

SPOTLIGHT

on mining projects: evaluation, finance, and management

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"Mining Projects: Evaluation, Finance, and Management" held in May 1980 rounded off a theme started with the colloquium on "Exploration Feasibility Studies and Investment Analysis" held in 1979. Seven papers on various aspects of the potential path of an ore-body from an exploration concept through to discovery, evaluation, and financing, to the management of the construction phase, were presented to the 300 delegates at the colloquium held at the National Institute for Metallurgy.

Opening

Dave Viljoen, President of the South African Institute of Mining and Metallurgy, in his opening address, pointed out that estimated capital to meet projected world requirements until the end of the century for copper, aluminium, iron, nickel and tin is \$278 000 million (in 1977 dollars). Under present conditions of high rates of inflation and wildly fluctuating metal prices (caused partly by speculation and rapidly increasing costs of energy), the management skills necessary to invest successfully the sums of money required, have to be developed to a high degree.

This colloquium was designed to give delegates the benefit of recent experience and thinking in various areas of the mining industry.

George Nisbet of Anglo American Corporation was Chairman for the morning session at which four papers were presented.

Ore Reserve Estimating

Howard Bird of Falconbridge Nickel Mines, Canada presented the first paper on "Ore Reserve Estimating and the Appropriate Geological Involvement." He stressed several points which he felt are often overlooked in this country because of the predominance of gold mining with its relatively simple geological conditions. Among the points he raised were as follows.

- (1) That when mineralisation was discovered and was being evaluated to see whether it could be an ore-body, the geologist should be collecting and recording information in such a way that it would be suitable and immediately accessible should a mine eventuate. Geological information should be gathered, recorded, interpreted and presented in such a way that it suits the characteristics of the mineral deposit, and is of direct use to engineers and metallurgists, both from technical and financial view points.
- (2) That when geological reports are presented for

further engineering and financial analysis it is essential that the geologist is involved.

- (3) That geologists should be involved in estimating ore reserves.

Computers

The second paper, entitled "The Role of Computers in Geological Mineral Evaluation and Mineral Project Management", was presented by Bart Cross, consultant to Control Data (Pty) Limited. He dealt with geological aspects but covered the uses of computers for recording, analysing and presenting geological data in various forms and under different assumptions of controlling factors. The first part of his paper outlined the history of the organisation changes in computer departments. At one time technical users tried to obtain service from commercial-type computer sections that did not understand and did not want to understand the problems that technical users had, which evolved into technical computer groups reporting to technical directors. As a result of improved data communications and a wide range of software and hardware designed for technical applications, the power of the computer was put into the hands of the user. Several examples of the use of computers were given. This writer felt that the geologist responsible for the geological analysis case study should have been fired for incompetence rather than have been used as an example of a computer application.

In the creation of financial/technical data bases which can be used for project evaluation, great care has to be taken in data collection, not only for accuracy but also for compatibility. It has been found from experience that 50% of the time used in data capture is spent on correcting data.

Shaft Systems

Peter Janisch of Goldfields of South Africa presented the third paper, on "Factors Which Influence the Disposition of Shaft Systems on Large Witwatersrand Gold Mines". This interesting paper outlined the reasons behind the change in thinking on shaft systems in the Goldfields Group from large capacity systems capable of handling all hoisted tonnage to smaller multiple shaft systems serving smaller areas, to the concept of short-lift service shafts close to reef. The change is justified on cost savings. Costs are divided into four broad categories.

- (1) Cost of energy—mainly for hoisting but also affected by heat pick-up in intake airways, pressure and coolth losses in air and water reticulation and excessive use of energy in tramping long distances on every level.

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- (2) Cost of manpower. Productivity of more expensive labour is influenced by wet bulb temperature and time available at the working face. These two factors are important because of the preference of workers for short travelling times and good environmental conditions underground.
- (3) Cost of capital. It is important from the point of view of capital funding to bring a mine into production in the shortest time and at the lowest cost. An initial lower capacity, cheaper shaft system should be used to open up the mine with build-up to full capacity from further shaft systems financed out of profits.
- (4) Cost of loss. Multiple shafts provide more security against loss when major accidents occur but additional operating costs are incurred.

Several examples from Goldfields mines were given and Janisch said that further work had led to the concept of service shafts which result in fewer main haulage levels and therefore, fewer shaft stations, fewer intake airways and consequently less heat pick up. This is brought about by raised-bored vertical lift-shafts close to reef replacing horizontal development.

Goldfields has found that stoping complements could be reduced by up to 20% for a given production level by a well-placed surface shaft and good refrigeration, effecting a saving of about R1,50 per ton mined. Complements are set by taking into account stope width, wet bulb temperature, strike distance and dip. Decisions on the timing and capacity of shaft systems take into account tonnages and grades of ore, shaft system characteristics, mill capacity and time. A computer graphics program produces plans of face positions over time, dependent on development and mining rates. Using ore grade values over time, total tonnage, tonnage per shaft and yield profiles are produced.

The output is compared with a set of empirical requirements which in general will maximise the net present value. After this shaft sinking schedules are prepared.

After presenting his paper, Peter made a fast exit for Natal where on Saturday he collected a Bronze Medal for his run in the Comrades Marathon.

Rates of Return

Danie Krige of Anglo Transvaal Consolidated Investment Company Limited presented the paper "Mining Threshold Rates of Return Indicated by Market Investment Results from the Newer South African Gold Fields", which was co-authored by J. D. Austin.

The main aim of the research work carried out was to calculate the returns on investments in gold mining, and particularly, realistic threshold returns for new mining ventures, discount rates for alternative projects on producing mines and for share valuations. All results were calculated in real terms.

Historical data on returns which could have been realised by investments on the Johannesburg Stock Exchange over various time intervals were used. These realised returns cannot be equated with the returns expected by the investor. Also, changes in internal and external factors which could affect returns were correlated with the returns realised; if the correlation was insignificant then the predictive efficiency of the investor

could be accepted as good.

It was found that change in gold price was by far the most significant factor; the returns calculated correlated well with and were affected significantly by changes in the gold price in real terms. The results were linked with the Capital Asset Pricing Model. (See also paper by Gilbertson in SAIMM Journal Vol. 18 No. 5).

It was concluded that over the last four to five decades the average return expected by investors was some 3% p.a. for established gold mines and could be estimated at 7%/8% p.a. at the stage of flotation of the mine; both return levels being expressed in real terms after allowing fully for the actual changes in gold price not anticipated by investors.

Project Management

Chairman for the three afternoon papers and panel discussion was Alf Brown of Goldfields. Graham Thompson of General Mining and Finance Corporation spoke on "Project Management in the Coal Division of General Mining and Finance Corporation". The paper described the management system and organisation structure which handles all types of projects from inception to completion. The projects range from new major mining ventures to minor non-capital projects of a technically innovative nature. This organisation handles projects from the stage of decentralised project identification, followed by evaluation, planning and control, estimating and monitoring of capital expenditure, feedback into planning (as a result of practical experience), manpower planning and correct selection of teams to work on projects.

A project that has been identified is called a "potential project" and once approved in principle, becomes a "foreseen project." The foreseen projects are ranked and passed into a detailed planning and evaluation phase. Management produces two "strategic" plans. The first is the "zero plan" defining the growth and eventual decline of the financial contribution of operating mines and approved projects. The second gives required future earnings, growth rates and dividend patterns for the Coal Division. The gap between these two plans is filled with foreseen projects.

Each project which reaches implementation is controlled by a standard system of capital monitoring and reporting. Reports are consolidated at mine, company and division levels.

A typical promotional route for an individual in the Coal Division lays stress on a mixture of technical and management development both in production and in projects.

Chemwes Uranium Plant

The second afternoon paper, "The Evaluation, Design and Construction of the new Uranium plant for Chemwes Limited," was prepared by a team of writers and presented by E. B. Viljoen of General Mining. The authors were E. B. Viljoen, B. J. Bluhm and W. Pilkington of General Mining and Finance Corporation, J. L. Taylor of Chemwes, J. E. Robinson of Buffelsfontein Gold Mine and P. le Grange of Stilfontein Gold Mine.

This paper stressed the importance of detailed preliminary studies which were combined into the final