
- (e) Actual costs of completed job orders are not ordinarily available to management until months after the job is finished; this is too late to correct deficiencies.

- (f) Payment of bills due is often heavily in arrears with the result that many firms may hesitate to grant the company credit or will make upward adjustments in supply prices or delay deliveries.

### (3) *Materials Management*

- (a) Each department orders its own "special" material, on its own material planning basis. There is no standard procedure for determining production bills of material against planned stock levels of major components, raw materials, or minor components.
- (b) Components and raw materials are not identified as to "Foreign procurement", "Indian procurement", or "local manufacture"—though lead times for procurement vary widely.
- (c) Not all components are identified in a standard coding system—Coding is done only after issues have been made from stores, by the Accounting department. Material ordered from suppliers is not required to be identified by company code, for easy receipt and stock control take-up; and no catalogue of standard company stock items exists, for use on indents.
- (d) There has been no demand and procurement analysis for common items to determine, on any predictive basis, stock and safety levels, "A B C", categories, or other techniques found useful in inventory analysis. Inventory stocks tend to be very heavy.
- (e) Serious problems exist in receiving and inspection procedures, with delays of up to several months, while material is being processed into stock. Procedures for priority issue of materials holding up production may be unsatisfactory. Insufficient statistical analysis is made of receiving or inspection history to determine the causes of these problems.
- (f) General stores procedures were inadequate, for proper protection of materials received, or for documentation.
- (g) No organization, or standard procedure was in operation to follow up on material and required to prevent production delays.

### (4) *Management Information*

- (a) There was no central planning group to assist the general management, in developing projects for improvement of operations and to co-ordinate departmental plans, actions and schedules.

- (b) There was a lack of an integrated planning system in which sales plans were matched with production plans and schedules, and these related to cost targets, materials planning and labour scheduling.
- (c) Feedback information on results was usually late and often inadequate.

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Problems of the nature described above are not easy to solve in any enterprise, much less so in a large and complex project engaged, perhaps for the first time in the country, in a new industry for which there is no readily available experience to draw on. The directions in which solutions lie can be indicated in capsule form to serve as a rough kind of check list, but in fact a great deal of intensive and sustained work is needed for giving effect to the various steps proposed, and on some matters there is need for an experimental, trial and error approach. In this area there is need also for more systematic exchange of experience between various public enterprises. In the case under study, the answers seemed to lie in a series of actions, along the following lines:

In the *production planning and control* area, there was an urgent need for:

- (a) Developing production plans for eight quarters in advance: This was feasible, in this case, as the company has a large order backlog. It also is desirable, since many of their products take a long time to complete and much of their material must be ordered from foreign sources, with a 15-18 months' procurement and issue. This production plan would be updated at least quarterly, to reflect any changes, and subsidiary plans, affecting engineering, drafting, or materials planning, could be changed in accordance.
- (b) Establishing a standard production planning system for all departments, to keep track of total work being processed on *all* orders in the department:

This system would allow a more orderly analysis of machine loading, manpower and overtime needs, and materials scheduling; and allow the production scheduling to be balanced as necessary, for optimum results.

- (c) Developing standard times and costs for all or as many production operations as feasible:

It would presumably be necessary to factor the experience of other plants abroad in similar industries until these

figures could then be refined and updated. However, it is an absolute requirement to have standards against which performance can be measured.

- (d) Maintaining detailed records of all production slippages, down-time, and the causes: These data are extremely useful, because by analysis of the difficulties encountered, it is possible to establish the nature of a problem, and take action to correct it.
- (e) Comparing the actual performance against that planned; and investigating the discrepancies for several of the above recommendations: This is the technique of "management by exception".—*i.e.*, managers are more interested in what does not go as planned, or what may not go as planned. It seemed that the present lapses from planned performance were accepted too uncritically.
- (f) Developing a standard system of materials planning: This must relate to the long range production plans. This is needed to determine requirements for major components, then the bills of materials for parts and raw materials. This can be done for all end items which are fairly standard products; and it was considered that this company should standardize its product line more than had been done.
- (g) Establishing a standard system in the departments for follow up on items which are not on hand but needed 8 months ahead, 2 months ahead, etc.: This will allow shortages to be foreseen, and additional action taken to follow up on Main stores, on suppliers.
- (h) Conducting a special study of labour and management difficulties in the plant and seek the assistance of high level personnel for outside, if necessary. Frequently it is useful to have qualified "outsiders" analyse problems, since they can take a more objective view of the difficulties, as well as bring special expertise to the analysis.
- (i) Making a study of utilizing punch card equipment, for production and materials planning and control: It seemed that the company was already too big to operate on a manual system for its paper-work.

In the *financial management* area, the recommendations were:

- (i) In addition to the present budget, a more accurate monthly analysis of cash income and cash requirements should be made to obtain a realistic view of how much money will be required. This is especially important, since the concern is

operating at a projected loss; and the government must periodically fund, not only its construction requirements, but its operating losses, as well. The revenue budget (regular profit & loss statement) is not a sufficiently accurate tool for this purpose.

- (ii) There is need for a clearer demarcation of the capital and operating expenses of the company as distinguished from those of the township. At present payroll accountants compute deductions for utilities in each quarter, pay the bills, etc., and capital budgets show business facilities with amenities.
- (iii) The matter of direct labour and overhead at this company is both a serious and complex one. Part of the analysis technique is to sort out what may be temporary difficulty and what may be a continuing one. A further review of the direct labour charge system, and a more careful statistical analysis of causes for % "down time" also seems desirable.
- (iv) In respect of special orders, executed on a "job order" basis, the management of an enterprise should bidding on the basis of its standard costs, brought up-to-date periodically. It would then be able to compare its actual costs with the projected standard costs and could determine if the job was profitable and, if not, the extent of the loss, and the reasons why. Feedback on cost information to management office takes place several months after job order completion. This means the data are of historical interest only. They cannot be used to identify which department in the process caused most of the problem, how much of it, and why, and what needs to be done to correct the deficiency. The problem needs closer analysis, specially regarding the elements in the delay on feedback information on costs.

On *materials management (and procurement)*, it was proposed that:

- (a) A standard procedure for matching the requirements, for the advance production schedules, for major components, raw materials, and parts to actual stocks on hand and on order should be developed. Obviously, the inventory model must consider planned production increases, to increase automatically, the stock and safety levels as production increases. This is especially important for standard stock items.
- (b) Punched card accounting techniques should be utilized to analyse inventory demanded and find common items, in lieu of a manual system.

- (c) All items should be identified as either foreign procurement, indigenous source, or local manufacture; and an historical study of lead-time experience should be made to establish realistic lead-times, for categories (and sub-categories).
- (d) The coding of all items on a standard basis should be completed; and a catalogue of "Factory Main stores" with codes and standard nomenclature, for use in the plant should be published. Direct suppliers should use these codes, and mark them on their containers in order to increase speed of receipt and stock record take-up. A standard coding system is a must for the eventual accounting machine system needed for production and materials planning in a plant of this size.
- (e) After the machine accounting analysis outlined in (a) above, and the analysis of lead times, indicated in (c) above has been made, it will be necessary to develop an "ABC" listing, mark the cards, establish stock and safety levels, order times; etc., and dispose of long supply stocks.
- (f) Procurement Procedures: It would be desirable to:
  - (1) make an analysis of receiving and inspection records, to determine delinquent or inefficient suppliers; (2) undertake the maximum amount of inspection at suppliers' plants wherever possible; (3) liberalize procurement rules, to negotiate contracts with capable suppliers of high quality components which are found consistently to be a problem when procured on tenders; (4) introduce simplified purchasing procedures for all items below a certain cost level (of Rs. 5,000); (5) set up a follow-up procedure to assist production departments to check on items which will hold up production as noted above; (6) establish a unit in the Purchase Division to handle the follow-up, and conduct liaison with production departments, on a regular basis; (7) use information on procurement lead time to up-date safety levels on a regular basis.
- (g) Stores Procedures: It would be desirable to: (1) review stores procedures, using as a model those of another public sector company; (2) develop improved receiving procedures; improve organization of receipt personnel, set up procedures for handling of priority items needed for production, and make increased use of materials handling equipment to speed up receiving and clear the receiving area; (3) increase the technical capability of stock control personnel by introducing some young, engineering-trained people; and (4)

improve the keeping of statistical records on significant action in stores (number of receipts, process time, etc.).

Finally in the *management information area*, it was suggested that:

- (i) The company should organize a high level group of personnel with rather specialized experience in sales planning and market analysis, in production planning, in materials planning and stores procedures, in systems analysis, etc., to act as a staff for the General Manager. Their duties would involve longer range planning, planning projects to improve the efficiency and profitability of the company with departments concerned and co-ordinating action on such projects after they had been approved.
- (ii) Complete information requirements in various important fields of interest to management should be assured and an integrated planning and control system, which would delineate objectives in the departments and report actual performance, should be developed. This would require the development, first, of standard systems and procedures mentioned above; but such action would—then permit an integration.

## V

### CONCLUSION

In this paper an attempt has been made to identify some of the directions in which the approach of management planning could be developed in projects in the public sector. Broadly, these projects pass through three phases—planning, construction and operation. In each phase it is necessary both to make full use of established techniques and to explore possibilities of developing new techniques. In the planning phase the main emphasis has to be on careful project definition covering all aspects. In the construction phase, in addition to management concepts which are already familiar and could be applied more systematically, project managements could benefit greatly from the work break-down concept, the networking techniques and cost control, which have been briefly described in this paper. Case studies of enterprises also suggest, amongst other things, that considerations involving contracting and contract planning can be of great importance to the success of a project. In the operating phase, an enterprise has to build both on its own experience and the experience of other enterprises. There is wide scope for integrating the techniques of functional analysis described in this paper into the management practices currently in vogue in individual enterprises. These improved systems are needed

for ensuring efficiency, obtaining accurate and timely data on which decisions based on facts can be taken, and assessing quantitatively the effects of various decisions which management must take increasingly on its own initiative and responsibility. Top managers and senior personnel can do much to encourage their associates at all levels to study and recommend, experiment and adapt.

Management is essentially a dynamic and creative function and, at the present time, both in socialist and in private economies, much new ground is being broken. Developments under the Five Year Plans are throwing open enormous new possibilities. These will be realised in the measure in which high standards of management are established in all sectors of the economy, and more specially in Government's own undertakings. These are expected to set the pace for the rest. In the last resort, the impulse to higher levels of management has to come from within the community of workers in each enterprise. In shaping policies, Ministries and Departments at the national and State level can create conditions in which individual enterprises are free to innovate and develop new systems to a greater degree than may have been possible in the past. In some matters, outside expertise may be of help. Exchange of experience with other enterprises, both public and private, can be of value. In the main, however, each enterprise has to identify its own problems and seek its own ways of solving them. Much will depend on the readiness of an enterprise to organize itself for giving effect to improved management practices, providing the necessary personnel and training, and creating throughout the enterprise the desire to work together and succeed together.

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