

# Project management in the Coal Division of Gencor\*

by G. C. THOMPSON†, B.Sc. (Min. Eng.), M.B.L., F.S.A.I.M.M.

## SYNOPSIS

A total system for the simultaneous management of various projects is presented. The objectives of the present organizational structure of the Coal Division in respect of projects are listed, as are the requirements for effective functioning of this organization. The processes involved in strategic planning and in the identification, evaluation, and development of projects are described. The monitoring and control of capital, as well as project construction and production management, are discussed. Finally, the important role of project work in the development of management is stated, and the necessity for the continual assessment of the effectiveness of the project organization is stressed.

## SAMEVATTING

'n Totale stelsel vir gelyktydige bestuur van verskeie projekte word voorgelê. Die doelwitte van die huidige organisasiestruktuur van die Steenkoolafdeling ten opsigte van projekte word gestip sowel as die vereistes vir doeltreffende funksionering van die organisasie. Die prosesse van strategiese beplanning en van projek identifisering, evaluasie en ontwikkeling word beskryf. Die monitor en beheer van kapitaal sowel as die bestuur van projek-konstruksie en produksie word bespreek. Ten slotte word die belangrike rol van projekwerk in bestuursontwikkeling gemeld en word die nodigheid beklemtoon om die doeltreffendheid van die projekorganisasie deurlopend te oordeel.

## INTRODUCTION

This paper describes a total system for the simultaneous management of projects of various types through all stages of development. The types of projects range from completely new major mining ventures involving considerable capital expenditure, to minor non-capital projects of a technically innovative nature. The stages of development proceed from the identification of potential projects to their eventual successful operation.

## REORGANIZATION REQUIRED

During 1978 the need for reorganization of project management in the Coal Division of General Mining became more and more obvious. It was apparent that the previous approach, by which the various mines of the Division were grouped together in either the 'Projects' or the 'Operations' Department, would no longer suffice in an environment in which completely new mines, each supplying a specific market sector, would be the exception rather than the rule. Multi-product arrangements, in which export, domestic, industrial, and 'tied' power-station requirements could be satisfied from the same mine, could be envisaged. In addition, the continuing escalation in capital costs emphasized the importance of better utilization of the existing facilities and, where possible, the adoption of marginal expansion in preference to the establishment of completely new facilities. Thus, one could recognize many situations in which fairly complex projects could evolve upon existing operating mines. At the same time, developments in the utilization of coal for a great variety of end-products, and in the mining technology and equipment related to

improved extraction from reserves, meant that rationalized planning and decision-making for the Coal Division as a whole would also be essential.

Thus, an organizational structure for the Division was evolved to meet these changing requirements. This structure is shown in Fig. 1, which incorporates the changes that became necessary as a result of experience in 1979.

## ORGANIZATIONAL STRUCTURE

It was considered that the organizational structure of the Division had to meet seven objectives if it was to cope effectively with the planning and execution of its various projects.

(1) *Decentralized project identification.* Potential projects can be identified in any part of the organization, and can be conceived as arising from the identification of uncommitted coal reserves or other resources, market demand, a growth 'gap', potential improvement of profitability, or any other factor or combination of factors. However, the Development Manager (Coal) is specifically responsible for the identification, investigation, and assessment of potential projects that are not part of, or associated with, existing mines or projects.

(2) *Co-ordinated project evaluation.* The Development Manager (Coal), assisted by the Commercial Manager (Coal), is responsible for the evaluation and priority ranking of all projects that have been subjected to a preliminary feasibility study. Recommendations in respect of project priorities can thus be made to the Management Committee of the Coal Division.

(3) *Rationalized conceptual planning.* The Senior Engineer, who is accountable to the Senior Manager, Projects and Technical, is responsible for the rationalization of conceptual planning in projects throughout the Division. This ensures, as far as is practicable, that proven principles are applied to a variety of projects in different parts of the Division.

\*Paper presented at the Colloquium on Mining Projects: Evaluation, Financing, and Management, which the South African Institute of Mining and Metallurgy held in Johannesburg on 30th May, 1980.

†Gencor, 6 Hollard Street, Marshalltown, Johannesburg 2107.

© 1981.



(4) *Application of technical expertise.* The Technical Manager's Section has functional responsibility for the rational application of methods and equipment throughout the Division, and for the provision of specialist services in the fields of rock mechanics, ventilation, and general computer applications. The organization facilitates the application of this knowledge and expertise to particular projects.

(5) *Rationalized estimating and monitoring of capital.* In addition to his responsibility for rationalized conceptual planning, the Senior Engineer in the Projects and Technical Department provides, through the Cost Engineer, rationalized estimates and a substantially uniform system of capital control throughout the Division. The control of capital is the responsibility of specific line management, but the system is such that, at any time, the status of capital is available on the basis of a mine, a company, and the Coal Division.

(6) *Effective control and feedback.* The largest projects in the Division are retained in the Project and Technical Department until such time as the line itself is a sufficient base for its own further expansion to be the direct responsibility of the area concerned. This gives the Mechanical and Electrical Engineering Section in particular the opportunity of testing their conceptual planning in practice. It affords practical experience and direct feedback for the improvement of future conceptual planning, and avoids the situation in which planning 'handed over' to another Department for implementation is rejected in principle by the Department. At the same time, mines on which ongoing operations constitute the major workload do not burden the project department.

(7) *Co-ordinated manpower planning.* Through association with the development of the whole Coal Division, the Project and Technical Department is able to provide the basic information for comprehensive manpower planning to the Manpower Manager (Coal).

#### REQUIREMENTS FOR EFFECTIVE FUNCTIONING

The fundamental requirements for the effective functioning of the project organization include co-ordination and teamwork.

##### Co-ordination of Potential Project Inputs

Although potential projects can be identified anywhere in the organization, it is essential that the Development Manager (Coal) should receive the market input, even before project proposals are formulated, in order to prevent overlaps and gaps in the reaction of the Coal Division as a whole.

##### Teamwork

All the projects that could lead to capital expenditure must involve the Mechanical and Electrical Engineering Section of the Project and Technical Department as team members at an early stage so that the advantages of the rationalized conceptual planning and estimating described earlier can be effectively realized.

Similarly, all the proposals that could lead to expenditure on methods and equipment must involve the Technical Manager's Section as team members at an

early stage.

The selection of the project leader and team members for accepted major projects is made by the Management Committee of the Division.

#### FUNCTIONING OF THE DIVISION

The main project functions of the Division include the monitoring of markets and resources, as well as processes for the matching of these two factors; the development of markets, resources, and processes; strategic planning; identification, evaluation, and development of projects; capital monitoring and control; and project construction and production management.

##### Monitoring of Markets and Resources

The continued existence and growth of any organization is highly dependent upon the extent to which it is aware of the changing environment, and the extent to which it is able to react successfully to stimuli by separating the input information into what is worth pursuing and what is not. This input information includes potential markets and resources, and the potential processes by which markets and resources are matched. This is a specific function of the Development Manager (Coal) under the direction of the Senior Manager, Marketing and Development (Coal), and together with the Marketing Manager (Coal), the Consulting Geologist (Coal), the Chief Fuel Technologist (Coal), and members of their departments.

##### Markets, Resources, and Process Development

The Marketing Manager (Coal), together with the Development Manager (Coal), actively promotes completely new business outside the coal-selling organization. Products other than coal may be involved where these are derived from, or in association with, coal. Co-operation with the Commercial Department of the Corporation may be necessary.

The Development Manager (Coal) participates in prospecting planning with the Consulting Geologist (Coal) and Assistant Consulting Geologist (Coal). He also participates with the Chief Fuel Technologist (Coal) and one of the two Project Managers in the development of processes for the recovery of products other than coal, where these are derived from, or are in association with, coal. Co-operation with other Divisions of the Corporation and bodies outside the Corporation may be necessary, such as in the Northern Transvaal Project.

##### Strategic Planning

###### *The Zero Plan*

The zero plan defines the growth and eventual decline of the Coal Division, emanating from the planned financial contributions that will be made by operating mines and approved projects until the end of their lives or the period for which the zero plan is being drawn up, whichever is the shorter period. The zero plan covers a period of at least 10 years, but preferably 15 to 20 years. It is a forecast of the Coal Division's future financial pattern and life if no additional new projects are brought into being. It consists of the forecast of financial results that will flow from the long-term approved plans for operating mines and approved projects. The zero plan is

revised annually, subsequent to the approval of the five-year plans by the Coal Division Management Committee. It is the responsibility of the Financial Managers of the Coal Division and the Corporation, assisted by the Commercial Manager (Coal), to draw up the zero plan.

#### *The Strategic Plan.*

The Executive Committee of the Corporation and the Boards of Directors of the companies concerned determine the required growth rate of the future earnings and dividend pattern of the Coal Division. The Commercial and Development Managers of the Coal Division compare the zero-plan estimates plus the estimates of projects in planning (defined later) with the desired growth rate, thereby determining whether the desired growth rate will be met, or whether and when a shortfall will occur. Should there be a shortfall or 'gap', it must be filled with foreseen projects (defined later) in order of priority. This total exercise is, in essence, the compilation of the strategic plan, which is then approved by the Management Committee of the Coal Division before submission to the Executive Committee of the Corporation for its approval.

### **Project Identification**

The process of project identification, together with that of project evaluation and development, is represented conceptually in Fig. 2.

Once a project has been identified as described earlier, it becomes a *potential project*, and a project proposal is submitted through the line to the Management Committee. This proposal incorporates a broad description of the project, the contribution that it is expected to make, the market that it will serve, a 'ball park' estimate of the capital required, and the estimated rate of return (if possible). The Management Committee of the Coal Division then deliberates on the suitability and possible viability of the potential project. If it is acceptable in principle, it is classified as a *foreseen project* and is referred back to the originator (at area level) and/or the Project and Technical Department for a preliminary feasibility study. The Management Committee also decides on the composition of the team that will be responsible for this study. For a major project based on or associated with an operating mine, the project leader is usually the Area Manager concerned.

When completed, a report on the preliminary feasibility study is submitted to the Management Committee, who may reject the project, refer it back for additional investigation and information, or accept it with a certain priority ranking as assigned to it by the Development Manager (Coal).

### **Project Evaluation and Development**

#### *Foreseen Project*

A foreseen project is one that has been identified and accepted as such by the Management Committee of the Coal Division. These projects are utilized by the Management Committee in order of priority ranking to fill the gap that may exist between the zero plan plus projects in planning and the required growth needed to fulfil the requirements of the strategic plan.

#### *Project in Planning*

A foreseen project that has been accepted with a certain priority ranking by the Management Committee of the Coal Division is submitted to the Executive Committee of the Corporation and to the Board of Directors of the company concerned with the recommendation that it be accepted as a project in planning. The Executive and/or Board may refer the project back to the Management Committee for amendments, additions, or revision before finally accepting it.

When the project has been accepted as a project in planning, the Management Committee decides on the composition of the project team and the team leader who are to evaluate and plan the project in detail. The project now passes through two distinct phases before it is finally approved.

(1) *Planning design and project evaluation.* The project team now plans the project in detail. The Commercial Manager (Coal) is intimately associated with the project, and starts compiling notes for the subsequent design of the commercial package. This phase of planning comprises a full feasibility study of the project and all the conceptual thinking, planning, and design that are associated with it from the evaluation of reserves to the accurately assessed market situation, selling prices, mining methods, beneficiation, detailed capital requirements, operating costs, manpower requirements, profits, tax, cash flow, and rate of return. The projected results of the project, as well as its various components, are subjected to sensitivity analyses, which highlight the areas in which the project is most vulnerable to changes in parameters such as escalation, washing yields, market prices, production volume, and operating costs.

(2) *Financial design and evaluation.* The project in planning now passes into the field of the financial department. The Commercial Manager presents the funding requirements and other financial details to the Financial Managers of the Coal Division and the Corporation. This team considers the financial implications, and formulates a package for the funding and financial gearing of the project in consultation with the General Manager of the Coal Division, the General Manager, Finance, and the Executive Chairman. This phase represents the financial conceptual design of the project, and it is during this phase that the parameters to be used for the negotiation of sales contracts and the financing of the project emerge. Projects in planning form part and parcel of the strategic plan of the Coal Division.

#### *Approved Project*

When the two phases of the project in planning as outlined above have been completed, the full report and the initial application for capital expenditure are submitted, via the Management Committee of the Coal Division, to the Executive Committee of the Corporation and to the Board of Directors of the company concerned for final approval. Once again, the Executive and/or the Board may refer the project back to the Management Committee for revision or any conceptual changes that they require.

When the project has been approved by the Executive Committee and by the Board, it is classified as an

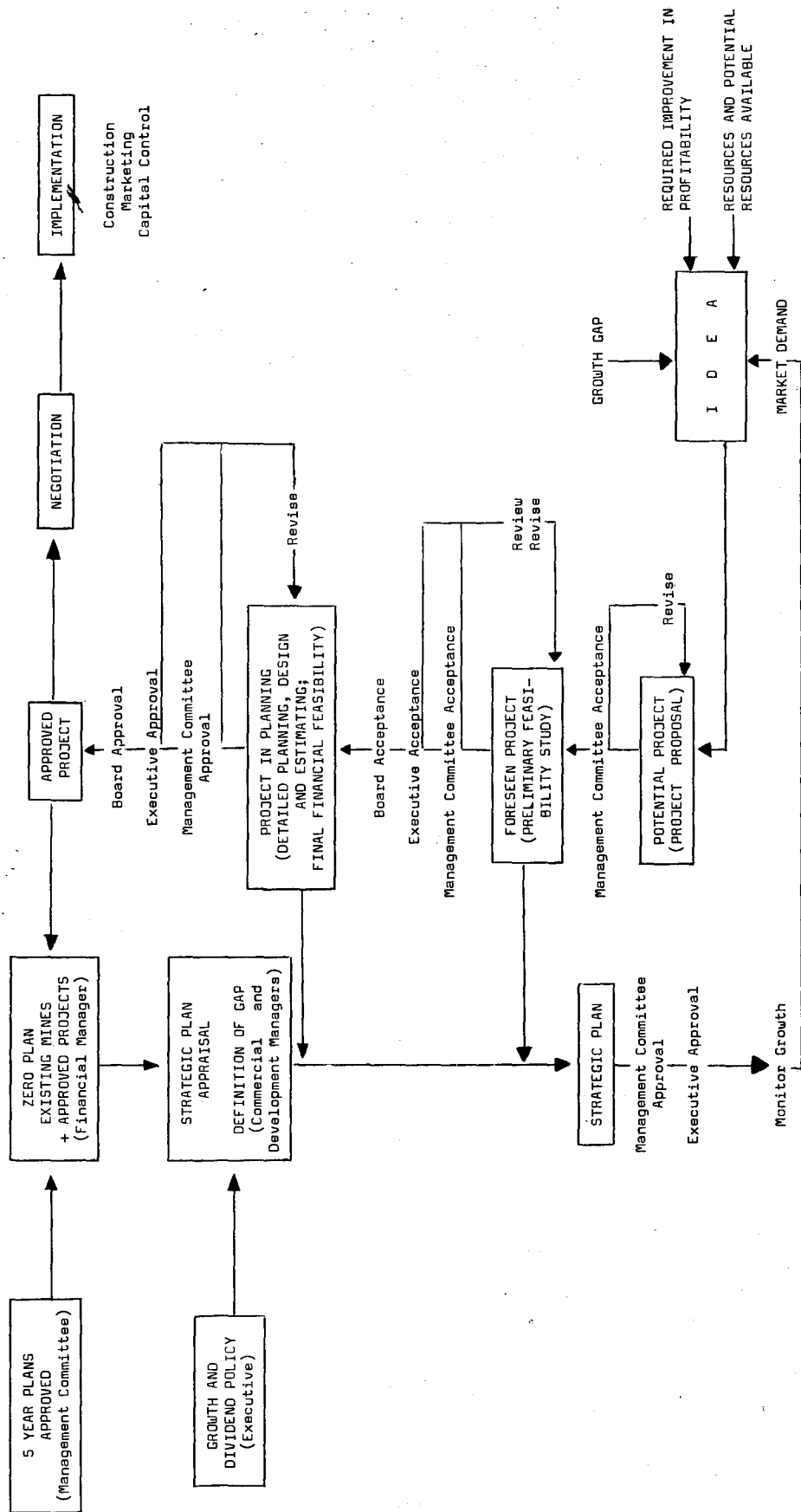


Fig. 2—Conceptual model for project identification, evaluation, and development

approved project and becomes an integral part of the zero plan.

#### Negotiation and Implementation

Only at this stage can negotiations for sales and for financing of the project proceed along the lines approved by the Executive Committee and the Board.

Once approved, the project can be implemented within the framework in which it was approved. Construction can proceed, marketing strategy can be implemented, and capital control can be applied to every item that was detailed in the planning phase.

#### Capital Monitoring and Control

##### Co-ordinated Capital Monitoring and Reporting

The Senior Engineer in the Projects and Technical Department is responsible for the provision of a standard system of capital monitoring and reporting on all projects throughout the Division.

The Cost Engineer provides standard capital status reports on the basis of a mine, a company, and the Division. These reports for individual mines are compiled by the mine and submitted to the Cost Engineer for checking and further consolidation. An example of a capital status report for a specific project is given in Table I. It refers to one mine of a complex of three at Matla, and was compiled from assessments of the status of a number of individual capital jobs on that mine.

Two points are worthy of note:

- (1) the adoption of a base date for reference and control purposes, and
- (2) the separation of commitments and expenditure for reporting purposes.

A commitment is incurred when a letter of intent is despatched or an official order placed, and expenditure when payment on an official invoice is made.

##### Responsibility for Capital Control

For each project, a detailed capital budget is drawn up, the final compilation being the responsibility of the

Cost Engineer. The budget is expressed in values as at some appropriate base date, and, from a schedule of capital expenditure phasing, a projection is made of cost escalations. Hence, the costs are calculated as at the completion of each item, each job, and the whole project. A contingency amount, which is calculated according to a percentage contingency allowance determined for each job, is included in the total budget estimate. The purpose of the contingency amount is to allow for justifiable expenditure on items that were previously, for good reason, completely omitted from the budget, or for additional expenditure because of a justifiable change in planning parameters.

The initial application for approval of the capital accompanies the budget, and includes the commitments to be made and the expenditure to be incurred during the current and ensuing financial years. Revised estimates of the capital required for the total project are submitted for approval on an annual basis, together with capital applications for the commitment to be made and the expenditure to be incurred for the ensuing year.

The system of capital control is based upon two fundamental measures:

- (1) a primary control, which is exercised before a commitment is made, and
- (2) a secondary control, which is exercised before a payment is made.

A statement prepared by the Cost Engineer accompanies each order to be placed. It stipulates the amount to be committed in base date values as compared with the budget, and the effect of making the commitment on the status of the item, the job, and the entire capital vote.

Every order must be approved, before it reaches the Purchasing Department, by the respective Area or Project Manager and by the Chief Consulting Mechanical and Electrical Engineer (Coal). Where a commitment will result in an overexpenditure exceeding defined limits, where the use of part of the contingency amount is

TABLE I  
CAPITAL STATUS REPORT IN RESPECT OF APPROVED PROJECTS ON PROGRESSIVE BASIS YEAR TO DATE FEBRUARY 1980  
(IN RANDBS)

Capital vote no. M1/2	Cost codes no. D07D/C11M	Mine Matla no. 1	Description of project u/g power-station mine	Date of report 3/3/80
A. Total amount budgeted	Base value November 1975 35 979 000	Escalation 16 550 000	Escal. incl. 52 529 000	Explanation of variances (amounts exclude contingency)
<b>Commitments</b>				
B. Progressive total approved	34 641 000	14 892 000	49 533 000	Brief description of progress Second module of plant will be completed within 2 months
C. Progress to date: Actual	26 250 180	7 766 316	34 016 496	
D. Budgeted	31 275 000	9 228 000	40 503 000	
E. Estimated further commitments (F-C)	7 833 354	7 353 689	15 187 043	
F. Estimated cost on completion (C+E)	34 083 534	15 120 005	49 203 539	
G. Overspent/underspent				
—Previous month	—648 616	+187 218	—461 398	
—Current month (B-F)	—557 466	+228 005	—329 461	
<b>Expenditure</b>				
H. Progressive total approved	29 172 000	10 058 000	39 230 000	
I. Progress to date: Actual	23 645 424	6 555 165	30 200 589	
J. Budgeted	26 456 000	8 251 000	34 707 000	

proposed, or where imported items are involved, the approval of the respective Senior Manager is also necessary.

All invoices for capital work are submitted to the Cost Engineer, who checks the claims against the order, particularly in respect of calculations of escalation. After verification by the relevant Senior Engineer, the mine Engineering Manager finally verifies that the equipment is on site, or that the contract is being or has been executed to his satisfaction, before payment is made from the mine.

To assist in capital control and to supplement the status reports of the type shown in Table I, two other reports are drawn up monthly for each project from an assessment of each job. These are a cost-escalation status report, and a contingency status report.

The cost-escalation status report analyses variances in cost escalation under three headings:

- (1) those due to variances in base date costs,
- (2) those due to changes in official cost-escalation indices, and
- (3) those due to variations in the timing of expenditure.

(It should be mentioned that the Technical Manager (Coal) is responsible for the provision of a standard system for monitoring extraordinary expenditure on working costs throughout the Division on major non-capital projects, and on minor non-capital projects of a technically innovative nature. The responsibilities and controls are very similar to those described for capital.)

## Project Construction and Production Management

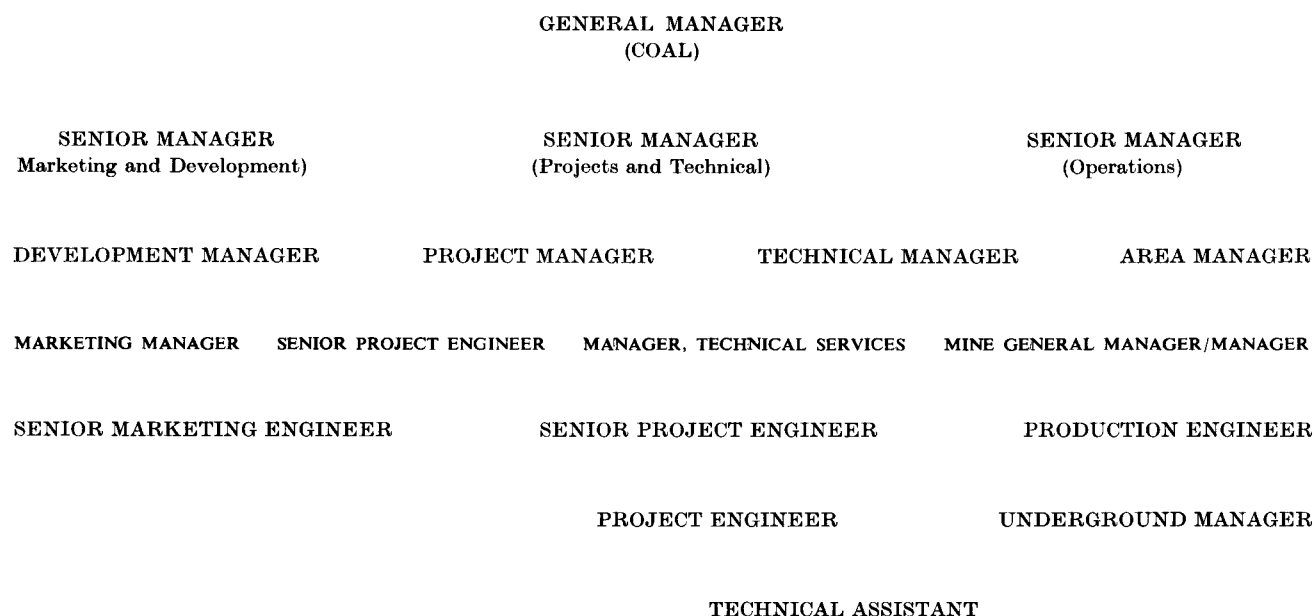
### *Individual Project Organization*

Project construction and production are entirely the responsibility of the relevant Senior Manager's Department; that is, the Project and Technical Department is responsible for these aspects only on the projects that are the direct responsibility of the Department. At the present time, this involves only Matla and Optimum.

Generally, it can be said that the departmental organization is employed in the normal manner as far as is possible, with specific appointments at mine level for construction and production management — separated if necessary. Each Area Manager has his own staff serving three mines; in acknowledgement of the considerable work load associated with Matla and Optimum together, the staff of the Project Manager concerned is available only for these two mines.

### *Control of Construction Standards*

Depending upon the scope of the project, a Project Engineer and staff may be appointed at the mine with specific responsibility for construction standards, but regular site inspections are conducted and site meetings are attended by Area or Head Office staff. Modifications to original orders that exceed stipulated amounts must be authorized by the Area Manager and the Chief Consulting Mechanical and Electrical Engineer (Coal); larger amounts require authorization by the respective Senior Manager as well.



**Fig. 3** —Simplified illustration of typical development opportunities for mining engineers through participation in project work (it should be noted that the organizational levels are only approximate)

### *Production Planning, Control, and Feedback*

Many projects undertaken by the Coal Division involve construction work over protracted periods of time, during which production from the project builds up to its eventual level. A typical example is a three-mine complex such as Matla Coal, which is being constructed over a period of some nine years with production building up to a maximum over some six years. During the construction period, production requirements and production technology may change considerably.

Production performance must be constantly compared with the predictions, and action must be taken to rectify deviations. If this is not done, productivity, capital requirements, operating costs, and return on capital could alter drastically, perhaps turning a previously profitable venture into a poor investment.

The action taken will almost certainly include replanning. Hence, it is necessary each year for every mine to prepare a five-year plan that includes its projects. This replanning may also indicate that changes are required in the method of project financing, and may obviously also be necessary more frequently than once a year.

### MANAGEMENT DEVELOPMENT

Because of the broad scope of involvement, the Division regards participation in project work as an excellent means of development for general management. For this reason, projects are used specifically for both personal/technical and management development: most of the posts of Project Engineer and Senior Project Engineer are occupied by young men in the formative years of their careers.

As shown in Fig. 3, a typical promotional route for a mining engineer could be as shown below. (The use of the term *mining engineer* does not imply that these avenues are not open to other aspirants; certain posts obviously require statutory qualifications.)

- (1) Technical Assistant
- (2) Underground Manager
- (3) Project Engineer
- (4) Production Manager
- (5) Senior Project Engineer
- (6) Mine General Manager
- (7) Development Manager
- (8) Senior Manager.

To be effective, an organization must be dynamic; while acknowledging that disruption can be most ineffective, the Coal Division does not hesitate to change its organization after carefully assessing its effectiveness in responding to changing circumstances. Since project work is essentially concerned with changing the *status quo*, the necessity for continual assessment of the effectiveness of project management is also recognized.

### ACKNOWLEDGEMENTS

The author thanks the General Manager of the Coal Division for permission to publish this paper and, more specifically, for his considerable contribution to the subject matter. The author also gratefully acknowledges the assistance of the Development Manager (Coal) and the Senior Engineer in his department, as well as the valuable suggestions made by Escom management some time ago in discussions with them on the control of capital.

---

## Asian mining

Asian Mining '81 is an international conference that is being organized by the Institution of Mining and Metallurgy in response to the growing interest in the South-east Asian minerals industry. It is to be held in Singapore from 23rd to 26th November, 1981. On 23rd November, keynote speakers will appraise the mining scene in south-east Asia and outline opportunities for investment within the region. Over the following three days, technical papers on current mining projects in Asia will be presented for discussion by authors from the ASEAN countries, Australia, Canada, India, Hong Kong, Japan, Papua New Guinea, the United Kingdom and the United States.

Registrants may participate in the specialist technical visits in Malaysia and Indonesia, and attend the associated Asian Mining '81 exhibition, organized by Industrial Trade Fairs International, Ltd, to be held at the World Trade Centre.

The importance of these events is highlighted by the bodies who are actively supporting the conference — the Indonesian Mining Association, the Malaysian Section of the Institution of Mining and Metallurgy, the Chamber

of Mines of the Philippines, the Mining and Metallurgical Institute of Japan, the Indian School of Mines, Dhanbad, and the Australasian Institute of Mining and Metallurgy.

*Asian Mining '81*, the volume of papers to be presented at the Singapore conference, will be published in October 1981, and all registrants will receive one copy as part of their registration fee. Copies of the volume may be purchased at the prices indicated below:

#### Registrants

One or more additional copies £28.00 each

#### Non-registrants

One or more copies purchased before 1st October, 1981 £28.00 each

One or more copies purchased after 1st October, 1981 £35.00 each

All enquiries in relation to the Asian Mining '81 conference should be addressed to the Meetings Secretary, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England (telephone 01-580 3802; telex 261410; cables Minanmet London W1).