INFORMATION PROCESSING

AND

COMPUTER STRATEGY

IN

MINING INVESTMENT ANALYSIS

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FOREWORD

I, Robert G. Miller, submit this thesis for the degree of Master in Industrial Administration. I claim that this is my original work and that it has not been submitted in this or in a similar form for a degree at any University.

This thesis is submitted to meet the 50% credit requirement towards a Master in Industrial Administration Degree.

The thesis supplements the Graduate Diploma in Industrial Administration, which constitutes the other 50% credit.

The diploma includes courses in industrial engineering, financial accounting, management accounting, principles and practice of management, human relations and organisation, professional communication, law, statistics, operations research and computational methods.

The diploma and degree are offered by the University of Cape Town within the Industrial Administration Programme under the direction of the Department of Mechanical Engineering.

ABSTRACT

. This thesis addressses institutional investment management regarding mining capital investment (analysis, decision-making and administration). Emphasised is information processing and computer strategy to support mining investment recommendations.

. The topic is inter-disciplinary: mining, investment and information systems/computers. It is non-innovative in these individual areas. However, their integration here into a comprehensive strategy contributes to a poorly documented management area. This strategy minimises differences between mining and non-mining institutions as investors. The documentation avoids the theory of economics, investment techniques, stock exchange operations, minerals technology and computers.

. In deriving a total strategy, the objectives are to:
- Identify practical problems in mining investment analysis.
- Formulate the broad framework for problem solution.
- Examine the existing analytical and administrative procedures.
- Provide guidelines for more effective and efficient procedures.
- Forecast technical developments over the next decade.

. The objectives were examined against personal observations during a diversified career in mining and commerce: The thesis was conceived after three years in active mining investment analysis. It matured subsequently in the commercial computer environment; but is firmly rooted in twelve years of earlier practical experience in mineral exploration and mining. The opinions expressed were influenced by contact with technical and financial mining directors, stock brokers, economists, mining and other sector analysts, portfolio and investment managers.

. The review concludes that:
- Investment institutions inadequately evaluate and monitor the mining sector using manual information processing methods within existing organisation structures. Resource deficiencies (time, money, skills, information systems, computer facilities) exist in the face of high volume data inflows and corporate complexity.
- Institutions must establish/maintain comprehensive investment information systems (manual and computer) to support all functions, including mining analysis. The mining analyst co-ordinates investment management, computer and mining information sources. Inter-institutional links will supplement areas weak in specialists.
- Traditional ratio analysis is often wrongly applied to mine performance forecasting. Technico-financial analysis based on intrinsic mine factors is more reliable. Computer modelling techniques facilitate this analysis. Interactive data base modelling is developing.
- Generalised models (e.g. gold, base metal) will evaluate most mines, modelling packages permitting consolidations. Specific models (econometric, industrial dynamic) are required for commodity forecasting. The existing potential of distributed data base technology must be applied to information systems and reports.
- Automated 'office of the future' technology is revolutionising administration. It involves integration of distributed networks, mini-computers and word processors into an effective communication entity. This will transform the organisation structure of investment offices. Management sciences and telecommunications departments will emerge to co-ordinate developments. In the new environment, shared data bases and inter-institution (financial, industrial and research) communication will optimise information resources.

ACKNOWLEDGEMENTS

This thesis was conceived five years ago. It developed from the personal problems experienced and observed in evaluating and monitoring the South African mining sector. The thoughts and structure matured outside the active investment environment. In this more detached situation, it was probably easier to contemplate the investment problem against the background of my earlier mining experience and my current commercial computer environment.

The broad spectrum of my technical and commercial exposure has made this review possible. For my good fortune, I gratefully acknowledge the following:

Rhodesian Selection Trust (Mine Services and Roan Antelope Division) - for base metal exploration and mining experience in the sedimentary/metamorphic geological terrain.

O'okiep Copper Company and the parent company, Newmont Corporation - for exploration and mining experience in the igneous/metamorphic geological terrain; and subsequent introduction to a computer career, using sophisticated technical computer applications.

Old Mutual - for the opportunity to view the entire Southern African mining sector from the investments point of view; and for the contact with technical and financial directors of mining companies, stock brokers, economists, mining analysts, other sector analysts, portfolio managers and investment managers.

Mobil - for the opportunity to return to the dynamic computer environment; and the use of their word processing facilities.

Finally, the orderly presentation of this document would not have been possible without the dedicated and patient co-operation of Claudine Delavignette, whose word processor responds so well under her skilled touch.

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INTRODUCTION

- INDUSTRIAL ENTERPRISE DEPENDS ON THE THREE FACTORS OF PRODUCTION - CAPITAL, MEN AND MACHINES.

- THIS THESIS IS CONCERNED WITH THE FIRST OF THESE THREE FACTORS. IT ADDRESSES INSTITUTIONAL INVESTMENT MANAGEMENT WITH REGARD TO CAPITAL INVESTMENT ANALYSIS, INVESTMENT DECISION-MAKING AND ADMINISTRATION. MORE SPECIFICALLY, IT INVESTIGATES INFORMATION PROCESSING AND ASSOCIATED COMPUTER STRATEGY IN THE SPECIALISED AREA OF MINING ANALYSIS. THE OBJECTIVE IS TO PROVIDE SUPPORT FOR MINING INVESTMENT RECOMMENDATIONS. HOWEVER, THE THESIS MAINTAINS A PERSPECTIVE OF THE OVERALL INVESTMENT ENVIRONMENT, AND ACKNOWLEDGES THE DEPENDENCE OF THIS MINING ANALYSIS FUNCTION ON OTHER SPECIALISED INVESTMENT FUNCTIONS.

- THE SCOPE OF THE SUBJECT IS INTER-DISCIPLINARY, WITH INVESTIGATIONS INTO AND INTEGRATION ACROSS THREE MAJOR DISCIPLINES:

  - MINING
  - INVESTMENT
  - INFORMATION SYSTEMS/COMPUTERS

- THE THESIS DOES NOT BREAK NEW GROUND IN ANY OF THESE AREAS, CONSIDERED INDIVIDUALLY. IN AS MUCH AS IT RECOGNISES THAT THESE THREE DISCIPLINES MUST BE INTEGRATED INTO A COMPREHENSIVE MANAGEMENT STRATEGY (FOR EFFECTIVE MINING INVESTMENT ANALYSIS), AND PROCEEDS TO DOCUMENT THIS STRATEGY, THE THESIS BREAKS NEW GROUND. IN AS MUCH AS IT ATTEMPTS TO BREAK DOWN THE REAL OR IMAGINARY DIFFERENCES BETWEEN MINING AND NON-MINING INSTITUTIONS (AS REGARDS THEIR OBJECTIVES AND FUNCTIONS IN ANALYSING AND ADMINISTERING MINING AND OTHER INVESTMENTS) THE THESIS ENTERS A SENSITIVE AREA.

- THE THESIS WAS MOTIVATED BY PERSONAL PROBLEMS EXPERIENCED IN EVALUATING AND REGULARLY MONITORING INSTITUTIONAL INVESTMENTS IN THE SOUTHERN AFRICAN MINING SECTOR. HOWEVER, FROM PERSONAL OBSERVATIONS, IT IS SUGGESTED THAT THE BASIC PROBLEM IS UNIVERSALLY EXPERIENCED:

MOST INSTITUTIONAL INVESTORS RECOGNISE THE NEED TO REGULARLY BACK UP THEIR LARGE CAPITAL INVESTMENT DECISIONS WITH FORMAL AND DETAILED IN-DEPTH FUNDAMENTAL ANALYSES. HOWEVER, LIMITATIONS IN RESOURCES (TIME, MONEY, SKILLS, INFORMATION SYSTEMS AND COMPUTING CAPABILITY) RENDER THIS IDEAL LARGELY UNACHIEVABLE. CONSEQUENTLY, COMPROMISES ARE REACHED IN ANALYSING COMPANY SHARES AND JUSTIFYING INVESTMENT DECISIONS. THESE VARY ACCORDING TO THE INSTITUTION'S PUBLIC IMAGE, MANAGEMENT PHILOSOPHY, STRENGTH OF SKILLS, AND RECIPROCAL RELATIONSHIPS WITH OTHER (COMPLEMENTARY) INSTITUTIONS. THESE COMPROMISES ARE MOST OFTEN OBSERVED IN THE TECHNICALLY COMPLEX AREA OF MINING ANALYSIS.

. INSTITUTIONAL INVESTORS COMPRISE BOTH MINING AND NON-MINING CORPORATIONS/INSTITUTIONS. THE MINING CORPORATIONS (INSTITUTIONS) ARE STRONG IN TECHNICO-FINANCIAL EVALUATION OF NEW MINING PROJECTS. THE NON-MINING INSTITUTIONS ARE STRONG IN OVERALL INVESTMENT ANALYSIS AND ADMINISTRATION. BOTH MINING AND NON-MINING INSTITUTIONS NEED TO COMPLEMENT THEIR INVESTMENT STRENGTHS (SKILLS), BUT HAVE NOT FULLY ACHIEVED THIS IDEAL.

. SUPERIMPOSED ON THE ABOVE PROBLEM, OF RESOURCE LIMITATIONS AND THE NEED TO DEVELOP RECIPROCAL INSTITUTIONAL RELATIONSHIPS, IS THE RAPIDLY CHANGING FACE OF OFFICE TECHNOLOGY. THE SO-CALLED 'AUTOMATED OFFICE OF THE FUTURE' IS ENCROACHING ON ALL ADMINISTRATIVE FUNCTIONS, AND IS EXPECTED TO DEVELOP DRAMATICALLY THROUGH THE 1980S. THE INVESTMENT OFFICE IS CAUGHT UP IN THE MOMENTUM OF THIS CHANGE.

. IN THE LIGHT OF THE ABOVE SCENARIO, THE OBJECTIVES OF THIS THESIS ARE TO:

- IDENTIFY THE PRACTICAL ANALYTICAL AND ADMINISTRATIVE PROBLEMS.
- FORMULATE THE BROAD FRAMEWORK FOR PROBLEM SOLUTION.
- EXAMINE THE EXISTING ANALYTICAL AND ADMINISTRATIVE PROCEDURES PRACTISED WITHIN THIS FRAMEWORK, INCLUDING COMPUTER METHODS.
- PROVIDE DETAILED GUIDELINES FOR THE DEVELOPMENT OF MORE EFFECTIVE AND EFFICIENT PROCEDURES WITHIN THE CURRENT STATE-OF-THE-ART.
- FORECAST TECHNICAL DEVELOPMENTS OVER THE NEXT DECADE AND THEIR IMPACT ON CURRENT PROCEDURES.

THESE OBJECTIVES ARE ACCOMPLISHED WITHIN FIVE MAIN SECTIONS:

SECTION A: CONSIDERATIONS IN EFFECTIVELY MONITORING THE MINING INVESTMENT SECTOR.

SECTION B: INFORMATION PROCESSING ORGANISATION AND FACILITIES TO SUPPORT MINING ANALYSIS IN THE INSTITUTIONAL INVESTMENT ENVIRONMENT.

SECTION C: MINING ANALYSIS.

SECTION D: COMMUNICATION OF INVESTMENT ANALYSIS FINDINGS.

SECTION E: THE FUTURE OF INFORMATION PROCESSING IN THE INVESTMENT OFFICE.

THIS SUB-DIVISION HAS THE ADVANTAGE OF PROVIDING BOTH A PHILOSOPHICAL AND PRACTICAL FRAMEWORK FOR ANY INVESTMENT INSTITUTION TO IDENTIFY:

- THE CURRENT STATE OF IT'S MINING ANALYTICAL FUNCTION.
- THE LEVEL IT WISHES TO ACHIEVE.
- THE MEANS TO REACH IT'S OBJECTIVE.

THE SECTIONS ARE ARRANGED IN A SEQUENCE LOGICALLY AND CHRONOLOGICALLY APPROPRIATE FOR REVIEWING THE INVESTMENT FUNCTION. EACH OF THE FIVE SECTIONS (A-E) ARE INTRODUCED BY THEIR OWN TABLE OF CONTENTS AND SUMMARY, PRIOR TO DETAILED DISCUSSION. THIS WILL PROVIDE SUITABLE BREAKS AND FACILITATE COMPREHENSION OF A MULTI-DISCIPLINARY SUBJECT.

LITERATURE SURVEY:

LITERATURE ADDRESSING INVESTMENT MANAGEMENT STRATEGY IS MAINLY EMBEDDED IN INSTITUTIONAL IN-HOUSE FILES. THESE FILES DOCUMENT GUIDELINES AND PROCEDURES. IN THE MORE SPECIFIC AREA OF MINING INVESTMENT ANALYSIS, DOCUMENTATION OF STRATEGY IS OFTEN VAGUE. WHEN COMPUTER SUPPORT IN THIS SPECIFIC AREA IS CONSIDERED, DOCUMENTATION OF STRATEGY IS VIRTUALLY NON-EXISTANT.

TECHNICAL LITERATURE IN MINING, INVESTMENTS AND INFORMATION PROCESSING/COMPUTERS IS WELL DOCUMENTED AND UNIVERSALLY AVAILABLE - BUT NOT THE PRIMARY CONCERN HERE. THIS THESIS ADDRESSES INVESTMENT MANAGEMENT WITH A TOTAL ADMINISTRATIVE STRATEGY IN THE LIGHT OF THE PROBLEM IDENTIFIED AND THE TECHNIQUES AVAILABLE AND/OR DEVELOPING. TECHNICAL DETAILS ARE DISCUSSED ONLY TO THE EXTENT THAT THEY PROVIDE CONTINUITY AND PERSPECTIVE (IN A MULTI-DISCIPLINARY AREA); OR UNDERSTANDING OF THE IMPLICATIONS OF A RECOMMENDATION.

THIS THESIS, IN MEETING THE OBJECTIVES (OUTLINED EARLIER), ALSO SETS OUT TO PROVIDE A COMPREHENSIVE DOCUMENTATION OF ALL THE RELEVANT FACTORS IMPINGING ON MINING INVESTMENT ANALYSIS (WITH A MINIMUM OF CROSS-REFERENCING FRUSTRATION).

SECTION A

SECTION A

CONSIDERATIONS IN EFFECTIVELY MONITORING THE MINING INVESTMENT SECTOR

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SECTION A

CONSIDERATIONS IN EFFECTIVELY MONITORING THE MINING INVESTMENT SECTOR

SUMMARY

THE IMPRESSIVE SCALE AND DIVERSITY OF THE SOUTH AFRICAN MINING INDUSTRY EMPHASISES THE IMPORTANCE THAT THE MINING SECTOR OCCUPIES IN ANY INSTITUTIONAL INVESTMENT PORTFOLIO.

THE CONSERVATIVE NATURE AND LONG-TERM INVESTMENT STRATEGY OF THE INSTITUTIONAL INVESTOR NECESSITATES A DISCIPLINED APPROACH TO INVESTMENT DECISION-MAKING - UNLIKE THE APPROACH OF THE SPECULATIVE INVESTOR. THIS INVOLVES BOTH THE INITIAL INVESTMENT EVALUATION AND THE SUBSEQUENT PERFORMANCE MONITORING.

SUCH DISCIPLINE IN THE SPECIALISED AREA OF MINING ANALYSIS IS COMPLICATED BY TWO MAIN FACTORS:

- THE TRADITIONAL INSTITUTIONAL APPROACH OF 'STANDARD HISTORICAL ANALYSIS AND EXTRAPOLATION' APPLIED TO ALL INVESTMENT SECTORS; AND THE COMMERCIAL ORIENTATION AND QUALIFICATION OF ANALYSTS EVALUATING THE TECHNICALLY COMPLEX MINING SECTOR.
- THE LARGE NUMBER OF COMPANIES WITHIN THE MINING SECTOR, AND THE REGULAR FLOOD OF TECHNICAL AND FINANCIAL INFORMATION IN AN ERA OF RAPID CHANGE.

THE INSTITUTIONAL INVESTOR WILL NOT ACT UNTIL THE INFORMATION SUPPORTING HIS DECISION HAS BEEN CONFIRMED AND EVALUATED. THE MINING ANALYST PROVIDES THIS EVALUATION SERVICE FOR THE MINING SECTOR.

DECISION-MAKING INVOLVES RISK. TO HANDLE UNCERTAINTY WE EMPLOY PROBABILITY THEORY; TO HANDLE COMPLEXITY AND VOLUME WE USE THE COMPUTER. HOWEVER, THE ANALYST MUST QUANTIFY THE FUNDAMENTAL FACTORS FOR THE COMPUTER.

MINING FINANCE HOUSES DIFFER FUNDAMENTALLY FROM INDUSTRIAL BUSINESSES. THEREFORE, THE NATURE OF MINING AND THE FUNDAMENTAL FACTORS THAT INFLUENCE MINING EVALUATION MUST BE IDENTIFIED.

THE OREBODY IS IDENTIFIED AS THE CORE OF FUNDAMENTAL ANALYSIS AS IT'S PHYSICAL CHARACTERISTICS IMPOSE THE INTRINSIC CONSTRAINTS ON ECONOMIC EXPLOITATION. THE GEOLOGICAL FEATURES ARE A PRIMARY CONSIDERATION AS THEY INFLUENCE THE MINING AND METALLURGICAL TECHNOLOGY TO BE EMPLOYED (SECONDARY CONSIDERATIONS).

THE POLITICO-GEOGRAPHICAL LOCATION IS ALSO OF PRIMARY SIGNIFICANCE AS IT IMPOSES THE EXTERNAL CONSTRAINT. OTHER FACTORS SUCH AS MINERAL PRICE, TAX AND LOAN REPAYMENTS ARE CONSIDERED AS TERTIARY.

THE COMPLEXITY AND ABUNDANCE OF FUNDAMENTAL FACTORS IN MINING ANALYSIS EMPHASISES THE NEED FOR ADEQUATE INFORMATION AND COMPUTER SUPPORT SYSTEMS; AND A RATIONAL INSTITUTIONAL APPROACH TO EFFORT EXPENDITURE IN COMPANY ANALYSIS.

MINING ANALYSIS EFFORT MUST ADDRESS THE TWO COMPLEMENTARY AREAS OF RESPONSIBILITY : REGULAR ROUTINE MONITORING OF THE MINING SECTOR; AND RESEARCH INTO IMPROVED DECISION-MAKING TECHNIQUES.

TIME IS A CONSTRAINT DUE TO THE LARGE NUMBER OF QUOTED COMPANIES. COMPLEXITY IS IMPOSED BY THE SIZE AND DIVERSIFICATION OF THE MINING FINANCE HOUSES. COMPUTERISATION PROVIDES AN EFFECTIVE STRATEGY TO OVERCOME THESE CONSTRAINTS AND SUPPORT THE MINING ANALYSIS FUNCTION.

A FEW FUNDAMENTAL MODELS (GOLD, COAL, BASE METAL) CAN POTENTIALLY HANDLE THE ANALYSIS OF MOST MINING COMPANIES. CALCULATIONS CAN BE OUTPUT IN DETAIL, IN SUMMARY OR GRAPHICALLY.

COMPUTERISATION WILL CREATE MORE TIME FOR THE MINING ANALYST TO RESEARCH MODEL PARAMETERS AND NEW TECHNIQUES.

THE MINING ANALYTICAL FUNCTION IS IDEALLY HEADED BY A MINING ANALYST, WHO HAS A PRACTICAL BACKGROUND IN MINING, INVESTMENT AND FINANCIAL ANALYTICAL SKILLS, AND A KNOWLEDGE OF INFORMATION SYSTEMS AND COMPUTER CAPABILITIES. HIS ROLE IN THE INSTITUTIONAL ENVIRONMENT IS THAT OF CO-ORDINATOR BETWEEN INVESTMENT MANAGEMENT, THE COMPUTER FACILITY AND THE HOST OF INFORMATION SOURCES.

CONSIDERATIONS IN EFFECTIVELY MONITORING THE MINING INVESTMENT SECTOR

1. INSTITUTIONAL MINING INVESTMENT

South Africa is one of the Big Five in the Mining World, together with the U.S.A., Russia, Canada and Australia. However, when compared by equivalent areas, South Africa has by far the richest and most diversified assemblage of minerals(1). These minerals occur in almost every identifiable type of geological environment(2).

In July 1980, the total market capitalisation of the Johannesburg Stock Exchange stood at ± R70 000 million. With gold fluctuating around $650/oz., gold and mining finance shares accounted for ± 55% of this total market capitalisation. Including the value of other mining shares, the ratio was ± 70%.

Consequently, any South African institutional investment portfolio is likely to have a significant stake in the mining sector, through share investment in the Johannesburg Stock Exchange. Portfolios with 20% to 40% Mining and Mining Financial shares are common.

The investment environment considered is primarily that of the institutional investor whose assets are tied up on a long-term basis(3). This includes the mining finance houses, life insurance companies, pension funds, investment and unit trusts, and others whose resources are largely drawn from the public in terms of services provided. Excluded are the institutions involved in the short-term capital or money market, such as building societies, banks and discount houses; and private investors and speculators.

The enormous investment capitalisation and the constant generation of large volumes of additional investable funds characterise the institutional investor. These additional funds are derived from interest and dividend receipts plus the revenue on normal business accounts i.e. profits, premiums, pension contributions or client savings.

The institution, unlike the private investor, has an indefinite life ahead of it. Therefore, it can afford to take a much longer view in selecting equity purchases i.e. lower yields and higher prices. This has an impact on the formulation and implementation of policy.

The institutional investor differs from the speculator essentially in his attitude and approach to the problems of risk and growth. The institutional investor is concerned about minimising risk - even if this involves a lower immediate benefit. With growth he is principally interested in income and profits gains over the long-term, although capital gains are not irrelevant.

The institutional investor is cautious and patient when buying or selling, justifying his action on projected future dividends and profits. These cannot be known with certainty, but he reasons that

their long-term direction can be judged more accurately than the short-term performance and price movements. Most importantly, the institutional investor will not act until the information supporting his decision has been confirmed and evaluated - even if this means waiting and losing part of a capital profit.

For this reason an effective information processing organisation and system is essential for supporting investment decision-making.

Traditionally, investment decision-making in the investment institutions has been the responsibility of portfolio managers with accounting, commercial and actuarial qualifications and experience. The Investment Analysis Department (equity, property and fixed interest), similarly qualified, has provided the main analytical support to the portfolio managers.

Investment analysis of the mining sector has often been based on the techniques applied to other sectors of the economy i.e. historical performance extrapolated into the future, measured in terms of prospective earnings per share, dividends per share and relevant financial ratios. Formal investment recommendations, based on these analyses, are conveyed via the portfolio manager(s) to the investment manager. The latter screens the recommendations prior to his presentation to the board of directors.

This approach to mining investment was acceptable in the years when:

- Gold and diamond mining were regarded as synonomous with the mining sector.
- The gold price was fixed.
- The diamond price was controlled by the Central Selling Organisation (De Beers).
- Inflation was negligible and predictable.
- Mining and metallurgical factors were technically less complex,
- The sub-continent was politically more stable.
- The evaluation of undeveloped mineral reserves and mining rights was less risky.

In recent years platinum, uranium, coal and a host of base metals have entered the investment picture as potentially attractive investments for the institutional investor. While the mining finance houses have the specialist expertise to evaluate the technical aspects of mining ventures, these decisions in the non-mining investment institutions are predominantly in the hands of commercial thinkers.

The technical complexity in evaluation is exacerbated by the fact that mining finance houses themselves have been diversifying out of their specialised areas of mining (e.g. gold) into other minerals, mineral beneficiation and the manufacturing industry(4).

With some of the larger South African institutional investors having a cash inflow of more than R1 million per day, of which a significant slice will be diverted to mining investment, it becomes obvious that a new strategy for more effective evaluation and decision-making needs to be employed.

For monitoring the mining sector, the concept of a mining analyst co-ordinator interacting between specialist sources of information, a computer support system and investment management is proposed. A computer-orientated strategy is emphasised in view of the sheer volume and diversification of data in performing this investment service function.

2. FUNDAMENTAL FACTORS IN MINE EVALUATION

'A mining finance house differs from an industrial business, which usually expands by an extension of its existing operations or by the acquisition of established companies. This latter type of expansion, if successful, soon reflects itself in the profits earned and available for distribution. On the other hand a mining finance house, like Johnnies, has, in the process of expansion, to create totally new enterprises. These are frequently in areas with little or no infra-structure and very often they represent the culmination of years of exploration, research and development. So a major feature of our business has been its expansion into capital intensive projects with long periods of little contribution to profits from such investments'.

(Extract from JCI Chairman's Report, 13.11.1973).

The above extract provides a succinct introduction to a review of mining investments analysis and decision-making.

2.1. Decision Making in an Uncertain World

Judgement is the ability to think of many fundamental factors at once - in their inter-dependence, their relative importance, and their consequences. Exercising judgement is a complex matter, and decision-making is the art of steering a course through the complexity, restricting the scope of the factors to be considered.

Human judgement is defective at times, but all are called upon continually to make decisions. These decisions should be made on the basis of one's judgement of the circumstances against which the decision is required. This is true of our personal activities and especially true within the framework of a modern industrial on mining enterprise. Even the astutest of men will be incapable of making the best possible decision, in any given circumstance, because of the sheer mass of information to be considered when making even routine business and industrial decisions. With the price of an incorrect decision growing with the complexity of the circumstances, the incentive to rationalise the decision-making process is very high.

Two factors are primarily responsible for the difficulty normally associated with rational decision-making: uncertainty and complexity. To handle uncertainty, we have at our disposal the mathematical theory of probability (now several hundred years old). To handle complexity, we now have the computer (a product of this generation). This combination, properly used, gives the modern manager unprecedented facilities for processing decision-making problems of surprising complexity.

2.2. The Concept of Fundamental Factors

'Fundamental analysis' of mining shares is the evaluation based on the fundamental or intrinsic factors of the mine.

Fundamentals are the smallest units of the total technico-financial mechanism, which, if altered separately or in combination, will bring about a significantly different cash flow position.

Fundamental financial analysis in the mining environment must therefore concern itself with identifying and quantifying the basic (or fundamental) financial and technical elements utilised in the synthesis of the total performance model.

Exactly what degree of breakdown is regarded as basic could lead to philosophic debate, which is not intended. Certainly to be avoided is over-simplification of a complex set of inter-related factors and blind acceptance of guesstimates and information derived from sources of dubious technical or financial competence. Such acceptance negates the subsequent information processing effort and raises the question of credibility.

2.3. What is a Mine?

A mine is different things to different people:

- To those without a vested interest, it is merely a hole in the ground.
- To the exploration geologist it's discovery is the culmination of years of diligent field work and vindication of his theory of ore occurrence.
- To the mining engineer it is a challenge against often overwhelming physical odds.
- To the thousands of mine employees, of different professions and skills, it is 'The Company', providing a high standard of living.
- To the government it is a source of bountiful tax revenue, and an entry in their balance of payments.
- To the chartist it is a graph reflecting market sentiment.
- To the financier and investor it represents a cash flow.
- To me, in my capacity as a fundamental analyst, with a practical geological/mining background, a mine represents a natural phenomenon with very definite physical characteristics (observed and implied) which dictate the profitability of exploitation.

2.4. The Orebody as Prime Dictate in Fundamental Analysis

What is the core of any mine evaluation? Obviously the orebody, and everything that is implied by its physical characteristics and geographical location.

While technical expertise and financial management of mining ventures may be of the highest calibre, cash flows are largely dictated by the physical characteristics encountered at different phases in the mine development and exploitation. Good technical management, through clever planning, can eliminate a large degree of the fluctuations in earnings by anticipation of the physical factors that are likely to arise.

A prime function of mine investment analysis must be the unravelling of the physical characteristics related to the orebody, and translating these into cash flow prospects at various phases of the mine life. To ignore these characteristics and to embark on generalisations will never provide the confidence required to hold the investment.

2.4.1. Physical Characteristics

These impose the intrinsic constraints on a mine. Major emphasis is on geology as the geological (primary) characteristics dictate the revenue-generating potential of an orebody and influence the cost structure, through the mining method required for ore extraction, and the metallurgical plant/process required for isolation of the metal or mineral.

2.4.1.1. Geological Considerations (Primary)

- The metal/mineral to be economically exploited, i.e. the ore type (simple ore, complex ore, associated mineralisation, trace elements).
- The tonnage and grade of the orebody (large, medium or small tonnage; high, medium or low grade).
- The attitude of the orebody (shallow or deep, horizontal, shallow or steeply dipping, vertical).
- The nature of mineralisation (massive or disseminated, evenly or erratically distributed).
- The origin of the ore (syngenetic, epigenetic).
- The origin of the host rock (sedimentary, matamorphic or igneous).
- The structure of the orebody (amorphous, tabular - elongate on strike or dip, lenticular, folded, sinuous, faulted, pipe-like, basin-shaped).
- The ground condition of the orebody and country rock (good, fair, poor; hard, soft; massive, blocky, friable, sheared).
- The presence/absence of water (conformable hangingwall aquifer, fissure water).
- Nature of the mineral province (concentration of occurrences, history of mining operations, probability of further ore discoveries).
- The credibility of information (density of drill hole coverage, experience of the company in the type-environment).

2.4.1.2. Mining Considerations (Secondary)

- The in situ grade/mining grade relationship.
- Percentage dilution (due to practicalities of mining layout, mining feasibility, waste caving).
- Sampling and grade control techniques.
- Development layout.
- Drilling pattern.
- Stoping method (open pitting, sub-level open stoping, continuous retreat, caving, cut-and-fill, rib-and-pillar, long-wall).

- Tramming/hauling arrangements.
- Hoisting capacity.
- Ventilation requirements.
- Flood control.
- Mine planning strategy.
- Life of mine (dependent on rate of extraction against proven reserves and potential additional reserves).
- Technological advances (rock cutting, tunnel borers, raise borers, rock mechanics, micro-climates).

2.4.1.3. Metallurgical Considerations (Secondary)

- The mine grade/milling grade relationships.
- Nature of mineral associations (grain size and distribution; chemical composition).
- Optimum crushing and grinding specifications.
- Suitability of reagents.
- Hydro- and pyro-metallurgical processes (leaching, flotation, smelting, refining; cyanide process; coal washing, gasification).
- Recycling of slimes dumps.
- Technological advances in beneficiation.

2.4.2. Politico - Geographical Location (Primary)

Imposes the non-intrinsic (external) constraints on a mine, such as: domestic politics, relationship of the country with neighbouring states and international standing; availability of raw materials, distances from sources of supply and markets etc.

2.4.3. Other Dictates (Tertiary)

- Fluctuations in revenue brought about by mineral price variations are dictated by international supply/demand factors and are beyond management control.
- Tax and lease formulae are imposed by the government.
- Royalties/tributes are the outcome of mutually beneficial arrangements with companies and governments.
- Sales contracts are normally concluded before the mine development and infra-structure are financed, and are subsequently expanded consistant with expansion in mine output.
- Technical feasibility and financial viability studies precede financing negotiations, and loan repayment is a matter of corporate strategy related to earnings performance and dividend policy.
- Marketing strategy is related to the needs of the customer and the capability of the mine to provide according to specifications.
- Railage and freight charges are generally beyond the control of mine management.

2.5. Guidelines

To those fully cognisant of the fundamental factors, investment in the technically sophisticated field of mining can represent one of the most lucrative forms of investment.

Unlike most other sectors of the economy, which are influenced primarily by domestic economic factors and company management considerations, successful evaluation of mining projects depends on the appreciation of a multitude of additional factors - technical (geological, mining and metallurgical), world mineral market behaviour/trends, political (domestic and international).

In the institutional investment environment, the function of the mining analyst is that of an information co-ordinator, drawing heavily on specialised expertise.

Due to the dynamic nature of the abundant information in the mining field, this co-ordinating function can be immensely facilitated by:

- Access to a well organised information system.
- The utilisation of a computing facility, with the emphasis on modelling techniques.

3. EFFORT EXPENDITURE IN COMPANY ANALYSIS

3.1. Time and Effort

The Mining Sector is only one of several sectors in the economy subjected to continuous scrutiny by the Investments Analysis Department of an Investments Division. It is thus necessary to establish an effort expenditure philosophy consistent with overall departmental acceptability.

As time is always the greatest limiting factor in any human effort, optimisation of effort expenditure is paramount. To this end the areas of effort must be identified for evaluation of their respective benefits and return on time invested.

3.2. Responsibilities of Mining Analyst

There are two main categories of responsibility:

- Routine scrutiny of mining company and mining finance house financial performances with a view to favourable buy/sell situations.
- Research and innovation techniques to progressively improve investment decision-making.

The two functions, while complementary, are of different emphasis:

The former, by virtue of its dynamic nature, necessarily requires regular re-evaluation of shares in the light of the most current information available. Any work output is of short-term value only.

The latter, by virtue of its more basic nature and broader application, is of longer-term benefit.

The question really addresses the balance of effort between the two categories and consideration of their degree of inter-dependence.

3.3. Routine Evaluation and Re-evaluation of Shares

Figure A1 below is a summary of the number of mining companies and mining finance houses quoted on the Johannesburg Stock Exchange (April 1980).

J.S.E. MINING SECTOR SUMMARY

(NUMBER OF QUOTED COMPANIES)

Coal			18)	
Diamonds			6)	
Gold:	Rand and Others	15)	)	
	Evander	4)	)	
	Klerksdorp	7)	53)	
	O.F.S.	10)	)	
	West Wits.	12)	)	94
	Curtailed Operations	5)	)	
Copper			5)	
Manganese			2)	
Platinum			3)	
Tin			3)	
Other			4)	
Financial:	Mining Houses	13)		
	Mining Holdings	19)		32
			Total	126

Figure A1

This represents $\frac{126}{545}$ = 23% of total market quoted stocks.

Not all of these might be institutional-type shares warranting in-depth analysis and review. However, the reliable evaluation of future performance of mining financials, and the comparison of these projections, depends on the reliable evaluation of all those shares in which they are invested.

Figure A2 below is a summary of estimated percentage breakdown of earnings which highlights the previous point.

MINING FINANCE HOUSE PERCENTAGE EARNINGS BY MAJOR DIVISION

(30.04.1973)

	Gold	Diamonds	Other Metals	Finance/ Industry
Anglos	30	20	28	22
Amgold*	100	-	-	-
Anamint	-	99	-	1
A-Vaal Cons.	15	-	20	65
Charter	5	3	40	52
Con. Gold	22	-	41	37

	Gold	Diamonds	Other Metals	Finance/ Industry
De Beers	7	70	4	19
Gen. Mining/	15	-	20	65
Fed. Mynbou	14	-	20	66
G.F.S.A.	85	-	5	15
Johnnies	10	15	40	35
Rand Selections	45	13	19	23
T.C. Lands	4	-	94	2
Union Corp.	43	-	25	32

*e.g. Amgold (31.12.1971) major investments:

Buffelsfontein, Hartebeestfontein, Kloof, Vaal Reefs, West Driefontein, Western Deep Levels, East Driefontein, Gold Fields of South Africa, Free State Geduld, President Brand, President Steyn, St. Helena, Western Holdings, Southvaal, Western Ultra Deep.

Figure A2

There appears to be no short-cut to reliability. What is needed is systematic evaluation and re-evaluation of all shares on a dynamic basis, according to the most recent performance results and future factors of influence currently indicated.

Regularity of company re-evaluation:

- Annually, on receiving the year-end report.
- Quarterly (or half-yearly) on receiving the quarterly (or half-yearly) reports.
- Randomly, on receiving the various stock brokers' reports and press information.

Assuming that on this basis each company is re-evaluated an average of 4 times per annum, we are involved in 126 x 4 = 504, say 500 re-evaluations per annum or 2 every working day - a formidable (if not impossible) and monotonous task to sustain (and no consideration has yet been given to research responsibilities).

With time thus the bottleneck, the options for analysis are:

- Sacrifice fundamental analysis for 'externally derived information' (stock brokers and news reports).
- Perform fundamental analysis on a random or selective basis.
- Apply computerised techniques on a broad basis to relieve the burden of thorough fundamental analysis.

The first alternative is contrary to the policy of 'in-house' analysis by specialists; the second is subjective and favourable situations will inevitably be missed.

3.4. Computer Techniques in Fundamental Analysis

Once computerisation is accepted in principal by management, as an innovation offering the best solution to the fundamental analysis of companies, management must provide the guidelines and support to facilitate co-operation and commitment during the difficult period of development and testing of the computer system.

The analysis of the majority of mines is capable of being handled by 3 fundamental models (each with a certain degree of internal flexibility):

- A gold model.
- A coal model.
- A base metal model.

Computer calculations are performed and results printed, according to 3 options:

- Detailed report.
- Summary report.
- Graphical output of comparative performance, e.g. of all gold mines - net profit, e.p.s., d.p.s., present value etc.

As the computer does all the routine calculations, effort is expended in the more careful interpretation of annual and quarterly reports etc. and transposing this technico-financial information (actual and inferred) to the standard input form. This imposes its own discipline in that reports are now read with a view to quantifying the information in a form acceptable to the computer program.

A standard input data preparation form has a 3-fold purpose:

- The working sheet for preparation of input data.
- The punch source document.
- A permanent record of assumptions (parameters) used in the evaluation, and including supplementary explanatory notes.

The net result of the exercise is:

- More accurate fundamental analysis due to the constructive utilisation of the abundant fundamental data available, but not possible to process manually.
- Job enrichment, in that practical experience in the mining sector can be turned to the more intellectual challenge of establishing reliable parameters.
- Analyses are available regularly, systematically and earlier than previously possible, allowing advantage to be taken of favourable share market prices.
- Time is created for basic research.

3.5. Basic Research

Various avenues exist for research that will contribute to more effective investment decision-making:

- Use of the abovementioned computer models to conduct mine viability and profitability studies, employing different combinations of changing parameters.
- Commodity price studies - historic and projected.
- Supply/demand analysis in traditional markets, prospective markets and in new commodity applications.
- Investigation of financing opportunities in new mining development ventures.
- Development of integrated on-line data base systems.

3.6. Guidelines

There is a very meaningful relationship between the two functions of routine analysis and basic research/innovation - any improvements in the latter will render possible more efficient execution of the former.

Strength of conviction and commitment is necessary to advance the modelling phase through to an integrated on-line data base system.

An ever present danger is that of conservative short-term expediency practices undermining bold long-term objectives.

Only when reliable fundamental valuation of companies can be rapidly obtained can market deviations from these 'theoretical bases' be explained (in terms of market sentiment, over-conservatism, chart influences, etc.).

4. STRUCTURING THE MINING ANALYTICAL FUNCTION

The Investment Analysis Department of an institutional investor provides an ideal environment for the exchange of ideas between individuals researching different investment sectors. The overall experience gained affords a better perspective of the economy and alternative investments than is possible within a more 'mining-bound' organisation. However, in evaluation of the more specific mining sector, institutional investment strategy often lacks credibility. It is manifested either as unduly conservative, unimaginative or isolationist. There is a tendency to avoid things technological.

If institutions are to invest in mining ventures (and it is obvious that in the South African investment environment they cannot afford not to), the label of 'a non-mining institution' does not provide any immunity from the risks affecting mine investments that the mining houses have to bear. Nor does it absolve them from the disciplines that mining houses have to apply for reliable initial evaluation and subsequent re-evaluation on a regular basis - to remain competitive as investors.

It is imperative to establish just how involved they wish to be in mine evaluation in terms of manpower, computing aids and depth of analysis. Clearly, a single analyst, without a computing facility and minimal contact with the mining scene, cannot aspire to the excellence achieved by a mining investments team, with sophisticated computing aids and regular interaction with the mining fraternity.

Irrespective of the degree of sophistication, balanced 'technico-financial analysis' based on published information and consultation, with directors and specialists, is essential as institutions are long-term, not speculative, investors. Mines cannot be evaluated from a desk with a stockbroker as the first line of reference (although the research teams of certain brokers do incorporate specialist mining expertise).

One would not think of investing in a property without thoroughly investigating the condition of the building or the potential of the location, not invest in a motor vehicle without a test run. How can one, therefore, invest in a mine, where the revenue-generating product is buried, without first discussing its potential with the geologists, engineers and metallurgists and taking a good look around to derive an independent opinion?

Each evaluation must be approached according to the emphasis required. Different evaluations have different problem areas requiring contact with different types and levels of informed opinion.

A diagrammatic representation of the liaison network considered essential for the Mining Analyst, as information co-ordinator, to provide an effective service in an institutional investment environment is outlined in Figure A3 below.

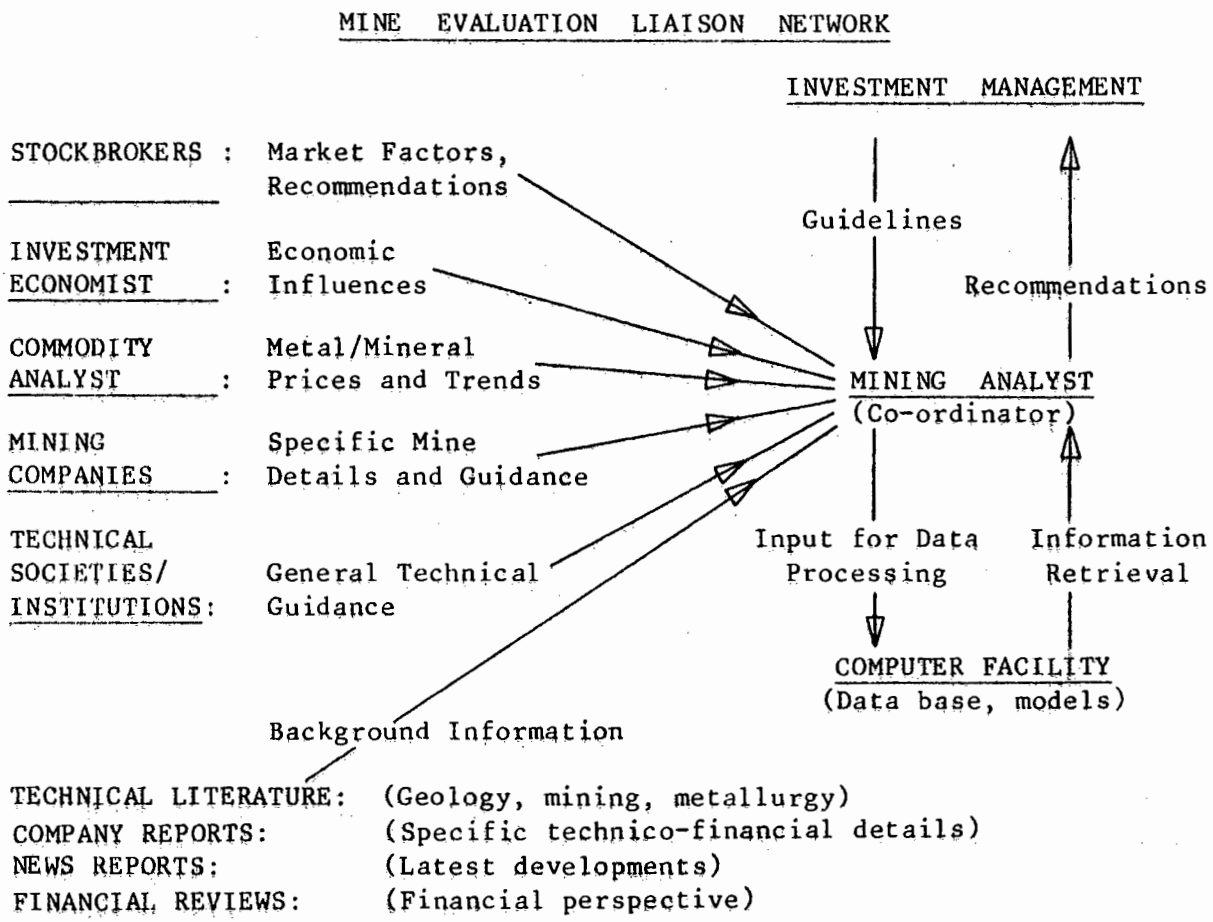

Figure A3

Priorities are:

- Formulation of investment guidelines.
- Development of dialogue with mining companies.
- Development and increasing use of the computer facility.

Information flow in the network is achieved mainly through the formal in-house information system supplemented by periodic personal contacts and visits. As most investment institutions lack a mine research team, as such, it is obvious that they must draw more heavily on outside specialist opinion. To this end it is essential to agree on the credibility of the various sources and levels of information and to work at developing these channels of communication and establishing firm relationships at technical and financial level.

A clear distinction should be made between the research and clerical (administrative) investment functions. On the basis that irreconcilable differences exist in the temperaments and motivations of research and clerical personnel, it must be clearly understood what is meant by research. Those suited to routine clerical functions generally have very little innovative flair, while the constraints imposed by routine practices stifle the innovative element.

ACTION

It is prudent to reflect on these observations and thoughts and formulate an effective mine investment strategy - with departmental consensus.

While it could be argued that institutions are not interested in investing in the majority of mines, but rather in the safer mining finance shares, the question that immediately comes to mind is: 'How do you evaluate a mining finance share, having little idea of the value of its individual holdings?'

SECTION B

SECTION B

INFORMATION PROCESSING ORGANISATION AND FACILITIES TO SUPPORT MINING ANALYSIS IN THE INSTITUTIONAL INVESTMENT ENVIRONMENT

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SECTION B

INFORMATION PROCESSING ORGANISATION AND FACILITIES TO SUPPORT MINING ANALYSIS IN THE INSTITUTIONAL INVESTMENT ENVIRONMENT

SUMMARY

. MINING INVESTMENT IS ONLY ONE OF MANY INSTITUTIONAL INVESTMENT ALTERNATIVES. MINING INVESTMENT STRATEGY MUST THEREFORE BE INTEGRATED WITH THE TOTAL INSTITUTIONAL INVESTMENT STRATEGY. IT FOLLOWS THAT THE VARIOUS ELEMENTS OF THE INSTITUTIONAL INFORMATION SYSTEM SHOULD ALSO BE INTEGRATED.

THE ANALYSIS OF THE MINING SECTOR IS UNLIKE THE ANALYSIS OF ANY OTHER SECTOR OF THE ECONOMY, DUE TO THE UNIQUE FUNDAMENTAL FACTORS DISCUSSED IN THE PREVIOUS SECTION. THIS CALLS FOR ESTABLISHING A SOPHISTICATED MINE TECHNICAL INFORMATION SYSTEM TO SUPPLEMENT THE MORE CONVENTIONAL INVESTMENT INFORMATION SYSTEM THAT SUPPORTS MINING INVESTMENT DECISION-MAKING.

WHILE IT IS IMPORTANT TO RECOGNISE THESE UNIQUE FACTORS AND CATEGORIES, IT IS UNWISE TO SEPARATE THE MINING INFORMATION (TECHNICAL, FINANCIAL AND OTHER) FROM IT'S LOGICAL CLASSIFICATION IN THE OVERALL INVESTMENT INFORMATION SYSTEM. THE CREATION AND MAINTENANCE OF THE INVESTMENT INFORMATION SYSTEM MUST PROCEED WITHIN A SINGLE ORGANISATIONAL STRUCTURE. THIS WILL ENSURE EFFICIENT RATIONALISATION OF HUMAN AND INFORMATION RESOURCES IN THE COMPLEX AREA OF INFORMATION ORGANISATION AND CONTROL.

. THE INVESTMENT INFORMATION SYSTEM MUST SUPPORT ALL FUNCTIONS (E.G. MINING ANALYSIS, ECONOMIC ANALYSIS, PORTFOLIO MANAGEMENT) WITHIN THE INVESTMENT DEPARTMENT. THIS CONFIRMS THE NEED FOR THE MORE SPECIFIC MINING INFORMATION TO MERGE EFFECTIVELY, FULLY COGNISANT OF THE OBJECTIVES AND

FUNCTIONS OF THE INVESTMENT DEPARTMENT. TO THIS END, THE DIFFERENT LEVELS OF THE INSTITUTIONAL INVESTMENT ORGANISATION ARE EXAMINED IN TERMS OF OBJECTIVES AND FUNCTIONS.

THE LEVELS CONSIDERED IN DETAIL ARE THE INVESTMENT ANALYSIS DEPARTMENT, THE INVESTMENT ANALYST (MINING) AND THE INVESTMENT ANALYSIS INFORMATION SYSTEM. THE DEPARTMENT PROVIDES THE MULTI-DISCIPLINARY INTERACTIVE ENVIRONMENT NECESSARY TO SUCCESSFULLY PERFORM MINING ANALYSIS AS PART OF A TOTAL INSTITUTIONAL INVESTMENT STRATEGY. THE INFORMATION SYSTEM PROVIDES BOTH RAW DATA (FUNDAMENTAL FACTS) AND PROCESSED DATA (INFORMATION).

INFORMATION SYSTEMS ARE OFTEN REFERRED TO IN THE SPECIFIC CONTEXT OF COMPUTER SYSTEMS. HOWEVER, IN THIS INVESTIGATION, INFORMATION SYSTEMS REFER TO ANY ORGANISED POOL OF INFORMATION WHICH HAS A DIRECT OR INDIRECT BEARING ON MINING ANALYSIS - BOTH MANUAL AND COMPUTER BASED. THE MANUAL SYSTEMS INCLUDE CONVENTIONAL DOCUMENT FILING SYSTEMS, PERIODICALS, MICROFILM AND REUTER'S FINANCIAL TICKER SERVICE. COMPUTER SYSTEMS INCLUDE DATA BASE AND MODELLING FACILITIES.

THE APPENDICES INCLUDE DETAILED DESCRIPTIONS AND CODES OF ALL CATEGORIES OF INVESTMENT INFORMATION, INVESTMENT METHODS AND PUBLICATIONS. FIRSTLY, THEY PROVIDE A USEFUL SUMMARY PERSPECTIVE FOR THE MINING ANALYST TO ORIENTATE HIMSELF WITHIN THE TOTAL INSTITUTIONAL INVESTMENT ACTIVITY - WITHOUT DEVIATING IN DETAIL FROM THE SUBJECT OF MINING ANALYSIS. SECONDLY, THESE APPENDICES ARE OF PRACTICAL USE IN DIRECTING THE MINING ANALYST TO BOTH MINING AND NON-MINING INFORMATION, THEORIES AND METHODS. THEY WILL SUPPORT HIM IN ANALYSING THE MINING INVESTMENT AND PREPARING SOPHISTICATED FORMAL REPORTS AND RECOMMENDATIONS FOR THE BOARD OF DIRECTORS.

INFORMATION PROCESSING ORGANISATION AND FACILITIES TO SUPPORT MINING ANALYSIS IN THE INSTITUTIONAL INVESTMENT ENVIRONMENT

To understand the purpose and nature of an Information System in an Investment Analysis Department, a perspective of the Institutional Investor organisation is required. Emphasised are the objectives and functions of:

- Investment Analysis Department.
- Investment Analyst (Mining).
- Investment Analysis Information System.

1. THE INSTITUTIONAL INVESTOR

- Invests the funds arising from the business operation prudently, in the most profitable manner consistant with security and the institutional image.

2. INVESTMENTS DIVISION

- Invests, with due regard to safety of capital, to produce the highest possible yield for the long-term.
- Invests with a view to promoting the Institution's business.
- Manages the investments of the Institution as efficiently and economically as possible.

3. INVESTMENTS ANALYSIS DEPARTMENT

3.1. Objectives

- Recommend the purchase and sale of equity investments and advise in the timing of such investments in accordance with the Division's objectives.
- Report on and elucidate economic trends and developments in the countries in which the Institution operates.
- Report on developments in the economic sectors in which the Institution as a substantial investor is interested.
- Project economic trends and developments in the countries in which the Institution operates and in the sectors in which the Institution as an investor is interested or should be interested.
- Identify and recommend new investment opportunities for the Institution.
- Recommend allocations of all investable funds into various types of assets and recommend targets for asset distribution in various portfolios controlled by the Institution. Such targets are to be short-term, medium-term and long-term.
- Recommend changes in the asset distribution of the portfolios controlled.
- Recommend purchases and sales of equity investments and advise on the timing of such investments and disinvestments.
- Act on decisions taken by Management with regard to sales and purchases of equity investments.

- Liaise with the Property and Fixed Interest Departments on action to be taken with regard to investments other than equity investments.
- Record and comment on the relative performance of the various portfolios in terms of the objectives set for such portfolios and the targets set for them.

3.2. Functions (To Achieve Objectives)

3.2.1. Econometric

- Establish a 5-Year Macro Economic Model for Southern Africa setting out particularly:

  - Course of interest rates.
  - Stock Market prices and yields.
  - Possible deviations.

  Review the model at least monthly.

- Prepare Sectoral and Industrial Models for the same period indicating:

  - Economic growth and profitability per economic sector.
  - Profitability level per industrial sector.

  Review the models at least monthly.

3.2.2. Portfolio Objectives

- Recommend, in conjunction with the Property and Fixed Interest Departments, the 5-Year Investment Objectives for the various portfolios. Review the objectives at least monthly.

  Note: By portfolio objectives is meant: Overall income return aimed for, overall capital appreciation aimed for, risk and speculative factors allowed for etc.

- Recommend, in conjunction with the Property and Fixed Interest Departments, Portfolio Targets and cash-flow allocations for the 5-Year period mentioned for the various portfolios. Review targets at least monthly.
- Review at least monthly all action taken on each portfolio in terms of objectives and targets.
- Review at least monthly all special funds and managed portfolios and recommend action.

3.2.3. Equity Analysis

- Update fundamental prices of all companies on the 'primary list' whenever results are announced.
- Update buying and selling lists at least monthly.

- Provide up to date in-depth analyses and views on the ± 100 'primary' companies and the industries in which these companies operate.
- Provide coverage on the ± 200 'secondary' companies.
- Construct computerised models for forecasting mining companies' dividends according to varying assumptions (such as metal prices).
- Provide a continuous view on future commodity price movements with a view to providing parameters for the computer models.

3.2.4. Information Systems

- Review and update the filing system.
- Set up a computerised data base, containing historical records of c.p.s., d.p.s., prices, volumes etc. of ± 300 primary and secondary companies.
- Design and implement computer systems, with access to the data base, to:

  - Update buying and selling lists.
  - Update portfolio valuations.
  - Update company statistics to provide 'screening sheets'.
  - Provide quarterly revisions of projected dividend income for each of the Institution's portfolios.
  - Provide accurate statistics annually on retained earnings for portfolios.
  - Update compound growth of c.p.s. and d.p.s. schedules for 300 companies.
  - Construct price, earnings and dividend indices for individual companies and groups of companies (by type of share or sector) for purposes of research into timing.

3.3. Sector and Company Classification

The primary objectives of sector allocation among analysts are sector specialisation and optimal work-load allocation for total share-market coverage. Within each analyst's sectors companies may be classified as;

- Primary Companies

  Those companies which the analyst must study and know in detail, for reasons such as the Institution's very large holdings, regular buying interest and potential selling interest when holdings are large etc. Regular annual analyses must be done, as soon after receipt of accounts as possible, and any significant changes, developments, interim results, etc. reported on immediately. Ideally, there should be a limit of 25 such companies per analyst.

- Secondary Companies

  Includes all the Institution's smaller holdings, potential buying interest, small scale periodic buying etc. These are subject to regular detailed review, but the analyst is not expected to know every aspect of operations, etc.

. Other Companies

The remaining companies do not require regular detailed review. However, analysts are expected to be conversant with their activities and major direction of development; and to use screening analyses to bring potentially interesting companies to management's attention. Until these companies are 'promoted' to the secondary list not too much time is spent on them - but they are not ignored.

The classification is subject to continuous review, and it is the responsibility of the analyst concerned to advise on re-classification. The mining analyst's allocation might look as shown in Figure B1 below.

MINING SECTOR AND COMPANY CLASSIFICATION

Mining Sector	No.	Primary Companies	Secondary Companies
Coal	10	Amcoal Trans Natal	Apex Min A T Coll Clydsdale Nat Ants R L Coal Vryheid Wankie Wit Colls
Gold	24	Ergo Vaal Reef West Drie	Blyvoor Buffels Doorns E Drie Elands F S Geduld Harmony Harties Kinross Kloof Libanon Pres Brand Pres Steyn Randfontein St Helena Southvaal Unisel W Areas W Deep W Holdings Winkels
Copper	4	Messina Palabora	MTD ZCI

Mining Sector	No.	Primary Companies	Secondary Companies
Manganese	2	Ass Mang Samanco	
Platinum	3	Implats Lydplat Rusplat	
Diamonds	2	Anamint De Beers	
Other Mines	4		Rooiberg Con Murch Gefco Msauli
Mining Finance	17	Amgold Anglos A Vaal Gen Min G F S A J C I T C Lands	Ass Ore Charter Con Gold Fed Mynbo Metamin Midwits Minorco Sentrust U C I Vogels
	66		

Figure B1

4. INVESTMENT ANALYST (MINING)

4.1. Objectives

Provide up-to-date analyses, views and recommendations on action to be taken in respect of those Mining Companies (including Diamonds and Mining Financials) in which the Institution has (or in his view should have) a direct or large indirect shareholding.

4.2. Functions (To Achieve Objectives)

. Construct computerised models for forecasting gold mining and base metal mining companies' profits, dividends, present values etc.

- Investigate alternative systems (through computer vendors) in terms of service offered and costs.
- Submit system recommendations to and discuss with Investment Management.
- If approved, set up models and test.
- Utilize the models to provide forecasts based on the latest company information available in the files and metal price parameters provided by the Commodities Analyst.

- Update interim and preliminary statistics on 'screening sheets' in respect of all 'primary' mining companies; evaluate results, discuss with Portfolio Managers and submit to weekly investment meeting.
- Monitor all 'secondary' mining companies, highlighting those which merit further investigation as potential investments. After discussion with Portfolio Managers conduct in-depth analysis, submit the recommendation (on a flysheet) together with the analysis.
- Prepare in-depth analyses of mining sectors and companies within those sectors, on request of Investment Management. This will normally follow a commodities report (including a view of the metal price prepared by the Commodities Analyst, and agreed to by the Mining Analyst, Commodities Analyst and Portfolio Managers).
- Keep abreast of developments in mining sectors and companies; develop contacts with the mining fraternity, visit mines and their controlling Finance Houses, particularly where in-depth analyses are concerned.

4.3. Planning and Control

As an aid to both planning and control, all Analysts compile a weekly schedule of work planned and completed. A specimen is shown in Figure B2 below.

(Name) _____ W/E _____

WEEKLY WORK PLAN SCHEDULE

Outline of activities planned for next 4 weeks	Work to be commenced or completed this week	Work commenced or completed during past week

COMMENTS:

Figure B2

5. INVESTMENT ANALYSIS INFORMATION SYSTEM

5.1. Objectives

- To save time and money.
- To establish a system for keeping analysts fully informed of developments in their subject fields.
- To ensure that important items of new information are not missed, that use of information possessed is maximized, that earlier information relevant to any evaluation is retrievable to avoid duplication of effort.
- To orientate any systems to the needs of the users, constantly maintaining and checking such systems to keep pace with changing needs.
- To preserve original copies of all reports and other decision-making information originating in the department for future research.

5.2. Basic Functions

- Collection and Storage

  Building up a collection of useful books, periodicals, reports and records, and maintaining these.

- Current Awareness

  Circulating current information to relevant persons.

- Enquiry and Retrieval

  Selecting a method of storage and indexing/cross-referencing to facilitate ready information retrieval.

5.3. Information Elements and Manual Processing Procedures

5.3.1. Investment Theories and Methods File

This file is kept by the Information Co-ordinator and is used for:

- Investment ideas and theories.
- Methods and techniques.
- In-house applications and research.

Items sent for filing are assigned their FILING CODES (detailed in 'Information Filing System' below) on the top right-hand corner.

New files are opened through the Information Co-ordinator so that the Master Index may be kept up to date (See Appendix 1).

5.3.2. Information Filing System

5.3.2.1. Categories

The filing system must support all the functions performed in the Investment Analysis Department and is housed in the filing room.

The filing code and date are entered on all material sent for filing.

Files may not be changed in name, discontinued, nor new files added without approval of the Information Co-ordinator in order that such changes may be incorporated in the Master Index.

Where only the first 3 letters of a filing code are used, this file is assumed to be a general file for that category.

The amount of sub-division in any particular category will depend largely on the volume of material to be stored.

The main headings of the system are as follows:

ECONOMIC AND FINANCIAL AFFAIRS

- International
- Stock Markets
- South Africa
- Rhodesia/Zimbabwe
- U.S.A.
- E.E.C. (Incl. U.K.)
- Japan
- African
- Miscellaneous

INVESTMENTS

South Africa:

- Agriculture (Including agricultural commodities)
- Financial
- Property
- Industrial
- Metals and Minerals
- Unit Trusts
- Johannesburg Stock Exchange
- Fixed Interest Securities

Rhodesia/Zimbabwe:

- Sectors

ADMINISTRATION

Subscriptions and Services

Details of filing sub-division and specific coding for metals and minerals are included below.

Details of all other categories are listed in Appendix 2.

5.3.2.2. Metals and Minerals

Filing Code		Category
MCH		Chemical Metals and Minerals (Potash, Phosphate Rock, Sulphur, Antimony, Barytes, Bismuth, Boron, Lithium, Fluorspar)
-	ANT	- Antimony
-	FLO	- Fluorspar
MEL		Electronic Metals and Minerals (Mercury, Cadmium, Mica, Rhenium, Selenium, Tellurium, Indium)
MFU		Fuel Minerals (Coal, Oil, Natural Gas)
-	COA	- Coal
-	OIL	- Oil
MGA		Gemstones and Abrasives (Diamonds, Gemstones, Abrasives)
-	DIA	- Diamonds
MIR		Insulants and Refractories (Asbestos, Graphite, Perlite, Vermiculite, Sillimanite, Magnesite)
-	ASB	- Asbestos
-	VER	- Vermiculite
MLI		Light Metals (Aluminium, Magnesium, Titanium)
-	ALU	- Aluminium
MNU		Nuclear Metals (Uranium, Calcium, Rubidium, Beryllium, Rare Earths, Zirconium, Hafnium)
-	URA	- Uranium
MOM		Older Major Metals (Copper, Tin, Lead, Zinc)
-	COP	- Copper
-	LEA	- Lead
-	LME	- The London Metal Exchange
-	TIN	- Tin
-	ZIN	- Zinc

MPM — Precious Metals (Gold, Platinum Metals, Silver)

- GOL - Gold
- PLA - Platinum Metals
- SIL - Silver

MST — The Steel Industry Metals (Iron Ore, Steel, Nickel, Manganese, Chromite, Cobalt, Molybdenum, Tungsten, Columbium, Tantalum, Vanadium)

- CHR - Chromite
- IRN - Iron Ore
- MAN - Manganese
- NIC - Nickel
- STE - Steel
- VAN - Vanadium

MINING — General (Technical Reviews)

MINING FINANCE — General (Industrial)
(Political and)
(Financial Reviews)

Where the volume of material justifies it, further sub-classification of the categories above may be made, as follows:

South Africa :
- Production
- Consumption
- Price Influence
- Reviews

World : (Same 4 as above)

Alternative Sub-classifications:

A. File items according to source of information:

- Brokers' Reports
- News Cuttings
- Departmental Work
- Company Statements

B. Mark items to be filed with expiry dates according to the following time categories:

- 3 Months
- 12 Months
- Permanent

5.3.2.3. Maintenance of Company Files

. Aims

- Simplification (e.g. eradication of duplication, rationalisation of circulation).
- Reduce information flow to desks by selection and filing at source.
- Provide up-to-date, easily accessible, essential information in the files.

. Method

At any one time a company file will only contain
- Information to be kept indefinitely; and
- 6 months batch of cuttings etc.

For continuity of file maintenance, analysts open a secondary file in front of each permanent file for depositing recent (last 6 months) information. When an analyst requires a file he transfers information from the 6-months file into the permanent file and signs out only the permanent file. He then sorts the new information in the permanent file or discards before returning the file.

. Information Flow from Companies

Includes:

Interim Results
Preliminary Final Results
Annual Accounts
Chairman's Statement
Dividend Declarations
Rights Issues or Take-overs
Gold Mining Quarterly Results

- A clerk cuts the ticker tape and files the information under the Company, noting the name of the company and type of statement on a board next to the ticker.
- A clerk cuts the first official company statement seen in the papers, staples it on a sheet of paper and files under the company, discarding the previous ticker cutting. The board will then be ticked off against the company to show that the official statement is there.
- When the formal company statement arrives the clerk files one copy and discards the previous newspaper cutting. The tick next to the Company on the board is then crossed through.
- A separate file for Gold Mining quarterly results is placed behind the major Mining Finance Houses (e.g. Anglos). Ticker cuttings are placed in there until the formal document from the company arrives, then the ticker cutting is discarded.

- Only the last 4 company statements are kept.
- No other newspaper reports and cuttings are kept. The main source of gold sector historical information is the Mining Journal.

. Information Flow from Brokers

- The share trader files all brokers reports on individual companies straight into the company 6-months file. If the analyst wishes to receive certain brokers reports personally he makes arrangements with the trader.
- Reports dealing with a number of companies in one sector should be filed next to the industry or commodity file (e.g. all platinum company reports next to platinum file).

. Basis of Permanent File

- One set of Company accounts (2 of latest year) going back as far as possible, plus the Articles of Association, are kept separately from the main file - in chronological order, latest year first. Good, well researched, brokers reports are also kept here.

- Company File is sub-divided under the headings below:

  Historical Statistics

  All Moodies, and series of Pollak and Freemantle reports and F.M. Cards.

  Brokers Reports

  One copy of last year's brokers reports clipped together, by broker, until the analyst has decided on their worth.

  Department Work

  One copy of all past analyses kept together. All department fly sheets on rights issues etc. with one copy of the relevant company documents attached.

  Company Circulars

  One copy of all interim statements, batched together. Chairman's statements to be stapled to annual accounts if they do not appear in them. Offer documents etc. where department made no decision.

  Newspaper and Periodical Cuttings

  Analysts' responsibility - keep only articles of permanent value. Be ruthless.

- Administration File

  Do not touch 'decision pending'.

5.3.3. Periodicals - Circulation, Reading and Filing

. Aims

- To bring to Investment personnels' immediate attention articles of importance.
- To keep permanently only those periodicals that contain historical statistical information deemed essential or whose contents are directly related to investment work.

. Method

- The information Department distributes a list of periodicals available (See Appendix 3) and an individual 'reading request form'.

  Each individual adds to his form the titles of any publications which appear on the list, which he can really use, and returns the form to the Information Department. Periodicals required, but not listed, are inserted for investigation by the Information Department. It is not how much information one has access to, but the amount one does something about which determines the efficient use of information. Rapid readers can deal with many periodicals, but slow readers should choose a minimum to ensure rapid circulation. Once the Information Department receives the individual periodical request forms they place the relavent names on a circulation list which is attached to the periodical. Those requesting immediate access will have their names on top of the list.

. Decisions required on Periodicals

- To be kept permanently in department?
- To be kept for 3, 6, 12 months?
- To be read and returned to Information Department (Institution's Main Library) for permanent filing (i.e. important to the Institution but not to the Investment Department although some articles may be worth photo-stating)?
- To be read and destroyed? (Important articles being cut out).

. Suggestions

- Bank Reviews: One copy should be filed on 3, 6 or 12 month basis for random perusal by anybody; while the economist receives a personal copy which he must read, cut up, photostat and possibly circulate in a weekly report, then destroy.
- Where a copy is to be kept permanently and no index is available, the list of contents should be photocopied and circulated to personnel for reading and then kept as an index.

- Everybody should have access to and must read a Daily paper, Financial Mail and Economist. The articles need not be circulated for information but can immediately be filed if deemed necessary for permanent record.
- A clear distinction must be drawn in the minds of all people responsible for reading magazines between information to be brought to people's attention and information that is of permanent value. Therefore articles should be marked for permanent filing only if considered essential.
- Periodicals of a highly specialized nature are retained by analysts for reference in their field. Periodicals to be retained for over 2 years are bound together (by year) by the Printing Department and kept in the Investment Analysis Library.

5.3.4. Microfilm Service

The following microfiche are available for technical analysis (received Monday morning in respect of the previous week's information):

Microfiche Identification		
A	Dow Jones Industrial Average	)
	FT Industrials	)
	FT Golds	)
A, B	RDM SECTORS (ALL)	)
B	ESE Banks	)
	New Car Sales	)
	New Commercial Vehicle Sales	)
	Comparison Car and Commercial	) Mainly Point
	Copper Price	) and Figure
	Foreign Exchange Reserves	)
	Sugar	)
	Tin	)
	Money and Near Money	)
	London Free Market Gold Price	)
	Short Term Interest Rates	)
	Reserves and Share Prices	)

B1-11 BAR-CHARTS - about 500 price/volume bar-charts covering all the more actively traded companies - 3 year period, log scale, etc.

PF1-24 POINT & FIGURE CHARTS - about 1 000 charts covering virtually every listed company, many over long periods - some over 10 years. In some cases 2 or 3 charts per share, using different methods.

Current microfiche are retained by users.

Non-current microfiche are dumped, except for a representative sample at regular intervals for research (keep the month-end edition of weeklies).

5.3.5. Reuter's Financial Ticker Service

Spot prices are dumped at the end of each day. General announcements and news items are also dumped. Company announcements are marked with the initials of relevant analysts, cut out at the end of the day and sent to the analysts; the rest are dumped. Closing prices and volumes are retained for 6 months. Other information is handled as arranged.

5.4. Computer Facility

Successful portfolio management is heavily dependent on the quality and timing of investment decisions. These decisions can only be as good as the quality of current information available in useable form.

The potential of the computer as an aid to investments analysis has long been recognized in the U.S.A. and U.K., due to the necessity of processing large streams of many variables into meaningful information as quickly as possible.

A similar trend of increasing useage of computer applications is already becoming manifest in South Africa. A number of Institutions are currently developing computer systems in the areas outlined below, as aids to improved equity decision-making.

. Specialized Groups of Shares

For which detailed statistics are regularly available.

In the case of mining shares, particularly gold, a large number of interrelated parameters are continuously in a state of dynamic change, necessitating regular re-evaluation of potential earnings and therefore the present value of shares. To this end the concept of a computer model is seen as the only efficient tool. (See 'Mine Modelling' section 5.4.2. below).

. Technical Analysis

Refers to timing (when to buy or sell), and necessarily involves a study of share price movements and traded volumes, often on a daily basis. Two main areas are:

- Calculation of a wide variety of indices to indicate trends in shares, sectors and the market.
- Specialized timing systems which indicate buying and selling pressures.

. Share Selection Aids

Due to its ability to scan and sift vast quantities of data, the computer can be used to highlight profitable situations. Chief uses are:

- Relative value reports - indicating whether shares are underpriced or overpriced according to various historical and projected criteria.

- Ranking of shares according to specified criteria (e.g. earnings growth rate, dividend yield, dividend cover, etc.).

. Processing of Investment Statistics

Is implicit in any kind of analytical research. This can be accomplished by:

The creation and maintenance of a data base, from company financial statements, etc., from which a large variety of useful information (ratios, etc.) may be extracted, and summarised in meaningful form. (For details see 'Data Base' section 5.4.1. below).

. Pricing of Individual Shares

By means of complex models, using such techniques as regression analysis, is a valuable facility and area for further research. (See 'Mine Modelling' section 5.4.2. below).

. Portfolio Performance Assessment

Manually, any type of assessment is a major statistical exercise at infrequent intervals. However, computerization enables regular assessment, using a variety of methods e.g. comparison of different portfolios.

5.4.1. Data Base

Will include at least the ± 300 primary and secondary companies identified during 'Sector and Company Classification' (Section 3.3.). Refer to this section for the 66 mining companies that would be typically included in the data base.

. Reference Data

This is in effect a status report which may be updated from time to time, accessed by company code. It occupies a fixed amount of space and no historical record is necessary. The term 'updating' implies record amendment, deletion or addition.

For each of the 300 companies:

Data Description	Units	Characters	Dec. Places
Name (abbreviated) and Code		16	
Number of issued shares	millions	6	3
Year-end for results herein	mnth, yr.	3	0
Number of shares held by each portfolio	thousands	8	1
Forecasts			
Dividends Interim	c.p.s.	5	2
Final	c.p.s.	5	2
Earnings, total	c.p.s.	6	2
Growth rate (comp. div.) 5 year	% + or -	4	0

Data Description	Units	Characters	Dec. Places
Miscellaneous			
Buying (B) or Selling (S) list indicator and approval date		6	0
Maximum buying price	c.p.s.	4	0

. Historical Data

For each of the 300 companies, a record of fixed length for each year indicated:

Data Description	Freq. p.a.	No. of Years	Units	Characters	Dec. Places	
Dividends, total	1	25	c.p.s.	5	2	
Dividends, interim	1	6	c.p.s.	5	2	
and date (LDR)			mnth, day	4	0	
Dividends, final	1	6	c.p.s.	5	2	
and date (LDR)			mnth, day	4	0	
Earnings, total (1)	1	25	c.p.s.	5	2	
Date of prelim. announcement	1	2	mnth, day	4	0	
Earnings, interim	1	2	c.p.s.	5	2	
and date announced			mnth, day	4	0	
Earnings attrib. total (2)	1	25	c.p.s.	5	2	
Shareholders' int.	1	6	%	2	0	
Current ratio	1	6	-	2	1	
Prices, High, Low, Last (3)	52+12	6	cents	4	0	Ø
Volume (3)	52+12	6	('00s)	5	0	Ø
Prior charge ratio	1	6		4	1	
Net asset value	1	6	c.p.s.	4	0	

. Non-Company Historical Data

Indices (to include dates)

RDM, weekly	52	6	-	4	1
ESE, weekly	52	6	-	4	1
SAM, weekly	52	5	-	4	1

Sector and Special Indices (details as appropriate)

NOTES:
(1) Incl. attributable earnings for pyramids.
(2) Only for certain companies such as Mining Finance, etc.
(3) Weekly and month-end.
Ø Per magnetic tape from E.S.E. Financial Services (Pty) Ltd., Johannesburg, weekly.

Initial Data Validation

- In order to have accurate data for initial data file creation, check the validity of the figures on the handwritten data capture record sheet against the following sources of reference (adjusting retrospectively for any capital issue or split):

  Sources of Reference

1967 Onwards	-	Analyses produced by Investments Analysis Department, and where these are not available FM cards.
Prior to 1967	-	Max Pollak reports.
	-	For gold mines, the Mining Journal Quarterly review of gold shares.

- Observe the coding conventions of the computer installation.

5.4.2. Mine Modelling

The computer has become a valuable tool in speeding work flow for a wide range of applications e.g. the data base decision - making support systems (section 5.4.1. above). Unfortunately for the non-programmer, the use of the computer has sometimes caused as many problems as it has alleviated.

This dilemma is particularly true for those involved in Investment Analysis. The nature of Investment Analysis requires intimate involvement by the analyst to ensure that key assumptions are properly integrated into the analysis. The same degree of involvement is also necessary to assess correctly the impact of 'what if' questions. The traditional approach of using a computer analyst/programmer to assist the investment analyst separates the investment analyst from the solution tool.

This separation creates numerous difficulties, particularly in communication and timeliness. If the Investment Analyst must rely on a computer specialist to provide the solution vehicle, then the assumptions of the problem must be communicated to this specialist, and the program must be tested, run, and the results validated. In most cases, the solution vehicle, i.e. the program, is a very poor communication tool for anyone except the programmer.

Similarly, the ability to respond to changes in the investment environment (variables) is inhibited by reliance on staff technical support. Whenever the support staff performs the calculations, the investment analyst is forced to interrupt the flow of thought that expands and formulates the conceptual problem. Inevitably something is lost due to lag time. The mental picture of the problem must be reconstructed before the results can be evaluated. If it is necessary to ask 'what if' questions, or change assumptions, the whole problem must be recycled.

Current Interactive Modelling Systems are designed to eliminate these problems by making the power of the computer directly available to the non-technician. They do this by providing a natural language syntax for model (problem) formulation and a set of simple commands to solve the model and generate results. The problem statements are entered in any desired sequence. The system resolves the correct sequence of computation and allows the user to focus on the problem, not on the solution vehicle. Because the statements of the model are readable, they provide documentation for the problem solution. Because modification and interrogation of the models are very easy, changes in assumptions or data take only minutes from conceptualisation to implementation and report generation.

With these modern Interactive Modelling Systems the Investment Analyst can obtain more accurate results, document the approach and assumptions automatically, and make better use of the decision time available at less cost than by any other method.

IBM's CALL/360 STRATPLN[5][6] and CDC's IFPS[7] (among others) are computer time-sharing systems for interactive financial modelling. Using a compact typewriter or CRT terminal, each user communicates with a powerful mainframe computer. Many users are connected to the system simultaneously but each appears to have the computer to himself. Time-sharing implies cost sharing, so that each user only pays a small proportion of the total cost of the machine.

Users' offices are connected to the vendor's mainframe service over the normal public telephone network. The procedure is simple - dial the appropriate number, wait a few seconds for the signal indicating connection to the computer has been made, and sign-on with a personal User Number and Password. (You can change your password at any time to maintain security of information).

To the Mining Analyst engaged in company and commodity evaluation, this modelling facility is ideal. It provides an economical computing service with the fast response needed to evaluate several sets of assumptions within minutes.

Models developed in the Mining Sector fall into the following broad categories (Figure B3):

MODEL CATEGORIES

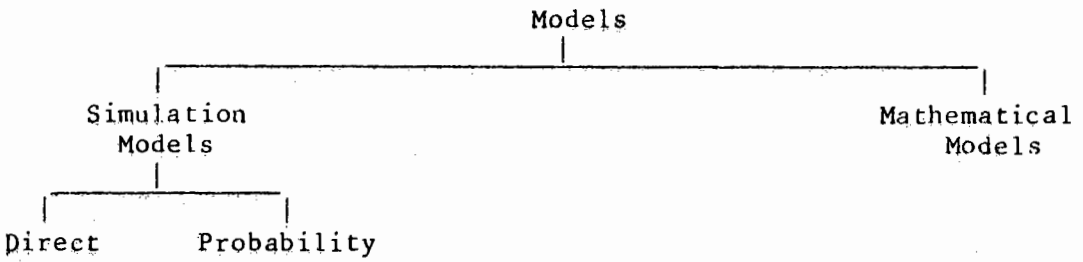

Figure B3

Technico-Financial Mining Investment Models are primarily of the Direct Simulation type with secondary Probability features. In its simplest outline the model can be represented as follows (Figure B4):

MINING INVESTMENT MODEL

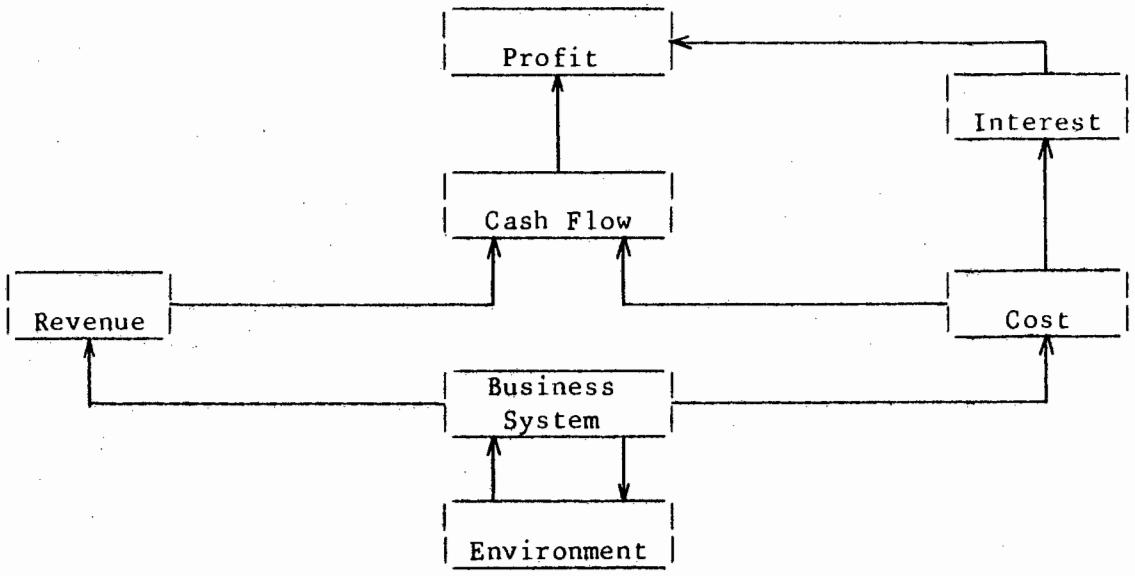

Figure B4

Within this framework details are expanded to accurately represent reality. Building the model is facilitated by the structure of current Modelling Systems, which separate definition of model logic, input data, report formats and communication commands as illustrated (Figure B5):

MODELLING SYSTEMS

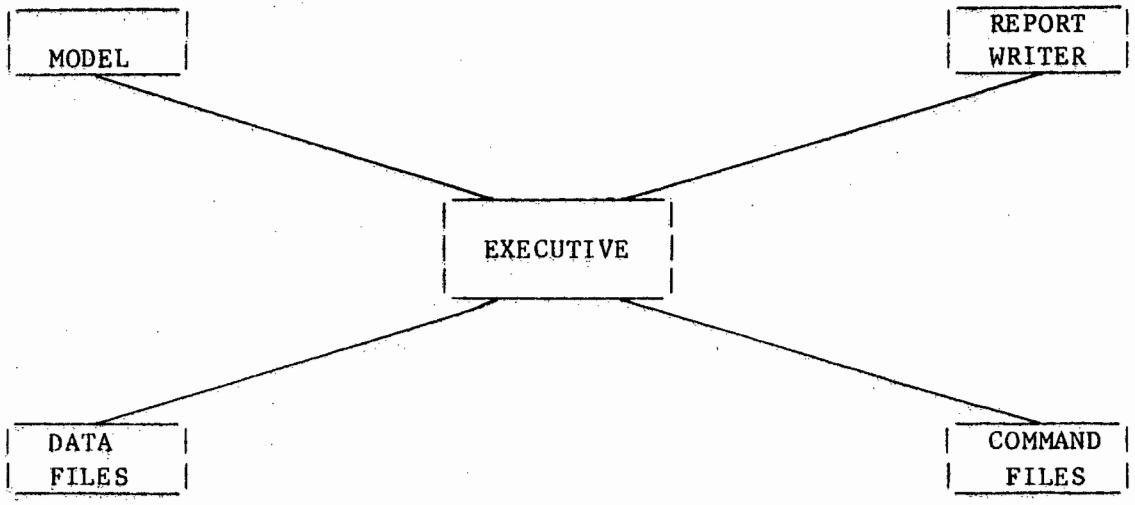

Figure B5

Details of commodity, base metal and gold models are discussed in the following section on Mining Analysis.

SECTION C

SECTION C

MINING ANALYSIS

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SECTION C

MINING ANALYSIS

SUMMARY

. MINING ENTERPRISES DIFFER FUNDAMENTALLY FROM OTHER BUSINESS ENTERPRISES. THIS DIFFERENCE IS REFLECTED IN THE FORMAT AND CONTENT OF THE MINING COMPANY ACCOUNTS AND REPORTS.

THE QUARTERLY AND ANNUAL REPORTS ARE ONE OF THE MAIN SOURCES OF INFORMATION FOR MINING ANALYSES. THEREFORE, THE NATURE OF THESE REPORTS IS EXAMINED WITH RESPECT TO THE BALANCE SHEET, PROFIT AND LOSS ACCOUNT AND TECHNICAL REPORTS.

EQUIPPED WITH THE ACCOUNTS AND OTHER SOURCES OF INFORMATION FROM THE INVESTMENT INFORMATION SYSTEM, THE MINING ANALYST'S MAIN CHALLENGE LIES IN REALISTICALLY EXTRAPOLATING FUTURE TRENDS OF THE MANY VARIABLE FUNDAMENTAL FACTORS.

. THE SINGLE MOST IMPORTANT FACTOR, AND THE MOST DIFFICULT TO PREDICT, IS THE FUTURE COURSE OF THE METAL OR MINERAL PRICE, BASED ON SUPPLY AND DEMAND. TO RESOLVE THIS PROBLEM, COMMODITY FORECASTING MODELS ARE REQUIRED. INDIVIDUAL MODELS NEED TO BE CONSTRUCTED FOR EACH MAJOR METAL AND MINERAL. THERE ARE TWO BROAD APPROACHES TO CONSTRUCTING THESE MODELS I.E. ECONOMETRIC AND INDUSTRIAL DYNAMIC TECHNIQUES.

. WITH THE COMMODITY FORECASTING PROBLEM RESOLVED, MORE GENERALISED MODELS CAN BE CONSTRUCTED FOR THE TECHNICO-FINANCIAL ANALYSIS OF THE MINING COMPANIES. TWO MODELS I.E. A BASE METAL MINE MODEL AND A GOLD MINE MODEL, WILL HANDLE THE BULK OF MINING ANALYSES.

THESE MODELS HAVE DIFFERENT FRAMEWORKS, BUT ARE SIMILARLY CONCERNED WITH HANDLING FUTURE UNCERTAINTIES OR RISKS. THEY EXPRESS THE MINE'S WORTH IN PRESENT VALUE TERMS (BASED ON DISCOUNTED CASH FLOWS OF FUTURE DIVIDENDS), INCLUDING A PROBABILITY RATING OF ACHIEVING THE PREDICTED RESULTS.

MUCH DETAILED WORK HAS BEEN DONE BY THE MINING FINANCE HOUSES IN THIS DIRECTION, BUT NON-MINING INVESTMENT INSTITUTIONS HAVE LAGGED IN OR AVOIDED THIS FIELD.

- ANALYSIS OF GOLD MINING COMPANIES IS COMPLICATED, EVEN WITH THE AVAILABILITY OF A COMPUTER. THIS IS DUE TO: THE LARGE NUMBER OF MINES; THE FLOOD OF REGULAR QUARTERLY PERFORMANCE DATA; THE WILDLY FLUCTUATING GOLD PRICE (AND IT'S EFFECT ON MINING GRADE, MINE DEVELOPMENT AND MINE LIFE); AND THE RATIONALISATION OF OPERATING MINES AND MERGING OF MINING FINANCE HOUSES.

THEREFORE INVESTMENT INSTITUTIONS MAY RESORT TO OTHER LESS SOPHISTICATED METHODS. THIS INCLUDES A 'RELATIVE VALUE INDEX' OF GOLD MINING SHARES AND AN 'AVERAGE BROKER VIEW'.

THE METHOD USED WILL DEPEND ON THE RESOURCES AVAILABLE (I.E. TIME AND COMPUTER FACILITIES), THE AMOUNT OF CAPITAL TO BE INVESTED AND THE MARKET STATUS OF THE COMPANY SHARES.

- MINING FINANCE HOUSES HAVE DIVERSIFIED INTO GOLD, DIAMONDS, URANIUM, COAL, BASE METALS AND MINERALS, MANUFACTURING INDUSTRY AND COMMERCE. THEIR ANALYSES ARE THEREFORE MORE COMPLEX THAN SINGLE MINERAL PRODUCING MINING COMPANIES. HOWEVER, THE TWO BASIC MODELS (BASE METAL AND GOLD) CAN MAKE A SIGNIFICANT IMPACT ON TOTAL ANALYTICAL EFFORT BY FACILITATING THE ANALYSIS OF MOST OF THEIR INDIVIDUAL MINING HOLDINGS.

MOREOVER, THE PRINCIPLES INVOLVED IN THESE MINING MODELS HAVE BROAD APPLICATION IN OTHER INDUSTRIAL AND COMMERCIAL MODELS.

1. MINING COMPANY ACCOUNTS AND REPORTS

1.1. The Business Nature of Mining Companies

The mining industry is generally in the unique position of enjoying an unlimited market for it's output. Price trends vary enormously, depending on the type of mineral. Consequently the accounts and reports differ greatly from those of other industrial enterprises(8)(9). The output of individual mines is often limited only by the ability to produce within the bounds of economics. This is influenced by the relationship between capital outlay and the mineral content (or life) within individual mine boundaries. A mine's competitive position therefore plays little part in it's fortunes. Naturally the ability to keep costs at the lowest possible level is no less pressing than with other industries, particularly with the so-called marginal mines where low-grade ore generates revenue barely sufficient to cover working costs.

As the industry is not competitive, means of reducing costs are derived through co-operative organisations established within the structure of the individual mining groups or within the wider structure of the mining industry i.e. The Chamber of Mines. The latter handles, inter alia, labour recruiting for the industry as a whole. Similarly, wage increases are a matter for negotiation by the industry as a whole. The net effect is that savings or increases in costs follow a similar trend at nearly all the individual mines.

1.2. Accounts and Reports

Shareholders in the South African Mining Industry receive quarterly profit and technical reports, in addition to the annual accounts and reports. The quarterly reports give the working profit and costs together with the tonnage and grade of ore milled. They also state the estimated amount of taxation, capital expenditure and various other financial information. In the technical section they disclose details of development and shaft sinking. At the end of the financial year, the composition of the latest ore reserve is estimated. Apart from these reports, special announcements are made regarding borehole results, values obtained in shaft intersections of reef and plans for increasing output. This means that progress at the mines can be followed with considerable accuracy, virtually from month to month. However, the value of annual financial and technical reports is much more limited than in the case of other enterprises.

The only new information disclosed by the annual reports is, with few exceptions, contained in the chairman's statement and in the plan of the workings. The statement may reveal: details of development in various sections of the mine; major plans for expansion; estimates of the corresponding capital expenditure; the means of financing this expenditure (from profits, loans or new share issues); the assessed loss for tax purposes (if applicable); and a general indication of the significance of development trends. The plan of the workings, when

considered in relation to borehole results and/or indications at neighbouring mines, gives an indication of likely value trends in development and is the basis of any assessment of the remaining life of the mine.

1.3. Balance Sheet

Fixed assets are largely in the form of 'a hole in the ground' and plant and buildings which will ultimately be of relatively little value. All successful mines gradually build up a comfortable excess of current assets over current liabilities during, or immediately after, the initial period of expansion. Dividend declarations are then for many years directly related to the annual profits until near the end of the mine's life. Consequently, the balance sheet is of little interest except in the early years and latter years of the life.

In the former case, the funds available are of prime importance in considering the mine's ability to finance estimated future capital expenditure. These funds are considered in conjunction with the likely level of future profits. This projection will determine whether additional share capital or loans have to be raised; alternatively, whether or not the level of capital expenditure calls for a reduction in the existing dividend rate. In considering these possibilities, reference is made to the directors' report or chairman's statement. If the mine is not already paying tax it will also give the assessed loss for taxation purposes, so that the timing of tax liability can be taken into consideration.

With old mines nearing the break-up or liquidation stage, the balance sheet is important in the assessment of share value. Apart from the net current assets, many mines have investments in co-operative concerns or are shareholders in other mines and even in industrial enterprises. The value of these assets can usually be determined accurately from the information given in the balance sheet and directors' report. This does not complete the assessment of the total break-up value, but will often provide sufficient guide to determine whether the market price of the shares is conservative or not in relation to the possible value of the assets. Other items taken into account are: the value of the remaining accumulated ore in the mine and plant (the recovery of which is termed the 'clean-up'); the value of the plant and machinery; and freehold land.

At this stage of a mine's life, the situation and extent of freehold land can usually be determined from the directors' report or from an inset of the freehold on the plan of the workings. Freehold areas do not necessarily coincide with the mining areas. The nominal value of the shares is also taken into consideration as the tax-free capital returns are limited to this amount. Any other returns, whether in the form of dividends or liquidation dividends, are subject to tax.

1.4. Profit and Loss Account

For the reasons outlined in the introductory comments dealing with the balance sheet, the profit and loss account deserves little more than a

glance, except with new and old mines. With new mines, it provides a background to the estimates. With the old, it confirms the indication, given by the trend of net current assets in the balance sheet, of whether or not current dividends are being bolstered by drawing on accumulated profits. This factor is considered when viewing the break-up possibilities of an old mine which has not started capital repayments.

For those mines still in the prime of life, the profit indicates the trend of profitability. However, this would already have been indicated by the quarterly reports and by the dividend declarations before the end of the financial year. The policy is usually to pay out profits in full. As the future profit trend is mainly determined by information given in the technical reports, the significance of the profit and loss account is very limited.

1.5. Technical Reports

These take the form of a manager's and/or consulting engineer's report. It is usually in one or other of these reports that the break-down of working costs is given. A comparison of these details with those of neighbouring mines, or a consideration of individual items of cost in relation to information given elsewhere in the technical reports or in the chairman's statement, may enable certain conclusions to be drawn regarding the future trend of costs. For example, a mine which has already reached it's maximum rate of output may still be building up the volume of its ore reserves. To do this requires extra development, but when the reserves are considered adequate the development footage will be reduced to merely maintain the reserves.

It is from the trend of the ore reserves and of development that the future profitability of the mine is estimated. The metal content of the reefs is measured in grams per ton. The value of reef exposed in development is normally stated in cm-g, which is derived by multiplying the grams by the centimetre width of the reef. The purpose of development is to test the reef by sampling to determine whether it is payable or not, and to prepare the reef for the stoping or mining-out operation. It is from these results that the volume and value of the ore reserves is computed annually. The ore reserve is stated as so many tons at, say, 10g over an average stoping width of, say, 120cm. Basically the g figure in the ore reserve is arrived at by dividing the cm-g factor, derived from development of areas taken into the ore reserve, by the estimated stoping width in cm. In practice, the ore reserve value is usually lower than the development results due to technical factors which must be taken into account. If the trend of the ore reserve value is upwards, then the trend of the mill or recovery grade (stated in g) and consequently of profits, will be upwards. If the quarterly development results are, on average, maintained or higher than the average in the previous year or two, it is probable that the ore reserve value, when published at the financial year end, will be maintained or increased as the case may be. It is consequently from the trend of development and ore reserve values that

the future profitability is determined. If an attempt is made to estimate the likely value of future development, reference must be made to the plan of the workings (which usually discloses borehole results) and/or to the results at neighbouring mines. This, although an interesting exercise, is no subject for the layman.

As indicated above, the stage is eventually reached when development is aimed simply at maintaining and not increasing the volume of the proved ore reserve. When a mine has reached this position, any steady decline in the volume of the ore reserve is a danger signal as it points to an inability to find sufficient payable reef in development to replace the ore which is being mined from the ore reserves. If such a trend continues, it will eventually lead to a reduction in output and, in extreme cases, perhaps to the premature closing of a mine. In mining, hasty conclusions should not be drawn from development or ore reserve trends over a short period as a low value zone which is adversely affecting the ore reserves may be of a very limited extent. However, if the ore reserves have been declining in volume, the percentage payability disclosed by development is a guide to the likely trend to be expected in the publication of the annual ore reserves. The percentage payability may be stated as the relationship between payable and total samples taken in development, expressed as a percentage. The lower the percentage payability, the greater the footage of development which must be advanced to maintain the reserves. As increased footage in development means higher costs, there is an economic limit beyond which the footage advanced in an attempt to maintain the ore reserves cannot be maintained. Basically, a falling ore reserve tonnage and a consistently low percentage payability are danger signals pointing to a decline in profitability.

The volume of the ore reserves may also decline without a reduction in the percentage payability. This is the stage when primary development is completed, i.e. when virtually the entire mining area has been explored by normal development. At this stage, the reef development is mainly directed to breaking up larger blocks of ore to facilitate mining, or to establish payability in doubtful areas. A glance at the plan will soon confirm whether this is the case as the development tunnels and workings would be shown covering virtually the whole area of the mine. If the ore reserves are large, it may still be several years before the mill grade and tonnage treated (and consequently the profits) are affected. The life factor must then be given considerable weight in assessing what proportion of the dividends are in effect repayments of capital, relative to the market price (not the nominal value) of the shares; and to the value of the net current assets, shareholdings, freehold and plant. As all mines are wasting assets, part of every dividend should be set aside to provide for the amortization of capital invested in the shares, but in practice this is seldom a major consideration until a mine is past its peak.

The lives of old mines are sometimes extended far beyond normal expectations through the mining of subsidiary reefs in the closing years of their lives, but this usually means the mining of lower grade reefs with a consequent fall in profitability.

The technical reports may also disclose the source of the ore milled - from ore reserves, from outside ore reserves, from development. At an average mine, ± 70% of the net tonnage (i.e. tonnage after dumping waste rock but before sorting) should be drawn from the reserves. This percentage may be rather less at a new mine because of the extra rock drawn from the excess development aimed at building up an adequate reserve; and considerably less at an old mine with small ore reserves and reaching the end of its life.

In the latter case, the mill grade will bear little relationship to the ore reserve grade. But if ± 70% of the mill tonnage is drawn from reserves, the mill grade (although not necessarily immediately) will follow the trend of the ore reserve grade. Generally, the mill grade is rather lower than the ore reserve grade due to loss of ore in mining and other technical reasons. The exceptions to this rule are those mines which practice a high rate of sorting, the sorting rate usually being disclosed in the annual technical reports. By eliminating rock containing little or no economic mineral before milling and treatment, sorting has the effect of up-grading the ore treated, relative to its value in the ore reserve. Thus the mill grade at mines which sort 20% or more, may equal or even exceed the ore reserve grade.

1.6. Conclusion

The technical reports and financial accounts both reveal the state of the enterprise at a particular time and, when considered in relation to previous results, the trend of its affairs.

2. METAL AND MINERAL COMMODITY FORECASTING

2.1. Supply/Demand and Price

Mining companies continually face the problem of whether to invest in additional production capacity. Decisions usually depend on the expected rate of return of the proposed investment. Techniques exist to give reliable short- and long-term forecasts of metal prices, and so contribute to a satisfactory analysis of expected mining profitability.

Computers permit the application of standard mathematical techniques to large quantities of data in order to make accurate and rapid estimates of capital requirements. Alternative production methods and schedules and their associated costs can be evaluated accurately.

Evaluation of controllable cost and capital requirements is only part of the picture. To determine the overall viability of an investment, a reliable assessment also has to be made of factors outside company control i.e. future demand and price. This has in the past usually involved extrapolations of existing trends of 'high-low' estimates. However, the outstanding feature of most commodity markets, including those of many minerals and metals, is that trends are erratic. In any one year, demand, supply and price are rarely on trend. Simple trend extrapolation is at best only a first approximation and inadequate for purposes such as estimating likely payback periods for mine investments.

However, quantitative techniques to cope with this type of problem have been evolved and refined. These techniques involve mathematically constructed behavioural models of different types of economic systems. It is no longer necessary to rely on historical market behaviour to extrapolate into the future. These models incorporate total market behaviour to forecast the likely future trend and behaviour consistent with that trend. It is obviously much easier to analyse a commodity market than it is to analyse a whole economy.

Some non-ferrous metals exhibit extreme price instability, but this is not entirely random. In the case of copper, for example, nearly all year-to-year price changes have been traced directly to quantifiable movements in supply and demand. This means that movements in price and other variables can be successfully forecast once the basic behavioural characteristics of the market for a particular commodity have been assessed. The key task is to construct a framework or model within which even, say, the price impact of strikes, usually considered completely unpredictable, can be estimated. Copper is subject to particularly wide and sharp price fluctuations.

Statistically-based forecasts cannot completely eliminate future uncertainty, but the quality of forecasts can be significantly improved by mathematical analysis of the relationships that have determined supply and demand in the past and the ones likely to pertain in the future. This scientific approach also allows assessment of the probability of error in advance. The probability assigned to likely future prices can in itself be a guide to policy decisions or forward planning estimates.

2.2. The Economic Model Framework

The economic model is a representation of the real world constructed in such a way that the reactions of a given economic system or market to particular stimuli can be investigated artificially. In practice, most economic models will be simplified representations of reality, in so far as different economic models focus on particular aspects of the real world.

The economic model consists of a system of equations that demonstrate the functioning of markets under various conditions.

Economic models have to cope with human behaviour, and therefore are not based on exact relationships. However, most decisions are based on considerations with a degree of uncertainty. Nevertheless, decisions are made, and the process is little different from building an economic model. The more complex the decision and the larger the investment involved, the more important it becomes for the decision - making process to be formalised, with all assumptions and hypotheses clearly defined. In addition, formal (as distinct from informal) model building has the advantage of clarifying ideas and views, and of generating new ones.

No mining company invests in a new project until it has been thoroughly costed in advance. This itself is a form of model building. Mining companies, as well as analysing (or modelling) the technical aspects of a project, analyse the market in which the product is sold. This is particularly important due to the instability in demand and prices of metals and minerals.

There are 4 stages in building the model:

. Defining the Purpose

It is vital for a speculator to know within a small margin what the price of the metal in question is likely to be over the next few weeks. The semi-fabricator, with a stock problem is interested in whether prices are going to be significantly higher or lower in the months ahead, without undue concern about the precise level. For the primary producer, and institutional investor on the point of investing, it is important to know the likely range of prices over the next 25 years, and particularly whether prices during the first 5 to 10 years of a new project will be at levels such that capital and interest can be repaid. The precise level of prices in each of these years is of less importance than knowing what the cyclical pattern is likely to be - provided that they are not at such levels that losses would be incurred.

Short-term models have to be very complex, since fundamental supply and demand conditions change and interact with each other slowly. Also, short-lived phenomena such as strikes or share price changes are important. For long-term evaluation these can be discounted; what is then required is accurate simulation of the way the fundamentals will change and interact.

Having established the purpose of the model, the construction is resolved in the next three stages.

. Specification

Identify the variables which are important in the real world and roughly their relationship. Essential to this stage, and to the construction of any economic model, is a detailed practical understanding of how the particular market operates. The final model is only as good as the knowledge on which it is based. The initial verbal specification of the variables and their inter-relationship must be translated into a system of equations which accurately reflect the way the particular market operates.

Simplicity is desirable because complex formulations, even though apparently more realistic, give less accurate predictions. This results from economic laws being inherently less accurate than physical laws. Economic models containing more complex relationships will follow as the underlying relationships become better understood.

Distinguish those variables whose values are taken as given (exogenous), and those values the model is attempting to predict (endogenous). A model of a mineral market takes the level of world manufacturing output as given - this is explained by factors outside the market and it would be unreasonable to require the model to predict it.

The primary endogenous variables are the supply, demand and price of the metal. These are then broken down into their constituent parts such as mine output, scrap, refined metal consumption and stocks (See Appendix C2). Their interaction is determined by an analysis of how they were linked in the past. These linkages between endogenous variables provide the behavioural characteristics of the market. The force with which they interact at any instant is then determined by the values assigned to exogenous variables, such as the level of industrial activity, strikes and net past consumption which constitutes the potential pool of recycled scrap.

. Estimation

Involves assigning numerical parameters to the relationships in the model. Thus if the model postulates a relationship between demand for the metal and the level of world manufacturing output, it is necessary to specify the precise increase in demand resulting from a given increase in manufacturing output. Assigning the numerical relationship between different variables is generally done on the basis of past experience, and with the help of techniques discussed later. Whatever techniques are used, this stage involves reference to data on the past behaviour of the relevant variables. The collection and refinement of data are the most time-consuming part of model building in an industrial and mining context.

. Forecasting

A system of simultaneous equations, involving the endogenous and exogenous variables in numerical relationships is now available. Values are assigned to the future levels of the exogenous variables. These are forecasts in themselves, but they are much simpler to make without a model than forecasts of the endogenous variables. Thus, the future world level of industrial activity may be the single most important exogenous variable. This changes irregularly from year to year, but there is a pronounced historical upward trend, which can be reasonably expected to continue. For short-term forecasts, refer to the forecasts of the next year's activity produced by the economic forecasting bureaux in the industrialised countries. For long-term forecasts, an extrapolation of the past trend would be more appropriate. Extrapolation to obtain values for the exogenous variables, does not infer that the figures produced by the model will be growing smoothly. Even assuming an even growth in refined copper consumption over the next 10 to 15 years, the behavioural characteristics of the copper market will, from past experience, produce significant price cycles.

Once values have been assigned to the exogenous variables, the set of simultaneous equations is solved to give forecasts of the endogenous variables. If the model has been specified correctly, and the estimation procedure carried out correctly (demonstrating that the equation did in fact represent past behaviour accurately), then the forecasts will be good, although never absolutely accurate. There is always an element of randomness. This implies that the forecasts will be subject to a margin of error, even if the assumptions made about the exogenous variables turn out to be absolutely correct. On the other hand, if econometric analysis is used at the estimation stage, the very existence of this inevitable margin of error can be used to specify in advance the probability of the actual outcome deviating from the forecast by more than a specified amount, say $\pm$5%. This measures the 'degree of confidence'.

The forecasts may appear dubious in the light of past behaviour. Closer examination may indicate that some aspect of the real world which was excluded from the model as unimportant is, in fact, important and should be included. Alternatively, the forecasts are to be believed.

The model must cater for unforeseen variables such as strikes. The strike pattern in copper mining, for example, has become a built-in characteristic of supply, but it may be that, in any period, there is an unusually large or small proportion of the metal lost in stoppages. Assumptions can be made and the effect of a strike loss on the price of the metal assessed, the loss of production/price relationship being a known characteristic.

Of the four stages of model building i.e. defining the purpose, specifying, estimating, and forecasting, in only the last two is the computer used. If, as is usual, econometrics is the estimation technique used, computing facilities are essential, since the mathematical operations involved (inversion and multiplication of possibly very large matrices), are inordinately time-consuming by hand, but simple by computer.

2.3. Econometric and Industrial Dynamic Techniques

There are two broad approaches to the estimation of economic models i.e. econometrics and industrial dynamics[10][11]. These two approaches are quite separate and, although considered alternatives, can be regarded as complementary. The aim of both techniques is similar: a set of quantified relationships between the key economic variables, such as consumption, production and price.

Econometrics is the quantitative side of economic science. By this definition, all economic models are econometric, but the term is reserved for a set of statistical techniques (in particular regression analysis) that extract from historic data a relationship between the variables of interest. However, there are many more complex techniques available than simple regression analysis, each appropriate in different circumstances.

The problems to which econometric analysis may be applied are limited mainly by data availability. If the estimation procedure is to be successful, historical data must be available for most of the important variables on a consistent continuing basis. Data inaccuracies must be minimal.

An econometric technique, useful in forecasting demand for a product or commodity in the short- to medium-term, is input-output analysis. In order to produce, say, a further R1 million worth of vehicles, the additional production of R100 000 worth of steel, R30 000 worth of plastics, R20 00 worth of copper, and R20 000 worth of rubber, amongst others, will be required. Moreover, since these ratios depend on the technology inherent in existing capital equipment, they will change slowly. These ratios (input-output coefficients) are often estimated accurately by government departments and are available for use by private enterprise.

The large amount of data required for econometric analysis is not always available, neither are econometric techniques always suitable even if these data are available. In some instances the data available may all refer to a period in which the institutions, practices or general state of the market were very different from those currently prevailing. Obviously, relationships estimated on the basis of such data will be inappropriate. For example, the demand pattern for platinum will change markedly if the use of platinum catalysts for motor exhaust pollution control becomes mandatory in all industrialised countries, as already in the U.S.A. Allowance would have to be made for this in a model of the platinum market.

Thus, full-scale econometric models are meaningful only in the short- and possibly medium-term when institutional and technological changes are likely to follow the established pattern and where market data are fairly readily available.

Industrial dynamics provides an alternative to econometrics for the longer-term. The approach is to specify a dynamic model of the industry, without particular regard to the problems of estimation (which are foremost in econometrics). Econometrics provides highly precise estimates of models which approximate only the market structure, whereas industrial dynamics provides reasonable estimates of precise models of the market structure.

Econometrics and industrial dynamics are not competitive techniques. The two sets of techniques are generally used by two distinct groups: only economists tend to be competent in econometrics, while those who practice industrial dynamics tend to come from an engineering or business school background. Simple econometric techniques are usually used by those working with industrial dynamics in making the reasonable estimates of their model parameters. Similarly, econometric practioners adopt industrial dynamics where data are either absent or inadequate for model estimating.

Consider the industrial dynamics model in which many of the crucial relationships are estimated econometrically. The object of this model is not, as is the case with the short- to medium-term model, to produce accurate price predictions at any moment, but to anticipate the general pattern of developments, including price movement, over the next two decades. The consumption and production relationships and the price formation mechanism are the results of econometric estimation, for these reflect technological and institutional factors which are either not expected to change significantly or are expected to alter fairly systematically. However, the relationships governing investment, which depend on available finance, producers' share-holding behaviour, and the control of production to maintain price levels, are either not easily estimated or are liable to differ from previously observed relationships. Thus, the investment process must be constructed through the use of industrial dynamics.

Industrial dynamics is also highly dependent on the computer, but in a different way to econometrics. Econometrics depends heavily on the computer at the estimation stage, but the resultant models are often manipulated fairly easily on a hand calculator. Conversely, parameters of industrial dynamics models may well be estimated on calculators, but the complete model is unmanageable without the computer. Indeed, such a model will generally be presented as a complete computer package.

COMMODITY FORECASTING MODEL EXAMPLE

(DIAGRAMMATIC VIEW)

A. ECONOMETRIC MODEL - GOLD

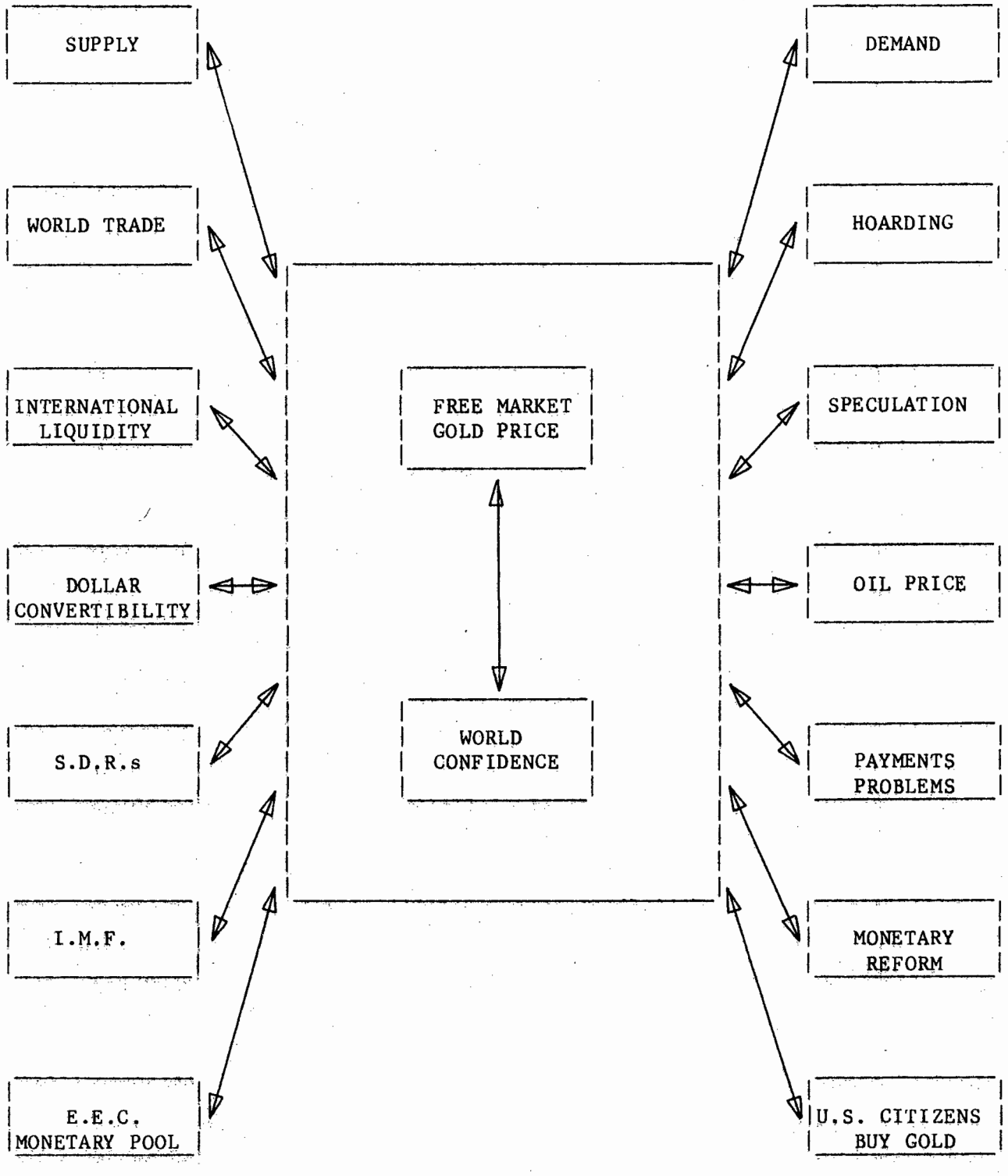

Figure C1

(DIAGRAMMATIC VIEW)

B. INDUSTRIAL DYNAMIC MODEL - COPPER

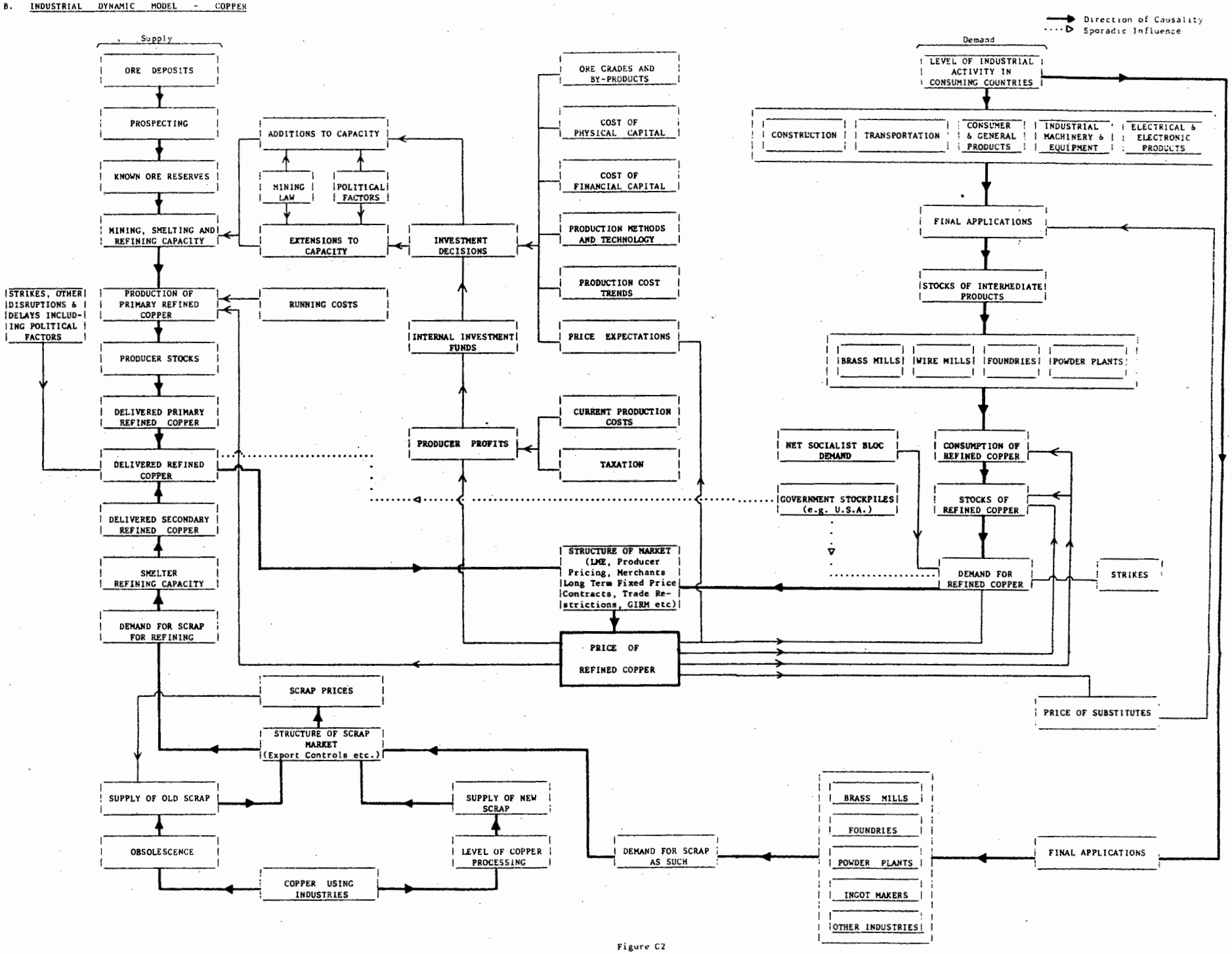

Figure C2

3. BASE METAL MINE ANALYSIS

3.1. Mining Capital Investment and Risk Analysis

Capital investment and risk analysis for new mining ventures is not a new technique. However, sophisticated applications of these techniques only became practical with the improvement in computer facilities in recent years. The computer techniques are based on statistical and financial simulation models of the planned mining, metallurgical, marketing and financing operations[12][13]. The computer has become indispensible in these analyses due to:

- The complexity and time-consuming manual effort involved in doing even a single complete calculation (starting with ore tonnage and grade estimates and proceeding through to the estimated return on the capital investment).
- The virtual impossibility of repeating such calculations to cover the hundreds of possible permutations of assumptions and estimates.

3.2. Objectives of Analysis

Investment and risk analyses for new mining ventures assists management in the following critical decision-making areas[14]:

- Project Viability
  - Comparison with alternative sectors of investment.
  - The risks of part or total investment loss; or not achieving the required minimum return.
- Production and Marketing Plan
  - The optimum initial scale of production and subsequent expansion program.
  - The degree of product beneficiation e.g. mine ore, mill concentrates, or refined metal.
  - Alternative marketing schemes.
- Project Financing
  - The total capital investment required for a chosen equity-loan ratio, and the risk of failing to come into production on this amount.
  - The best loan term combinations of repayment periods and interest rates (linked with currency risks).
  - Effects of variations in the gearing ratio and loan terms on the vendors' interests.

3.3. Investment Return Criteria

The criteria for return on equity investment depend on the business activities and financial status of the vendor. Liquidity, alternative avenues for investments and timing are major considerations. Consequently, four criteria are recognised:

. Discounted Cash Flow (compound interest) rate of return[15].

This is generally used. It is the compound interest rate required to be paid on the capital invested to allow for interest plus capital repayments, equivalent to the estimated dividends over the life of the project. The DCF rate provides a useful relative measure for alternative investments. It is also directly comparable with ruling rates of interest paid by banks (after allowing for differential tax effects on receipts).

. The Present Value of the estimated dividends (or the estimated share values) at a specified rate of discount.

For that interest rate at which the market is likely to discount estimated future earnings, the present value provides an estimate of the market valuation and hence of the potential capital gain or loss on sale of the shares.

. Payback period for equity capital and the estimated average dividend per annum over the remaining life.

This measure is important where the timing of the return on investment is vital to the vendor. This measure is readily understood, even where the capital is invested periodically, as the average payback for each unit of capital can be calculated.

. Break-even calculations, expressed in metal price(s), also measure the extent to which a mining venture exceeds a critical level.

3.4. Uncertainties or Risks

There are two broad areas of risk:

. Decision Factors

Alternatives have to be examined and decisions taken prior to project commencement and as the project develops. These include:

- Level of full production and possible future expansion, with corresponding capacities e.g. shaft capacity, water services, township development.
- Nature of products to be produced i.e. concentrates or metals.
- Structure of the finance to be provided i.e. equity-loan ratio.
- Choice between alternative sales contracts (allowing for the risk of having only one or two buyers versus diversification in different countries with a spread of currency risks).

. Variable Estimation Factors

These include:

- Ore grades, tonnages and waste dilution factors.
- Metal prices.

- Working and capital costs.
- Cost and price escalation rates (in the light of different sales contracts).
- Commencement of production and build-up rate.
- Plant recovery factors.
- Working capital to finance debtors, creditors and stores.

Examination and comparison of each alternative decision factor, at appropriate stages of the project, are necessary to make decisions based on the best available information and analyses. The effects of all possible combinations of variable factors must be considered. For this purpose risk analysis techniques are used.

In situ ore grades and tonnages can be estimated within limits of error by statistical theory. Due to the high cost, a limited number of boreholes are drilled from surface to define the orebody boundaries. These ore intersections provide samples for ore grade estimates and metallurgical tests. The borehole cores also give an indication of likely mining conditions and waste dilution in mining. The variations in grade within the orebody are analysed statistically by determining the value distribution patterns (usually skew and lognormal).

This knowledge permits improved grade estimates, probability distributions for the grade estimates, and an estimate of the likely grade improvements which would result from selective mining (where applicable).

Uncertainties associated with other factors, with the possible exception of plant recovery factors, cannot be defined in a completely objective way. Human judgement plays the major role in assessing these uncertainties and the quality of the estimate depends on the quality of the judgement. In risk analysis, the uncertainties for each variable have to be defined by probability distribution[16]. This is normally done by estimating the likely value with lower and upper limits for the variables (judged at levels representing say only a 5% or 1 in 20 chance of the variable having an even lower value and a similar chance of having an even higher value respectively); then fitting a distribution curve either symmetrical in shape (normal curve) or skew (usually accepted as lognormal) to these 3 values. Such a probability distribution if now subdivided into say 20 equally sized areas under the curve would indicate the 20 probable values which the variable could assume.

Example, metal recovery in metallurgical concentrating process:

Likely Percentage	80%
Judgement of Lower Limit	70%
Judgement of Upper Limit	90%

The symmetrical normal distribution is used and this suggests that the following 20 values for the recovery percentage are equally likely, where each value in effect covers the range about halfway to it's two adjacent values,

67,5	71,2	73,0	74,3	75,4	76,4	77,2	78,1	78,8	79,6
80,4	81,2	81,9	82,8	83,6	84,6	85,7	87,0	88,8	92,5

i.e. for practical purposes it can be assumed that each of these 20 values has a 5% chance of being realised.

3.5. The Financial Model Framework

Having established for each of the risk-variables its probability distribution in the form of 20 values, all equally probable, a risk analysis can be performed. Randomly select one value from the 20, for each variable, and use this set of values in a detailed calculation of the cash flow, etc. for a given set of decision factors. This process is repeated for a new selected set of risk-variables until, say, 100 cases have been calculated giving 100 cash flows, DCFs and other measures of return on the capital investment. This is impossible on a manual basis and can only be done by computerising the logic for a complete technico-financial model of the project.

. The broad framework of the logic for such a model includes the following:

- Preproduction Period

  Equity.
  + Loan capital raised.
  Less raising and other fees.
  Less capital expenditure.
  ± Changes in working capital (stores and creditors).
  ± Interest paid or received.
  Less loan repayments.
  ± Balance of funds brought forward from previous year.
  Equals cash balance carried forward.

- Production Period

  Ore tons mined year by year at estimated grades.
  Plus waste dilution in mining.
  Less plant losses.
  Equals estimated tons milled and metals recovered in concentrates.
  Less handling losses in transport.
  Less percentage of metal content not paid for by smelters and refiners.
  Equals metal tons sold.
  Gross revenue from sales.
  Less selling commission.
  Less smelting and refining charges.
  Less transport, loading, port and freight charges and insurance.
  Less mining and milling costs.
  ± Stock adjustments.
  ± Changes in debtors including revenue from sales not yet received.

Less further capital expenditure.
± Interest paid or received.
± Changes in stores and creditors.
Less taxation (when payable).
± Balance from previous years.
Less loan repayments.
Equals amount available for dividends.
Less dividend declared.
+ Dividends declared but not yet paid.
Equals cash balance at year end.

- Return on Investment

  From the dividends declared up to the end of the mine's life, and after adding the net breakup, the DCF, Present (share) Values and Payback are calculated.

. Many of these steps are complexly interrelated, such as:

- Smelting and refining charges for all the individual contracts involved.
- Tax calculation, allowing for the effect of the quantity of concentrates not exported on the processing allowance and hence on rate of capital redemption allowed.
- Dividend declaration logic, allowing for the cancellation or reduction of a dividend(s) in a previous year(s) in order to build up funds to cover heavy future capital expenditure or loan repayment commitment.

. The model caters for:

- The stipulation of the number of random sets of risk-factors to be selected and calculated e.g. 50 or 100.
- A summary of the corresponding returns specified and the probability distribution of each type of return, e.g. DCF, Present Values at 8%, 10% and 12% per annum.
- The estimated shortfall of capital funds during the pre-production period and/or the first few years of production build-up.
- Where a full risk analysis is not required but only estimates for one specific set of factors, a detailed year by year cash flow analysis as well as the indicated returns on the investment.

3.6. Application of the Financial Model

3.6.1. Project Viability

Exploratory analysis, before the capitalisation structure has been finalised, can assume only equity capital or, alternatively, loan funds up to a level and on terms considered realistic in the prevailing economic climate. Returns indicated for these

alternatives will not be the same, but they can be reconciled after allowing for the loan gearing effect.

Figure C3 illustrates the DCF return on an investment in a base metal mine, on the basis firstly of 100% equity and secondly of 50% equity/50% loan at 10% per annum interest.

The first half of the figure shows the frequency distributions and the second half the cumulative frequency distributions.

PROJECT VIABILITY

A = 100% Equity Capital
B = 50% Equity/50% Loan @ 10% per annum

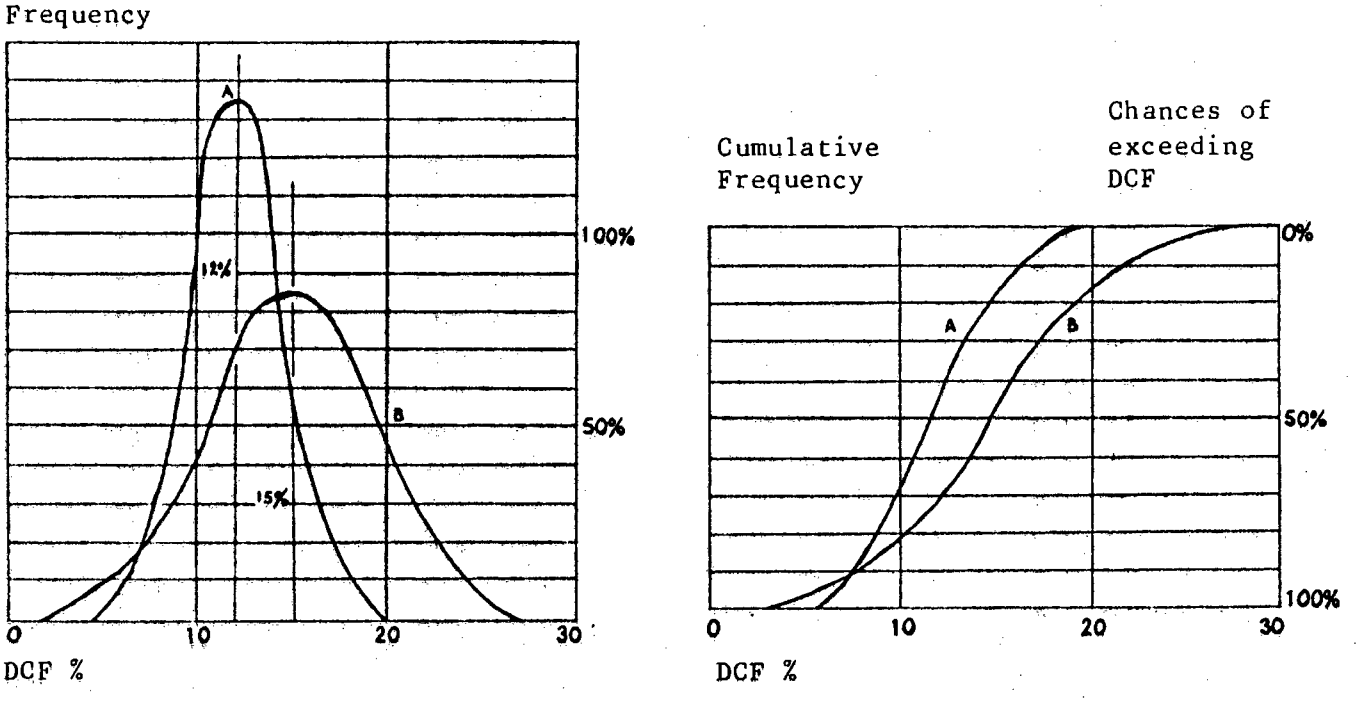

Figure C3

These graphs are interpreted as follows:

	All Equity	50/50 Structure
- Likely DCF	12% p.a.	15% p.a.
- Chances of return exceeding a basic 10% p.a. (See cumulative graph)	70%	80%
- Chances of return exceeding 15% p.a.	15%	50%
- Chances of return exceeding 8% p.a.	90%	90%

(The graphs intersect at 8% per annum and not 10% per annum, i.e. the rate on the loans. This is because loan interest is allowed for tax purposes and therefore costs the company effectively only 6% per annum. With tax deferred for say 10 years the saving in DCF is diluted and the effective cost is about 8% per annum).

Similar graphs are prepared for the present values of the share and for the relevant paybacks.

With such a set of graphs, management can assess the viability of the proposition and compare it with alternative investments, cognisant of the inherent risks and chances of success.

3.6.2. Production and Marketing Plan

It is essential to analyse the effect of different levels of production on the likely return and on the overall risks to be faced. The project viability exercise is, therefore, repeated for several feasible levels of production, each with its appropriate estimates of capital cost, working costs, production build-up schedule, etc. Typical results are illustrated in Figure C4.

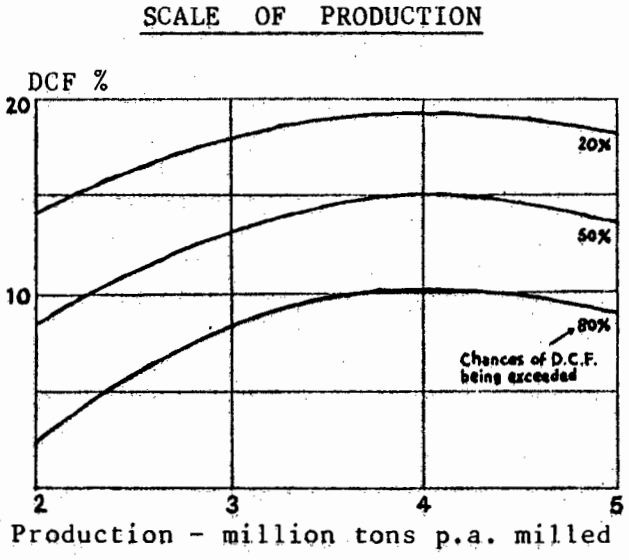

Figure C4

The highest DCFs indicated e.g. 15% per annum for a 50% chance of exceeding this return, correspond to a production level of 4 million tons per annum. However, the magnitude of the capital investment to be made and the differences in payback period (not shown) might influence management to proceed on the 3 million tons per annum level.

A similar procedure may follow to show:

- The effect of investing a further R10 million on a local smelter.

- All the possible alternative schemes of marketing the products e.g. sales contracts with various combinations of overseas smelters and refineries each with its own terms, possibly linked with loan finance.

The latter results might necessitate a re-examination of the best level of production and hence new sets of analyses. This enables management to arrive at the best combination of decisions on the broad physical planning of the venture.

3.6.3. Project Financing

. Gearing Ratio

In general, high gearing of equity capital is advantageous to vendors, provided that loans can be raised on reasonable terms and that the return specified is relatively high. However, where the potential return is mediocre and the risk high, there is a significant chance of the capital not being fully repaid. Hence shareholders will lose some of their invested capital, after allowing for the priority of loan repayments, and a lower gearing is preferable. This aspect is illustrated in Figure C5.

GEARING RATIO

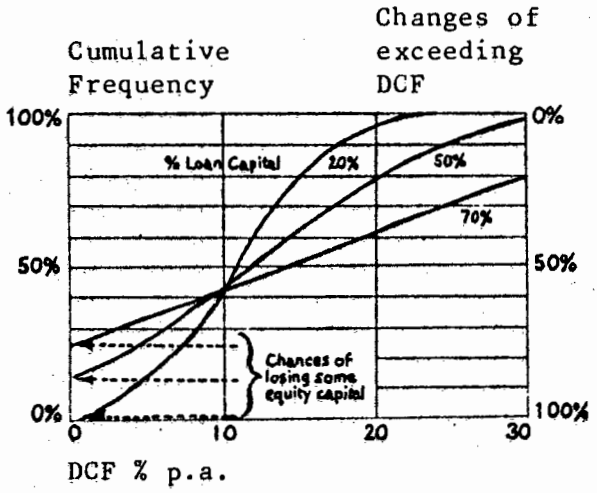

Figure C5

The indicated likely DCF return improves from 11% per annum for 20% of the capital in loans to 14% per annum for 70% loans, but the corresponding chances of not having all the equity capital repaid in full increases from a neglible level to 25%. Such analysis, carried out within the practical limitations of the levels of equity capital available for investment by the vendors and the possible levels of loan funds which could be raised, will enable a logical decision as to the desirable gearing ratio.

. Loan Terms

Loan terms cover a number of pertinent factors such as interest rate, repayment terms, security or guarantees required, prepayment penalties, raising fees, dividend restriction provisions, etc. Where alternative loan proposals are to be compared, it is possible to use risk analysis techniques to compare the overall effect of the different proposals not only on the likely DCF return, present share value and payback period, but also on the associated risks of any specified return, share value or payback period not being achieved. The procedures are the same as before and will enable the vendors to judge whether a loan with a lower interest rate, but carrying conversion rights into shares, is to be preferred to a loan with a higher interest rate and no conversion rights.

The calculations on financing alternatives may also indicate the level of share subscription rights the vendors could afford to give, at any stipulated premium, to a major provider of loan capital so as to leave them either with the same DCF return or with the same potential capital appreciation on their equity investments.

Alternatively, if the vendors are willing to let an outside party in only up to a fixed percentage interest, the number of shares for which subscription rights are to be available to the lender could be fixed, and the corresponding share premium calculated which would give the desired result.

The lender must be satisfied that his overall return on his loan plus equity investment is likely to be reasonable in relation to the overall risks involved. The same analyses can also provide answers to his problem.

As negotiations proceed with the potential lenders such analyses are essential, often at short notice, and only a computerised risk analysis program can provide this service.

. Total Capitalisation Required

The form and extent of the capitalisation usually has to be settled at a stage when the uncertainties have not been fully resolved. This implies that the total amount of capital funds necessary to reach production and finance net outflows in the first few years, until the mine becomes self-financing, is also uncertain. The amount of capital funds to raise, even allowing for a degree of flexibility from bank overdraft, is a risk decision with a definite danger of the funds being insufficient.

Emergency funds raised in a hurry are often negotiated on terms dictated by the lender. Therefore, the level of capital funds to be raised should be estimated on the same basis as before. The risk analysis program can process 50 or 100 cases, each with

a selection of risk factor values. It will give a frequency distribution of the total capitalisation required to provide the funds for the critical early years of production. (See Figure C6).

TOTAL CAPITALISATION

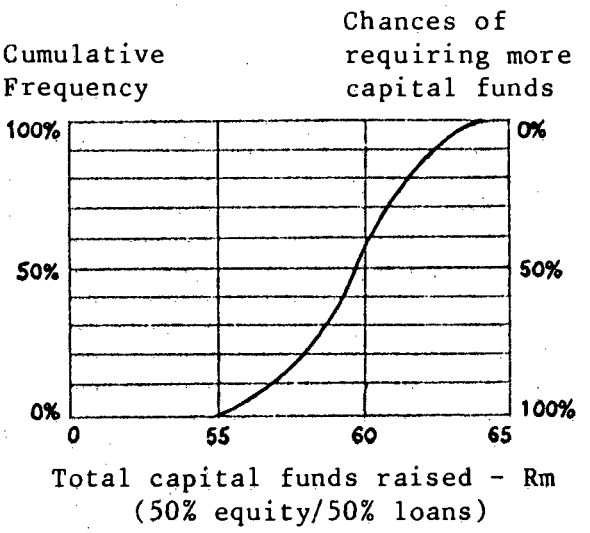

Figure C6

3.7. Benefits for Investment Management

With computerised risk analysis, management can arrive, by re-iterative procedure, at that combination of answers and decisions which, under the prevailing circumstances, is logically the best. These decisions can constantly be reviewed as the relevant associated factors or risks change.

As the sales and capitalisation negotiations for the mine proceed, the program gives investment management a clear and constantly updated picture of the risk factor, the relative merits of alternatives and the overall effects of changes in the basic estimates.

4. GOLD MINE ANALYSIS

4.1. Fundamental Approach to Gold Mine Analysis[17][18]

4.1.1. Basis for Evaluation

In assessing any share for investment purposes, the market price is compared with share valuation based on expected earnings. This involves making certain assumptions about the future. A share does not have a specific value, but rather a value related to a particular set of assumptions.

It is important, when reviewing share valuations, to be aware of the assumptions made and the degree of sensitivity which the valuation has towards changes in the assumed values.

A gold mine is a wasting asset. After its youthful years, when dividends are rising, its value gradually declines until operations cease. It then has no value, except that associated with certain residual assets, such as machinery or possibly freehold land or cash.

A mining share can be evaluated on its yield. To assess the yield required from a particular share, the average annual dividend over the life of the mine is estimated, and the assumption made that part of this will be invested at risk-free rates in a sinking fund whose value at the end of the life of the mine will be equal to the price paid for the share. The remainder of the dividend is then required to yield a value consistent with yields obtainable from investment in stocks of comparable status. The required yield will vary with the life of the mine, being relatively low for long-life mines and becoming very large during the last years of a mine's life. This point is illustrated in Figure C7 where the return from the sinking fund is assumed to be 9% and the required return from the investment is 10%.

REQUIRED DIVIDEND YIELD VERSUS LIFE OF MINE

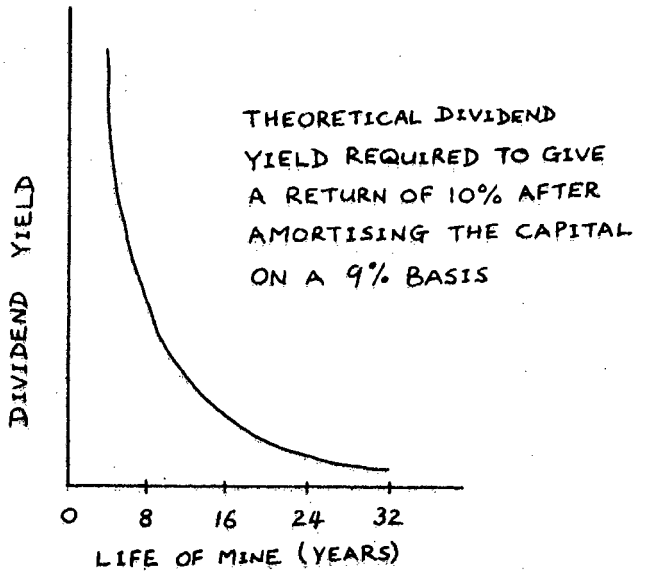

Figure C7

In the past, this 'yield curve' was a useful tool in evaluating gold shares. The price of gold was fixed at $35/oz. and mining costs changed by small and predictable amounts.

The main uncertainty in long-term dividend forecasting centered on ore grade and the total payable amounts available. Thus, valuation was a fairly static process; dividend predictions could be checked periodically in the light of quarterly results and a few minor adjustments made.

In recent times conditions have changed radically. Costs are rising at a rate of ± 20% a year and the free market price of gold fluctuates erratically from day to day. The effects of these changes vary from mine to mine. A large gold price increase brings about a much greater percentage increase in the earnings of marginal mines than those with a relatively high profit per ton. A higher gold price also raises the pay limit and may allow the mining of previously unpayable ore. However, the extent to which this can be done varies from mine to mine and depends on a number of factors such as the availability of ore at lower grades, stoping methods, etc.

Under these conditions it is better to obtain a valuation by first making estimates of future dividends, including any capital repayment, and then discounting these so as to arrive at a present value. This method is mathematically the same as the sinking fund method, but is preferable in that a better allowance is made for the effects of varying dividends over the mine's life, and the end result can be compared directly with the share price.

The operating characteristics of a hypothetical mine are illustrated in Figure C8.

MINE OPERATING CHARACTERISTICS

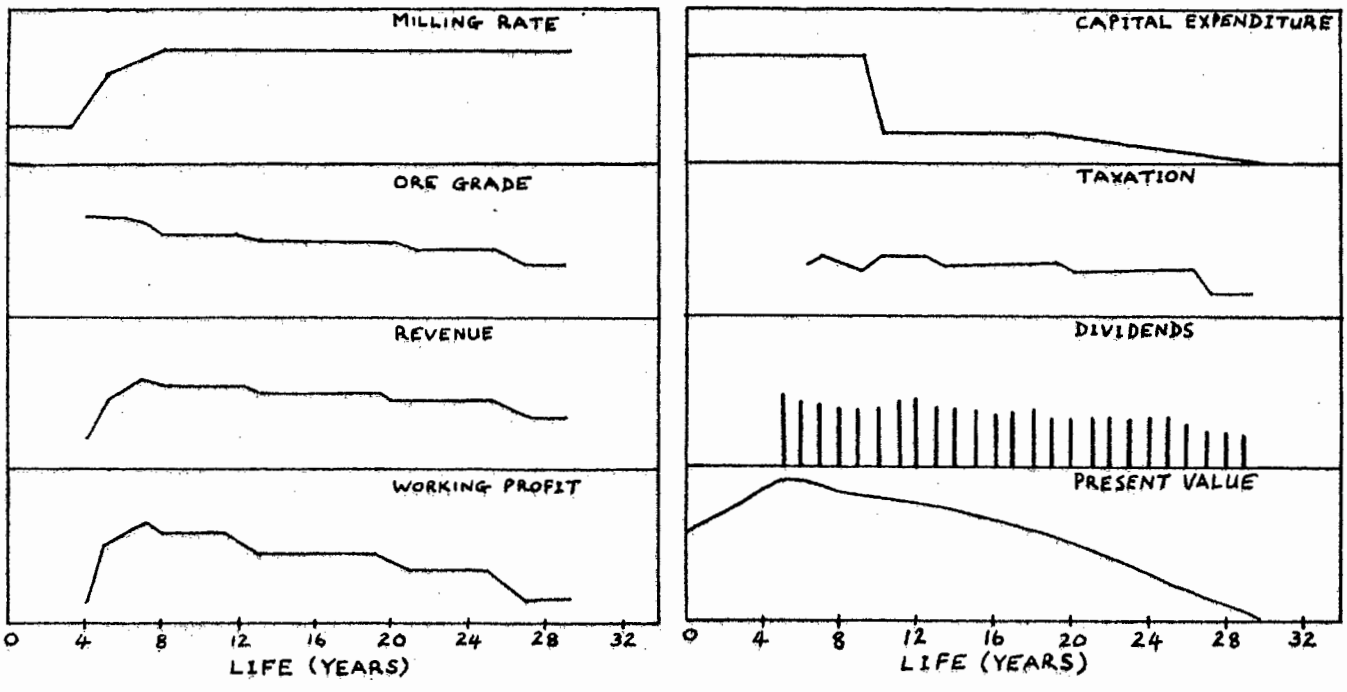

Figure C8

The present value of the mine varies over its life. The share price of a gold mine tends in the long-term to follow the trend of its present value, but is likely to fluctuate considerably over shorter periods mainly for speculative reasons. With a fixed gold price, the share price tends to decline slowly over most of the life of the mine. This can be seen by plotting the monthly averages of the F.T. Gold Mine Index. From around 1950, when the Orange Free State mines came into production, the average remaining life of the mines in the index reduced every year, so that the index followed a long downward path interrupted by speculative reactions. Only from the early seventies with the higher price of gold has the trend of the index risen.

For the purpose of valuation, gold mines are conveniently considered under the following categories:

Developing

Established	-	Long Life	(Over 20 Years)
		Medium Life	(10 to 20 Years)
		Short Life	(5 to 10 Years)
Break-up	-	(Less than 5 Years)	

Different approaches are required for the valuation of each type. For developing mines, certainly in the early stages, estimates of life, ore grade, working costs and capital expenditure are based mainly on borehole results and comparisons with similar established mines. At the other end of the scale, the valuation of short life mines is complicated by the importance of their break-up value and the effects of state assistance. The valuation method discussed later applies mainly to established mines.

4.1.2. Present Value Gold Model Framework

To arrive at a present value first estimate the annual dividends over the mine's life. An example of the calculation required for one year is given in Figure C9.

EXAMPLE OF DIVIDEND FORECAST CALCULATION

PRESIDENT STEYN

Reference is made to the appropriate Mining Journal Quarterly Review for statistics.

Dividend Forecast Calculation for 1972/3:

		Rands (000)
Assumed Gold Price (Rands/g)	1,47	
Tons of Ore Milled (000)	2 550,0	
Ore Grade (g/ton)	12,50	
Revenue		46 864
Working Costs/Ton (Rands)	9,50	
Working Costs		24 225
Working Profit		22 639
Sundry Profit		250
Tax and Lease		9 018
Net Profit		13 871
Capital Expenditure		7 000
Distributable Earnings		6 871

Distributable Earnings/Share: 49,1 cents

Figure C9

Here statistics for President Steyn have been extracted from the Mining Journal Quarterly Review of South African Gold Mines, and the dividend forecast calculated:

- The gold price is first converted to Rands per gram and then multiplied by the tons milled and the ore grade to obtain the revenue.
- Working costs are obtained by multiplying the working costs per ton by the tons milled.
- Working profit is the revenue less working costs.
- Tax and lease payments are then calculated as described in Appendix 4, leaving net profit after tax of R13 871 000 (compared with R10 602 000 for 1972).
- Next, capital expenditure is deducted to leave distributable earnings of R6 871 000 which, on 14 million shares, represents approximately 49 cents per share.
- The company may not pay out the total available amount of 49 cents; cash may be accumulated in advance of a high capital expenditure period. Such factors are taken into consideration in making a dividend forecast.

. The variables which enter into an estimate for a single year include:

Gold price, milling rate, ore grade, working costs, capital expenditure, uranium revenue and profits, amortisation allowance, tax and lease repayments, other income, and loan repayments.

. To calculate the present value it is necessary to have:

- An estimate of the number of years of life remaining to the mine.
- Estimates of the future values of the above variables.
- A suitable discounting factor.

4.1.3. Uncertainties or Risks

. Mine life estimates can usually be made with reasonable accuracy, but uncertainty about the future gold price and the escalating rise in costs have reduced the reliability of such estimates.

. Milling rates are known with some accuracy.

. Ore recovery grades can usually be predicted fairly well from borehole results, subsequent development work and current milling grades. The same factors which have rendered mine life estimation more difficult are making projections of ore grades less reliable.

. Current working costs are known, and an estimate of future costs can be made by assuming a rate of cost inflation. A present value model might allow the inflation rate to be varied for each mine over the first five years ahead, but thereafter an overall uniform rate is more practical.

. Theoretically, it should be possible to forecast capital expenditure requirements over the life of the mine fairly accurately, particularly if cost inflation were non-existant.

. This would involve a detailed knowledge of the likely pattern of mine development, together with some idea of shaft sinking costs and the associated development work. In practice, sufficient accuracy for the purpose of calculating present values can be obtained by making some quite simple assumptions, described later.

. The forecasting of uranium revenue and profits is somewhat hazardous. The mines do not reveal the revenue derived from the sale of uranium oxide, but do state uranium profits and the amount of oxide recovered. Frequently some of the output is stockpiled. Thus, uranium profit estimation has to be based on past figures together with an interpretation of periodic comments

concerning sales contracts. At present world demand for uranium is rising and uranium profits will become increasingly significant. The main uranium producers are Buffelsfontein, Hartebeestfontein, Vaal Reefs and West Rand Consolidated. In addition a few other mines produce relatively small amounts of uranium or have installed treatment plant - these are Blyvooruitzicht, Harmony, President Brand, Virginia, Welkom, West Driefontein and Western Deep Levels.

- Tax calculations(19) are explained in Appendix 4. In summary: for most mines, capital expenditures is allowed as a cost and the excess of accumulated capital expenditure over accumulated profits, i.e. the amortisation allowance, is carried forward to be offset against the current year's figure. This is continued until the amortisation allowance disappears. The newer mines have a further advantage in that they may increase their amortisation allowance by a small percentage each year. In the case of the older mines the amortisation allowance is calculated on the basis of 27,5% of the unredeemed capital expenditure and the current capital expenditure. Generally speaking, in the early years of a mine's existence it pays very little or no tax and is therefore in a position to pay higher dividends than later in its life.

- The remaining items, Other Income and Loan Repayments, are not usually important and where they are there is generally adequate information on which to base a forecast.

- Choice of a suitable discount rate presents a problem. One cannot say that the rate should have a specific value at a given time, but its choice is not entirely arbitrary. The discount rate is the expected rate of return obtained on capital invested, allowing for the capital to be returned at the end of the investment period, and can thus be compared with the redemption yield of a gilt-edged stock. Whereas there is no uncertainty about the expected interest payments from a gilt-edged stock, there is some uncertainty about the accuracy of the forecasts of gold share dividends. The discount rate should therefore be of the order of the gilt-edged redemption yield (of similar term), plus some amount to allow for the risk associated with the uncertainty surrounding the dividend forecasts. However, it is virtually impossible to quantify the uncertainty element and then to translate it into a specific amount of additional compensatory return. An alternative approach is an experimental one whereby the implied overall discount rate for a sample of gold shares is calculated at different times and compared with gilt-edged redemption yields. On this basis a suitable discount rate appears to have a value about one and a half times the average redemption yield for gilt-edged stocks.

A year-by-year set of calculations for the present value of President Steyn is shown in Figure C10.

PRESENT VALUE CALCULATIONS

PRESIDENT STEYN

Yr	Tons Milled (000)	Rec Grade (g/t)	Revenue (R000)	Working Profit (R000)	Tax (R000)	Cap Exp (R000)	Earn /Shr (c)	Disc Earn (c)	Pres Value (c)
1	2 550	12,5	46 864	22 639	9 018	7 000	49,1	43,6	43,6
2	2 550	12,5	50 214	23 439	12 953	2 000	61,3	48,4	92,0
3	2 550	12,5	53 261	24 191	13 364	2 000	63,7	44,7	136,7
4	3 000	12,3	67 823	31 229	16 302	3 970	77,7	48,5	185,2
5	3 300	12,1	20 731	37 660	19 838	4 598	89,5	49,7	234,9
6	3 300	12,0	88 071	41 985	22 082	5 290	98,0	48,3	283,2
7	3 300	12,0	96 678	47 566	25 026	6 153	109,8	48,1	331,3
8	3 300	12,0	106 566	53 802	28 261	7 207	122,7	47,8	379,1
9	3 300	12,0	117 222	60 765	31 820	8 469	136,8	47,4	426,5
10	3 300	12,0	128 944	68 535	36 371	9 061	154,1	47,5	474,0
11	3 300	11,5	135 929	71 291	37 892	9 234	161,1	44,1	518,1
12	3 300	11,5	149 522	80 359	43 934	8 892	183,4	44,6	562,7
13	3 300	11,5	164 474	90 470	51 088	7 929	209,3	45,3	608,0
14	3 300	11,5	180 921	101 737	59 516	6 222	239,1	46,0	654,0
15	3 300	11,5	199 014	114 286	69 396	3 631	273,9	46,8	700,8
16	3 300	11,0	209 397	118 738	74 641		290,9	44,2	745,0
17	3 300	11,0	230 336	133 332	84 017		325,4	43,9	788,9
18	3 300	11,0	253 379	149 575	94 464		363,7	43,7	832,6
19	3 300	11,0	278 707	167 646	106 100		406,1	43,3	875,9

Figure C10

The first line corresponds with the calculation shown in Figure C9, resulting in a distributable earnings per share of 49,1c, which discounted at 12,5% gives a figure of 43,6 c. Similarly, for the second year the discounted earnings are 48,4c. The right hand column gives the running total of these discounted earnings figures which, taken over the 19 years life of the mine, results in a present value of 876c.

4.1.4. Computerised Gold Share Evaluation

4.1.4.1. Motivation

The calculations for a dividend forecast and present value are simple, but the process when performed for thirty mines is exceedingly tedious and therefore an obvious application for computerisation.

The use of the computer is also virtually essential for sensitivity studies e.g. observing how present value changes with a change in gold price, ore grade, working costs etc.

The two computer models described below will aid gold mine investment analysis by providing for each mine:

. A five-year forecast of distributable earnings.
. A present value for the shares.

The calculations performed by the computer are along the same lines as those described earlier. The present value program also prints out a statistical summary of information for each mine designed to assist in the assessment of the shares.

4.1.4.2. Five-Year Forecasting Program

This program provides a five-year forecast on the same basis as the single year manual forecast described earlier (See Figure C9).

Five years forecasting provides a better idea of the likely dividend distribution, particularly where the tax position of the mine is changing or where a relatively high capital expenditure is imminent. An example of the output report for President Steyn is given in Figure C11.

FIVE-YEAR FORECAST REPORT

PRESIDENT STEYN

Share Price: 842,8 cents
No. of Shares Issued (millions): 14,000
Last Financial Year Ended: September 1972

	Financial Years				
	1973	1974	1975	1976	1977
Av. Gold Price (R/g)	1,47	1,58	1,67	1,78	1,90
Tons Milled (000)	2550,00	2550,00	2550,00	3000,00	3300,00
Grade (g/t)	12,50	12,50	12,50	12,30	12,10
Working Costs/Ton (Rands)	9,50	10,50	11,90	12,30	13,20
Revenue (R000)	46664,45	50213,55	53260,87	65837,44	75767,02
Working Profit (R000)	22639,45	23438,55	24190,87	28937,44	32207,01
Uranium Profit (R000)	0,00	0,00	0,00	0,00	0,00
Sundry Profit (R000)	250,00	250,00	250,00	250,00	250,00
Tax & Lease (R000)	9017,79	12953,29	13353,64	16163,00	18039,67
Net Profit (R000)	13871,66	10735,26	11087,23	13027,44	14417,33
Capital Expend. (R000)	7000,00	2000,00	2000,00	2000,00	2000,00
Loan Repayments (R000)	0,00	0,00	0,00	0,00	0,00
Distr. Earnings (R000)	6871,66	8735,26	9087,23	11027,44	12417,33
Distr. Earngs/Share (c)	49,08	62,39	64,91	78,77	88,70
Surplus Liquidity (R000)	2808,00	3379,66	3014,92	1742,15	1009,69
Total Cash Avail. (R000)	9679,66	12114,92	12102,15	12769,69	13426,92
Dividends (R000)	6300,00	9100,00	10360,00	11760,00	13300,00
Div/Share (Cents)	45,00	65,00	74,00	84,00	55,00
Dividend Yield (%)	5,34	7,71	8,76	9,97	11,27

Gold Price Sensitivity 12,2 Cents per 10% Change (19,5%)
Working Cost Sensitivity 5,7 Cents per 10% Change (9,1%)

Figure C11

The input for this program comes from two files, one of which provides five year forecasts of the values of the differnt variables for each mine; and the other contains the gold price forecasts, the currency exchange rates and share prices. The normal procedure is for the information in the first file to be updated as soon as the latest quarterly results are published; a new second file is created and the program is then run. The output is used in the second program as described later.

An example of the data input for President Steyn is shown in Figure C12.

GOLD MINES DATA INPUT (FILE 1)

MINE CODE NO.: 3

NAME: PRESIDENT STEYN

No. of Shares Issued (Millions)	Last Financial Year Ended	Expected Life (Years)
14,0	September 1972	19

Tax Allowance Rate (100% or 27,5%)	Unredeemed Cap. Allow. (R000)	Cap. Allowance Rate %	Surplus Liquidity (R000)	Taxation Constants XA	Taxation Constants XB
100	0	0	2 808	0,703	0,06

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30
Milling Rate (000 Tons/Yr)	2550	2550	2550	3000	3000	3300	3300	3300	0	0
Ore Grade: (G/Ton)	12,5	12,5	12,5	12,3	12,1	12,0	11,5	11,0	0	0
Wkg Costs/Ton (Rands)	9,5	10,5	11,4	12,3	13,2					
Cap. Expenditure (R000)	7000	2000	2000	2000	2000					
Sundry Profit (R000)	250	250	250	250	250	250	250	250	0	0
Uranium Profit (R000)	0	0	0	0	0	0	0	0	0	0
Loan Repayments (R000)	0	0	0	0	0	0	0	0	0	0
Last Year's Dividend (Cents)	27									

DATE: 13 February, 1972

Figure C12

This, together with similar data for the other mines, forms the content of the first input file. Values for most of the variables are given for future years beyond the five years with which the program is concerned, because the same input files are used by both this program and the present value program. An example of the other data input file is shown in Figure C13.

GOLD MINES DATA INPUT (FILE 2)

DATE: 13 FEBRUARY, 1973			
EXCHANGE RATES			
RANDS/$		RANDS/£	
1,4192		1,72	

GOLD PRICE FORECASTS				
Year	Quarterly (Rands/oz)			
	March	June	September	December
1972	35,3	36,4	42,8	44,9
1973	45,0	46,0	47,0	48,0

Year	($/oz)
1972	52
1973	65
1974	70
1975	75
1976	80
1977	85
1978	90

Annual Rate of Gold Price Increase (%)	Cost Inflation Rate (%)	Discount Rate (%)
10,0	7,0	12,5

CODE NO.	NAME	Price (c)	DIVIDEND FORECASTS Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
1	Free State Geduld	1190	245				
2	President Brand	975	175	175			
3	President Steyn	780	70				
4	Southvaal						
5	Vaal Reefs	1125	80				
6	Welkom	300	65				
7	Western Deep Levels	800	110				
8	Western Holdings	1910	360	360	360		
9	Hartebeestfontein	866	120	120			
10	Blyvooruitzicht	330	50				
11	Harmony	270	40				
12	Doornfontein	475	55				
13	East Driefontein	405	30	65	70		
14	Kloof	630	55	80			
15	Libanon	565	95				
16	West Driefontein	1865	320				
17	Buffelsfontein	685	70	85			
18	Elsburg	175					
19	Randfontein						
20	Western Areas	200	30	50			
21	Bracken	145	40				
22	Kinross	300	50	50	65	80	
23	Leslie	65	25				
24	St. Helena	1345	185				
25	Winkelhaak	505	55				

Figure C13

Referring to Figure C11, the average gold price is the forecast average price received by the mine during its financial year. This figure is based on the calendar year figures in File 2, but adjusted to take account of the difference between the calendar year and the corporate year for each mine. Surplus liquidity is cash in hand and on deposit, or loan which is not required for dividends or tax.

The program is devised to calculate a forecast dividend figure, but this can be overridden by a manual forecast (in File 2) in any of the five years. The method of calculation is as follows:

The distributable earnings for each of the five years are calculated, and to each is added one fifth of the surplus liquidity (on the assumption that this liquidity will disappear over five years); a straight line is fitted to these adjusted earnings figures and is used to provide the dividend forecasts. If a manual forecast has been entered, the difference between the computed and the manual figures is spread equally over the remaining years. The computed dividend per share figure is rounded down to the nearest whole number of cents.

The gold price sensitivity is the amount by which distributable earnings per share in the second year would change for a 10% increase in the average gold price. Similarly the working cost sensitivity measures the change in earnings in the second year for a 10% increase in working costs.

4.1.4.3. Present Value Program

This program performs two functions:

- It computes the distributable earnings each year in the same way as the first program, but throughout the expected life of the mine, discounting these back so as to obtain a present value.
- It prints out, in addition to the present value, a statistical summary of information likely to be of use in investment analysis. (See Figure C14).

STATISTICAL SUMMARY OF SOUTH AFRICAN GOLD MINES

MINE	YEAR END	LIFE (YRS)	AVERAGE MILL RATE (TONS/YR)	ORE GRADES (G/TON) MAX.	MIN.	WORKING PROFIT COST (RANDS/TON)		DIVIDENDS (CENTS) ACTUAL	F/CAST	PRICE (c)	PRESENT VALUE (c)	PRICE - PV VARIANCE (%)	F/CAST AV YLD (%)	GOLD PRICE SENSITIVITY
East Driefontein	Dec '73	35	2140	22,0	14,0	19,7	11,0	0,0	20,0	405	524	-29,4	9,1	20
Kloof	Jun '73	35	2677	16,5	12,0	11,9	11,8	13,0	33,0	630	731	-16,0	7,5	30
Vaal Reefs	Dec '73	25	6740	13,5	12,0	8,1	10,7	50,0	50,0	1130	1487	-31,6	7,0	33
Western Deep Levels	Dec '73	25	3200	12,5	12,0	16,8	10,9	80,0	70,0	800	947	-18,4	9,4	18
Kinross	Dec '73	20	1462	9,5	7,0	6,8	7,4	30,0	30,0	300	281	6,3	12,1	41
Winkelhaak	Dec '73	20	1662	9,5	7,5	7,0	7,2	26,0	35,0	510	440	13,7	8,3	20
President Steyn	Sep '73	19	3165	12,5	11,0	8,9	9,5	27,0	45,0	780	877	-12,4	8,8	19
Elsburg	Dec '73	19	1100	13,0	11,0	6,3	10,1	0,0	0,0	175	194	-10,9	14,7	49
St. Helena	Dec '73	19	2178	14,0	12,5	13,4	7,5	90,0	115,0	1342	1305	2,8	9,0	15
Doornfontein	Jun '73	18	1383	14,5	12,0	9,2	11,6	26,0	35,0	475	472	0,6	9,9	21
Buffelsfontein	Jun '73	18	2783	12,5	8,0	7,0	11,0	19,0	45,0	685	502	26,7	9,0	25
President Brand	Sep '73	17	2358	16,5	13,0	14,5	9,8	107,5	110,0	980	888	9,4	9,9	14
Hartebeestfontein	Jun '73	17	3064	14,0	11,0	8,0	12,1	30,0	75,0	865	858	0,8	9,7	31
Harmony	Jun '73	16	3460	8,3	7,0	3,6	6,3	18,0	25,0	270	316	-17,0	13,3	26
West Driefontein	Jun '73	16	2775	29,0	25,5	30,0	12,6	140,0	200,0	1865	1985	-6,4	11,6	12
Libanon	Jun '73	15	1400	13,5	10,0	10,8	9,0	50,0	60,0	565	561	0,7	11,6	24
Western Areas	Dec '73	14	2482	8,0	7,0	3,4	8,5	16,0	20,0	200	192	4,0	12,8	23
Free State Geduld	Sep '73	13	2000	21,5	12,0	21,6	10,0	170,0	155,0	1190	761	36,1	9,7	11
Blyvooruitzicht	Jun '73	12	1883	17,5	14,0	14,1	11,0	26,0	30,0	330	338	-2,4	14,4	16
Western Holdings	Sep '73	11	2816	17,5	15,0	16,8	8,9	235,0	225,0	1905	1451	23,8	11,1	12
Welkom	Sep '73	10	2150	10,5	9,5	6,0	9,4	32,0	40,0	302	269	10,9	13,8	22
Bracken	Dec '73	6	1000	11,5	10,0	9,0	7,4	25,0	25,0	145	116	29,0	20,0	15
Leslie	Dec '73	5	1500	7,2	6,0	4,3	6,5	14,0	15,0	65	57	12,3	24,5	21

General Assumptions:

Gold Prices (Dollars/oz)

1973	65,00
1974	70,00
1975	75,00

Annual rate of gold price increase	(%)	10,0
Cost inflation rate	(%)	7,0
Discount rate	(%)	12,5

NOTE: Forecast average yield refers to next 5 years. Gold price sensitivity is the percentage change in distributable earnings in second financial year for 10% gold price increase.

DATE: 13.02.73

Figure C14

The statistical summary is printed in descending sequence of expected mine life. The average milling rate is the average rate over the life of the mine. The two ore grade figures are respectively the maximum and minimum figures which appear in the data input file. In most cases the maximum is the current figure, but for new mines the ore grade may rise at a later date; the minimum figure is usually that referring to the grade during the final years of the mine's life. The working profit and working cost figures are forecasts for the current financial year. The two dividend figures show last year's actual dividend and a forecast figure for the current financial year. The price is that which is quoted on the JSE on the date given at the foot of the page. The present value is calculated as explained in the previous section; the general assumptions are printed at the bottom of the summary, along with an explanation of the 'gold price sensititivity'. The percentage variance between the market price and the present value is shown so as to give an indication of apparently over- or under-valued shares. The 'forecast average yield' is obtained from the average of the first five years' forecast earnings per share, using the current market price.

The model requires the capital expenditure for the first five years to be specified, and thereafter assumes that the general level will be 15% of working costs, but there is a transition period after the first five years when capital expenditure is increased or decreased to the 15% level. Also, during the last ten years of the mine's life capital expenditure is reduced until it reaches zero four years before the mine ceases to operate.

The program is arranged so that if the working profit of any mine becomes negative before the mine has completed its expected life, the calculations for that mine are terminated and the expected life figure, which is printed in the statistical summary, is automatically adjusted.

4.1.4.4. Effects of Varying Input Assumptions

The program is arranged so that the values chosen for

- long term annual rate of gold price increase,
- long term cost inflation rate, and
- discount rate

apply to the mines as a whole. If any one of these values is varied, the effect on the present value will vary from mine to mine. For example, a change in the discount rate will affect long life mines more than short life mines. These effects can easily be observed by running the program for different sets of assumptions.

It is interesting to know how the valuation of the shares as a whole compares with the market valuation under different sets of assumptions. The results of such an experiment can be plotted as in Figure C15. Here the average percentage deviation of the present values from the market prices, for the whole set of shares, is plotted against each one of the above variables while the remaining two are held constant.

SENSITIVITY OF PRESENT VALUES TO INPUT CHANGES

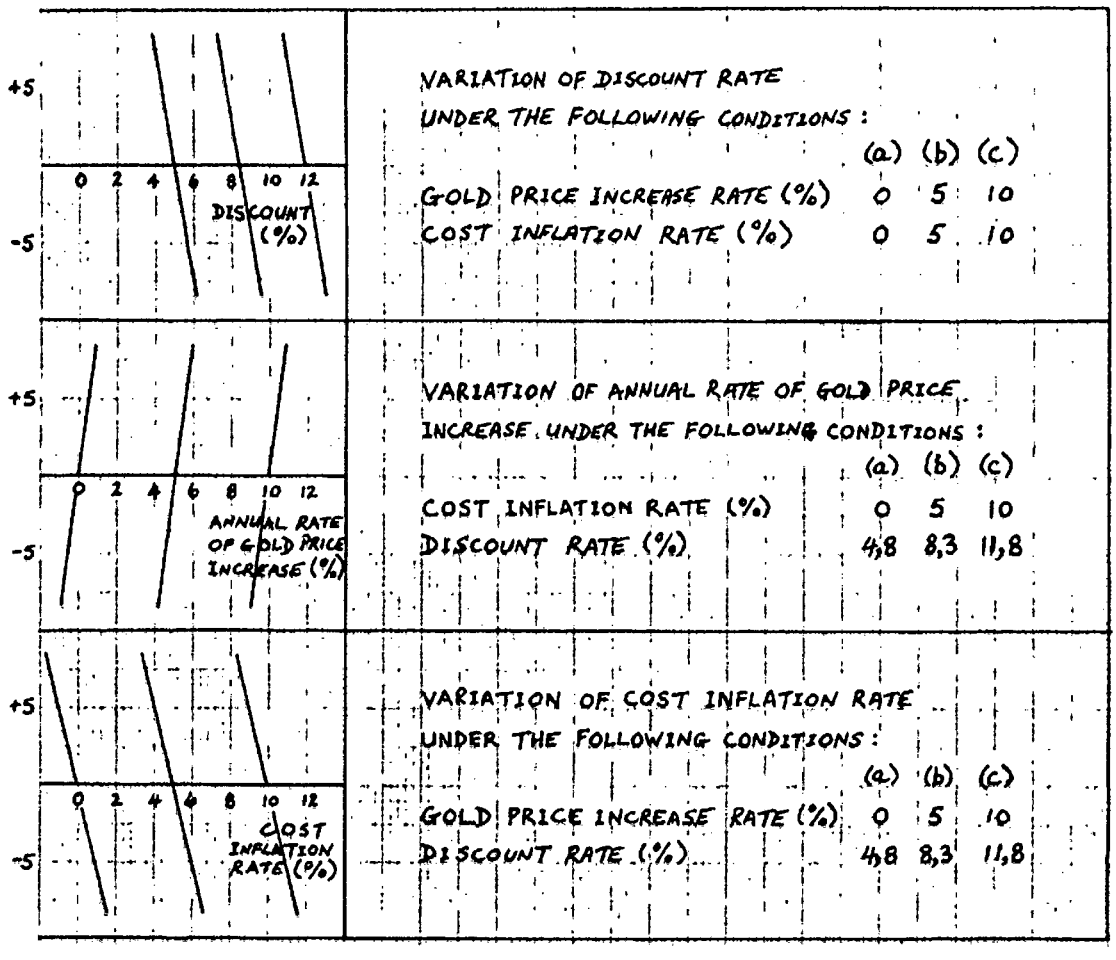

Figure C15

Applying multiple regression to these results gives the equation:

$$\% \text{ Deviation} = 10{,}7G - 5{,}6C - 7{,}4R + 36$$

Where G = Annual rate of gold price increase (%)
C = Annual cost inflation rate (%)
R = Discount rate (%)

The equation refers to data applicable to a specific day. The constant term (+ 36) will vary from day to day, but the coefficents are fairly stable. This equation shows, for example, that if one postulated a zero growth rate for the gold price and no cost inflation, and used a discount rate of 8%, the deviation would work out at about -23%; in other words, the present values of the shares as a whole would be 23% lower than the market prices.

The values given to these three variables will depend on the view taken by the program user. Therefore, the program is written so that several runs, for various sets of assumptions, can be carried out quickly and cheaply. An example of the plotted results of such a series of runs is illustrated in Figure C16.

PRESENT VALUE UNDER VARIOUS CONDITIONS

PRESIDENT STEYN

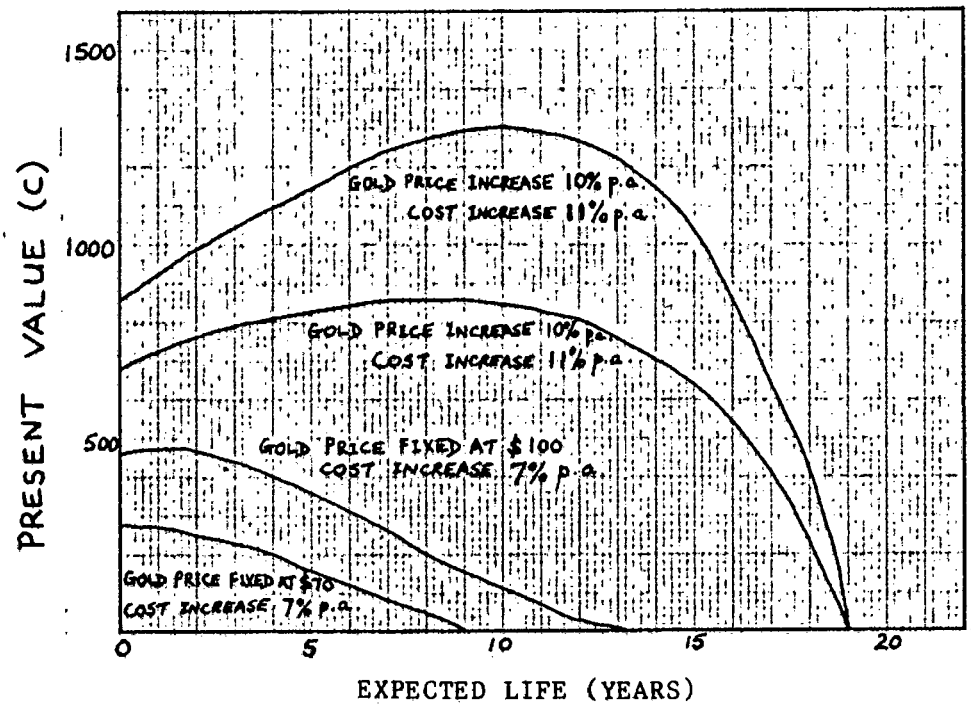

Figure C16

4.1.4.5. Yield Curves

In Figure C17 the 5-year forecast average earnings yields given in the Statistical Summary in Figure C14 have been plotted against the expected lives of the mines. The points tend to lie on a curve similar to that shown earlier in Figure C7, although there is considerable scatter.

YIELD CURVE

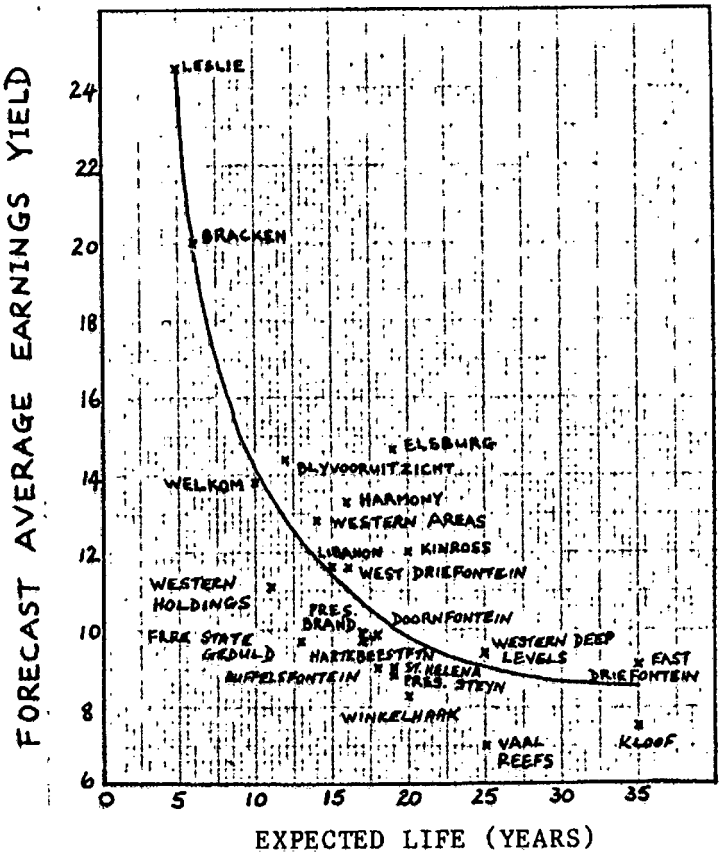

Figure C17

This type of yield curve can be used to highlight shares whose prices seem in need of correction. In the case of long life mines this approach may produce results which differ from those obtained by comparing present values and market prices. For example, in Figure C14 President Steyn has a forecast yield of 8,8% and Elsburg 14,7%; yet their present values differ from their actual prices to a fairly similar degree. In such cases the yield criterion is likely to be the more useful.

4.1.4.6. Probabilistic Forecasting

There is nearly always some uncertainty about the data values used in forecasting. For example, one cannot say with certainty that in say five years time the ore grade of a particular mine will have a specific value; but one can say that it is likely to lie within a certain range of values. If forecasts are made using ranges of values for the input data rather than single values, then the

resulting forecast will also have a range of values, the extent of which will be governed by the extent of the input data ranges. Thus, if say future ore grade values are very uncertain then the upper and lower limits for the present value of the share will be further apart than would be the case if future grades could be predicted with more accuracy.

The two programs described above produce single value forecasts; in the interest of simplicity probabilistic forecasting is not used. However, the program can be enhanced to produce probabilistic forecasts of quarterly mining results. When the actual results are known, in cases where they fall outside their predicted range, a quick check will determine which input assumptions were incorrect. This procedure draws attention to unexpected changes to which the market is likely to react.

The program user specifies maximum and minimum values for each of the input variables needed to forecast the next quarter's results. The program assumes that the input variables are uncorrelated and are normally distributed about their means. (These assumptions are not actually valid but this is unlikely to have much effect on short-term forecasts. In the longer-term however, the fact that there is correlation between some of the variables and that the probability distributions may not be normal could seriously affect results). The user is in effect required to select maximum and minimum values such that there is only a 1 in 40 chance of the actual value exceeding the maximum value, and a 1 in 40 chance that it is less than the minimum value (i.e. a 5% chance of the actual value falling outside the chosen range). The program then takes account of these uncertainty ranges in such a way that after manipulating the variables the final earnings forecast range is also expressed in the same terms (i.e. there is a 5% chance that the actual earnings figure will fall outside the specified range).

One way of dealing with the longer term forecasting problems mentioned above is to use probability trees. An example of a simple probability tree is given in Figure C18.

PROBABILITY TREE FOR REVENUE

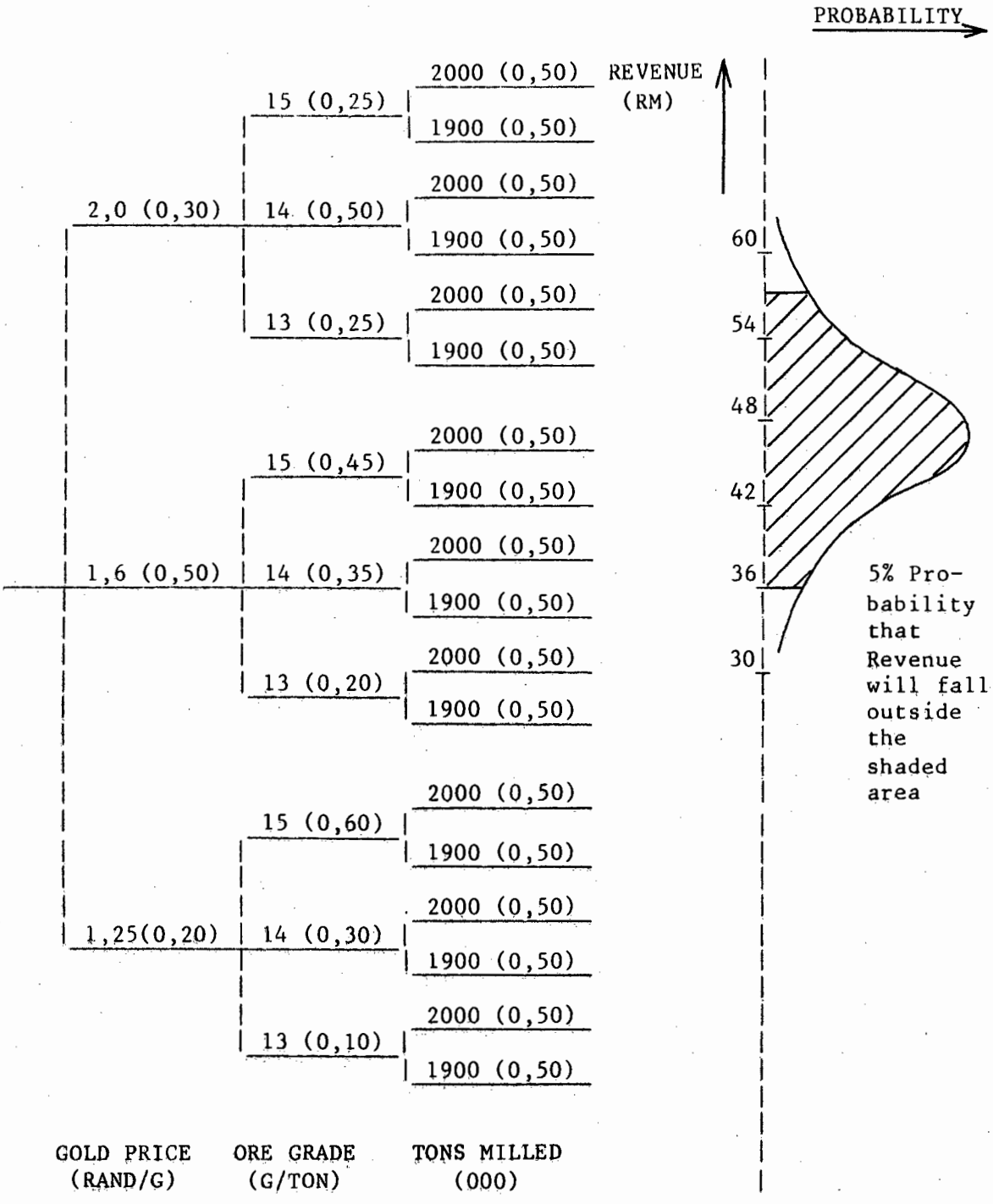

Figure C18

The figure illustrates the calculation of the probability distribution of gold revenue for a particular mine in a particular year. Similar trees could be constructed for working costs, capital expenditure etc., leading eventually to probability distributions for earnings forecasts.

The tree is used as follows:

First assign probabilities to gold prices; in this case there is a 30% chance of the price being R2,00/g, a 50% chance of it being R1,60, and a 20% chance of it being R1,25. Next, probabilities are assigned to various ore grade values. Here it is assumed that if the gold price is high the mine will reduce it's recovery grade; thus for a R2,00 gold price the probability of having a grade of 15 g/ton is only 25%, as opposed to 60% if the gold price were R1,25. Probabilities are next assigned to milling rates; it is assumed that there is an equal probability of the rate being 1 900 tons/year and 2 000 tons/year. Finally, the expected value and probability for each of the possible paths are computed. (For example, the expected value for the top branch is 2 x 15 x 2 000 = R60 000, and its probability is 0,3 x 0,25 x 0,5 = 0,0375). The results can then be expressed in the form of a probability curve as shown.

The number of calculations needed to obtain a set of earnings forecast probability distributions is very large, so that a computer is essential. The main disadvantage of this approach is the somewhat complicated form of input data required from the user, compared with the simple maximum and minimum figures used in the model described earlier. It is this consideration which usually leads to the adoption of the simpler model which, because of its limitations, is used for short-term forecasts only.

4.2. A Relative Value Index for South African Gold Shares

Gold shares, due to the volatility of the gold price, are subject to significant fluctuations in value and it is important to be aware of changes in relative values. A Relative Value Index (R.V.I.) for South African gold shares highlights under- or over-valued situations.

A gold mine is a quantifiable investment since, given price, costs, grade, tonnage, etc., a competent analyst can, with reasonable accuracy calculate the likely earnings flow over the life of a mine. In practice, however, the analyst is faced with a number of variables - the greatest of which is the price of gold which in turn has a bearing on mine management's decisions regarding other variables such as tonnage, grades and costs.

Inflation within the economy is a variable beyond management control.

Chamber of Mines studies indicate that the production of gold will decline steadily from now on - the rate of decline depending very much on the price of gold. How the gold price is going to behave over the short term is questionable(20) - but it seems fair to assume, with declining production, rising consumption and continued inflation that price in the longer-term will show a rising trend.

With Central Banks holding more than 50% of all the gold mined, this is a potential source of supply which could prove to be more important than the decreasing supply of newly mined gold in time to come. Whether Central Banks become aggressive traders in gold remains to be seen.

The standard (fundamental) method of gold mine evaluation calculates the present value of the estimated distributable earnings which will flow over the life of the mine, together with an estimate of break-up value. An alternative method works on distributable earnings estimates rather than dividend flow projections. The present value technique has one major short coming i.e. that a value is placed on a share at a set rate of discount - and it is the rate of discount which is frequently contentious. To circumvent this problem, use a fixed rate of discount to calculate present values which are then expressed as a ratio of market price. From the ratios obtained calculate the average ratio for the market as a whole. This is done by calculating the simple average of the ratios of the shares included in the analysis. By relating these ratios to the average, we determine which shares appear to be over- or under-valued relative to the market average.

This has the advantage of not showing the present value which can be very misleading due to misinterpretation. In simple terms, a rating of 100 is the average for the market. Ratings of over 100 indicate the degree of under-valuation relative to the market average at the indicated price of gold. Ratings of under 100 indicate the degree of over-valuation. The higher the rating the more attractive the share is in relative terms and vice versa for low rating.

This technique does not show whether gold shares are cheap or expensive in absolute terms, but rather which shares afford the best value at various prices of gold in relative terms.

A major problem in the analysis is the difficulty of forecasting the price of gold over the life of the mine. This problem can be tackled by assuming either a future fixed price or a variable price for gold.

A range of fixed prices is preferable, highlighting those shares which offer the best value at the various prices for gold. The variable price method is too subjective.

Another important variable is the way in which management planning will be affected at varying prices of gold. The price of gold has much to do with management's (and indeed the Government's) decision regarding the control of grade with respect to the life of the mine. By constantly reviewing each analysis and up-dating figures, the errors which may result from this particular problem are minimised.

Inflation is a particularly thorny problem. The recent rate of inflation is probably the order of 13% with costs at the mines increasing by around 20%. By canvassing the opinion of leading mine executives, mine managers, financial advisers to the mines, merchant bankers and economists one can establish a likely cost escalation rate over the next five years and probable rate thereafter.

This factor must be constantly reviewed.

With a computerised gold mine data base, updated relative values are readily available after changing any of the many variables.

In any present value calculation it is extremely difficult to compare the value of a state assisted mine with a short life mine or a very long life mine, particularly since the method of calculation drastically discounts all returns over the longer-term. It is therefore convenient to categorise the mines into groups of short, medium and long life, with additional groups showing state assisted mines (See Figure C19). Uranium and non-uranium producers can also be highlighted.

Alternatively, the mines can be categorised into groups of marginal, low, medium and high grade and expanding operations (See Figure C20).

This subsequent R.V.I. illustrates:

- The staggering increase in gold share values little more than a year later.
- The change in relative value of the shares at the higher gold prices.

RELATIVE VALUE INDEX

15th November, 1973

SHARE	MKT PRICE (CENTS)	R.V.I. @ GOLD PRICE $80	$100	$120	$150	$180
State Assisted Mines:						
Durban Deep	830	51	72	90	88	98
E.R.P.M.	620	146	153	143	147	137
Loraine	230	59	86	87	130	142
Short Life Mines: (Capital Repayments)						
Leslie	90	210	188	170	164	165
Old Low Grade Mines:						
Grootvlei	170	117	104	99	96	97
Marievale	315	132	119	105	95	87
Venterspost	340	120	126	131	129	123
Short Life Mines:						
Bracken	208	159	158	150	139	127
Stilfontein	395	124	112	115	112	101
Welkom	415	76	79	81	82	101
Medium Life Mines:						
Blyvooruitzicht	660	122	121	117	112	110
Free State Geduld	1550	102	107	107	102	95
Kinross	370	112	104	93	82	74
Libanon	920	105	111	118	119	114
West Driefontein	3100	110	107	102	97	94
Western Areas	325	63	63	68	71	70
Western Holdings	2950	134	118	114	107	107
Winkelhaak	750	112	95	85	80	74
Long Life Mines:						
Buffelsfontein	1725	51	53	69	78	83
Doornfontein	970	68	72	73	79	98
Harmony	530	95	91	86	86	91
Hartebeestfontein	1850	59	70	81	83	85
President Brand	1500	100	109	110	105	107
President Steyn	1425	34	33	60	64	68
St. Helena	1825	115	112	111	108	106
New Long Life Mines:						
East Driefontein	580	93	91	83	79	78
Kloof	1080	85	88	89	86	87
South Vaal	565	56	61	70	75	72
Western Deep Levels	1400	102	107	105	104	107

Figure C19

RELATIVE VALUE INDEX

28th February, 1975

SHARE	MKT PRICE (CENTS)	PV @ $175 (CENTS)	R.V.I.	PV @ $200 (CENTS)	R.V.I.
Marginal Grade Mines:					
Durban Deep	1450	1025	72	1300	75
Grootvlei	395	233	60	422	90
Leslie	200	218	111	241	101
Marievale	575	558	99	638	93
Sallies	760	608	82	1010	111
South Roodepoort	515	387	77	583	95
Low Grade Mines:					
Bracken	370	380	105	420	95
Elsburg	485	500	105	590	102
E.R.P.M.	1400	1160	85	1610	96
Harmony	950	950	102	1175	104
Kinross	740	735	101	855	97
Libanon	1700	1785	107	2090	103
Loraine	600	682	116	876	122
Stilfontein	490	540	112	670	115
Venterspost	1100	1066	99	1386	106
Welkom	540	670	126	800	124
Western Areas	800	783	100	913	96
Winkelhaak	1300	1410	111	1650	106
Medium Grade Mines:					
Buffelsfontein	2300	2465	109	2900	106
Doornfontein	1550	1397	92	1670	90
Hartebeestfontein	3250	3120	98	3660	94
President Brand	2900	2560	90	3210	93
President Steyn	2575	2300	91	2735	89
St, Helena	3725	3040	83	3600	81
Zandpan	470	520	113	610	109
High Grade Mines:					
Blyvooruitzicht	1120	1070	97	1197	90
Free State Geduld	3100	3390	112	3760	102
West Driefontein	5350	4210	80	4790	75
Western Deep Levels	2375	2700	116	3000	106
Western Holdings	4000	4520	115	5620	118
Expanding Operations:					
East Driefontein	1200	1150	98	1340	94
Kloof	1400	1870	136	1960	117
Randfontein	3550	3137	90	3687	87
South Vaal	1275	1414	113	1800	118
Unisel	365	415	116	470	108

Figure C20

Assumptions

- Gold price of $175 and $200 increasing by 12%, 10%, 8% and then 4% until the end of the mines life.
- Cost escalated at 2% above increase in gold price.
- Present Value Discount at 10%.
- Johannesburg mid-day prices 28th February, 1975.

The Relative Value Index must be studied in conjunction with commentary from company, broker and press reports before selecting shares based on the buyer's criteria.

Appendix 5 provides an example summarising this supplementary commentary (for the corresponding R.V.I. of 15.11.1973 i.e. Figure C19).

4.3. Gold Mine Dividend Forecasting Utilizing Projections From Brokers/ Analysts Reports

4.3.1. When to Use this Approach

Ideally gold dividend projections should be the outcome of 'in-house fundamental evaluation' (the Institution's individually derived value).
However, for 'pragmatic reasons' (lack of time and computing facilities) related to 'departmental policy' this approach may be superceded by 'an average broker view'. As several brokers themselves employ mining specialists and use computers, this represents a 'quick and dirty' indirect computational result.

Ready reference charts can show the current year dividend projections made by various brokers/analysts(21) for say 20 selected(22) gold mines, at alternative average bullion prices per ounce for the year.

4.3.2. Method of Evaluating Broker Opinion

Whilst Investment Management may request a tabulation based on bullion prices of $175 and $200, say, the brokers may unfortunately not take views at exactly the same levels. However, a broker view can generally be found within the approximate range $150 - $200. The view nearest to $175 (whether $150, $160 or $175, say) is selected as CASE LOW (L) and the view nearest to $200 (whether $190 or $200, say) is selected as CASE HIGH (H). Where several options exist the Mining Analyst applies discretion in selecting a LOW and HIGH view (the brokers approach is mostly non-commital, providing the client with a range of options from which to choose).

It may be found that a particular broker's note caters only for Present Value estimates and earnings estimates, not necessarily in the same report. Thus several reports might have to be consulted before dividend estimates and other necessary details can be extracted (maintaining brokers reports in the files in chronological order facilites the exercise).

The 'Broker Report Summary Chart' (See Figure C21) contains those items of information considered by the Analyst to be the 'minimum essential information' necessary for:

- The intelligent and meaningful selection of a dividend view consistent with fundamental information released by the mining companies.
- The convenient filling of 'information gaps' in broker reports, more specifically:
  - Dividend estimation where earnings only are indicated (by deriving an average dividend cover for all other broker dividend estimates and applying this cover to the relevant earnings estimates where dividend is not provided).

- Earnings estimation where dividends only are indicated (by application of the aforementioned average dividend cover).
- Dividends and earnings where Present Value only is indicated (by firstly deriving average dividend yield on Present Value and applying this yield to calculate dividend, and secondly applying the dividend cover to calculate earnings).

All such 'derived' information i.e. not provided directly by brokers, is indicated by underlining the item, and readily identified on the chart.

The use of arrows serves to highlight constants.

The sign ($\pm$, $>$, $<$) or lack of sign preceding an item has a significance relating to type of information. An unsigned item almost invariably indicates a parameter incorporated in a broker tabulation. The signed items in most cases represent the Mining Analyst view based on the latest historic information (e.g. last quarter's results) recorded by the broker.

The chart is completed by extracting the appropriate data from the latest broker/analyst report and, where 'information gaps' exist, referencing the earlier broker reports in chronological order, always accepting information from the most recent as valid. Due to the escalation of gold price over the recent past and the acceleration of working costs, broker views earlier than say the beginning of 1974 are considered to be of little worth. The date of the evaluation/ information indicated on the chart is useful in tracing the source broker's report and may also influence the chart user's view on a 'time of information' basis. Similarly, a broker credibility rating may be established.

The 5 variables, gold price, tons milled, recovery grade, working cost and life-of-mine are directly inter-dependent. It is the fluctuations inherent in this mutual dependence which causes most of the valuation problems and it is in this area that confusion is often reflected in broker reports.

A rate of discount of 10% is commonly used presumably on the assumption that if the high rate of inflation persists over the long-term then a real rate of return of less than that generally expected by the market will become acceptable and the conservation of capital could become the major issue.

4.3.2.1. Averaging Techniques

In deriving the average of broker estimates per mine per calendar year (see bottom of each chart) 'discretionary weighting' can be applied. Discretionary weighting includes 'broker weighting' and 'time weighting'. The statistical method is principally one of arithmetic averaging. Where the signs $>$ and $<$ are encountered, an arbitrary 10% may be added or deducted from the value.

Statistical method has been kept as simple as possible so that it can become a simple clerical function. The credibility of the results can be tested at the end of the calendar year by plotting the 'actual results' in the row immediately below the 'weighted averages'. If the discrepancy between dividend projections derived in this manner and actual dividends paid is less than say 10%, this method can be adhered to in the future as a 'simple but effective statistical technique for gold mine dividend forecasting'. If on the other hand this discrepancy is greater than 10% consideration should be given to weighting based on broker competence, time status of the report, and any other relevant considerations based on sound statistical theory.

The influence of common sources of mining expertise, common computational programs, and cross-fertilization of ideas amongst the broker/analyst fraternity should be diligently investigated in consultation with those responsible for producing the client reports. Without this information it will be difficult to apply a 'quantitative' broker rating for weighting purposes.

4.3.2.2. Ready Reference Chart

There are several ways in which this chart (See Figure C21) can be used:

- According to the users preference for, or faith in, a particular broker, that particular broker is selected and dividends and/or PV for the required mine read off against the nearest bullion price view, irrespective of the dependent variables - although this is a somewhat reckless approach.

- Preferable to the first approach above, the user should consult the latest quarterly report, comparing the dependent variables (gold price, tons milled, recovery grade, working costs and life-of-mine) in the quarterly against the equivalent items on the chart (certain brokers provide multiple options e.g. cost and grade, against a fixed bullion price). Select those brokers whose parameters approximate closest and then select from these 2 or 3 the one favoured; or derive an average of these 2 or 3.

- Where the user feels inadequate at interpreting technical information, the 'weighted averages' of total broker opinion (at the bottom of the chart) can be read off - a method which depends on faith in the law of averages.

- The 'probability ranking' indicated on the extreme left hand column represents the Mining Analyst's view that situation 1 is more likely to occur than situation 2. It will be noted that the numbers 1 and 2 always share a common line with a HIGH (H) or LOW (L) indicator on the far right hand side of the chart. As the H and L represent the considered reasonable high-low ranges of possibilities, intermediate views can be roughly weighted by leaning more to the values associated with number 1. This is obviously only a secondary technique and should be used with discretion.

. The vacant column on the extreme right can be used for recording:

- The year's highest-lowest market prices of the share; or
- The current market price; or
- Earnings and dividend yields; or
- Any brief comments.

4.3.3. Computer Adaptation

The approach as presented here provides the most efficient and reliable gold mine information system under manual circumstances. However, inherent in the design is the potential for ready computerisation, with terminal access for updating and interrogation.

Deriving an average broker/analyst gold dividend estimate consists of two phases:

. The interpretation of broker/analyst reports.
. Statistical averaging.

The first phase is largely interpretive - the information is there, but often masked in the technical discussion. Completing this phase systematically and correctly requires somewhat more involvement than merely transposing values (garbage in, garbage out).

The second phase, on the other hand, is a time-consuming 'number-crunching exercise' the sheer monotony introducing the potential of error - an ideal case for computerisation.

Computerisation is further emphasised by the fact that results are rendered obsolete as soon as one or two new brokers reports are received, necessitating repetition of the entire tedious averaging exercise. Moreover, by mid-year the portfolio managers will be casting an eye to the next calendar year's objectives and targets.

The size of the above task can be readily appreciated:

If all information were available in the most recent of each broker's reports, the job would entail 20 x 10 = 200 company reviews. However, as the last 2 or 3 brokers reports are often required to extract the 'minimum essential information', a level in excess of 300 reviews is more correct.

An on-line computer terminal would provide a dynamic system, easily updated. An automatic discipline would be imposed for 'processing' incoming brokers reports. The computer file would be a permanent file of the most current gold views with the advantage of instant processing and listing - what is manually accomplished in weeks could be accomplished in minutes.

BROKER REPORT SUMMARY CHART

MINE: PRESIDENT STEYN

Y/E : 30/9

ESTIMATES FOR CALENDAR YEAR : 1975

BROKER	PROBABILITY RANKING	DATE OF EVALUATION	GOLD PRICE ($/OZ.)	TONS MILLED MONTHLY (000)	RECOVERY GRADE (g/t)	COST (R/TON MILLED)	EPS (c)	DPS (c)	LIFE (YEARS)	DISCOUNT RATE (%)	PV (c)	HIGH/ LOW
Davis, Borkum, Hare	2	1/75	147	240('75) 270('76)	(N) 11,5 9,5	19,0	159 108	114 78	± 20	8	1988 1350	L
			206		11,5		276	199			3450	
	1	↓	↓	↓	9,5	↓	205	147 (Av. Cover = 1,39)	↓	↓	2563	H
Du Plessis and Milton	2	/74	150	236	11,0	15,6	194	145	18	10	2080	L
	1	↓	200	↓	↓	17,7	276	210	24	↓	4775	H
Fergusson Bros		21/2/75	175						20	10	2355	L
		↓	200						↓	↓	2955	H
	2	28/1/75	160	±216	±11,9		132	95				L
	1	↓	190	↓	↓		202	145				H
		18/2/74				13,7/14,6						
Ivor Jones		14/3/75	175		(N)					10	2300	L
		↓	200							↓	2735	H
	2	28/1/75	150	237	10,5	17,0	262	105				L
	1	↓	200	↓	↓	↓	351	194				H
		12/74							>15			
Martin & Company		17/6/75	175	±213	±11,1	>18,7	< 211	< 152				L
McKie, van Velden (Est. 1/10/74 - 30/9/75)		18/11/74	160	237/266	10,5/10,0	17,9			20	K+0	3070	
			200							↓	4566	
	2		160				189	136		K+3	2341	L
			200			↓				↓	3485	
K+0 = No Cap. Growth			160			19,3				K+0	2871	
	1		200				353	254		↓	4367	H
K+3 = 3% Real Growth			160							K+3	2189	
		↓	200	↓	↓	↓			↓	↓	3333	
								(Av. D.Y. on P.V.=5,82)				
Max Pollak	1	8/74	175	221	< 12,1	±16,9	315	230	±20	10	2868	L
		↓	↓				340	255			4264	
			200				365	280			1465	
	2	↓	↓	↓	↓	↓	395	310	↓	↓	5060	H
Syfrets		15/2/74	200				292	210	±20			H
Fred Levy	1	1st Qtr.'75	170	230	10,7	17,5	141	135	20		2706	L
	2	↓	190	↓	10,5	↓	172	165	↓		3300	H
Mining Journal		2/75	4th Qtr. '74 Level (152)	240('75) 272('76)	10,5	> 16,5	±137	±135	±20			L
Weighted Averages (Discretionary)		Feb. '74 to Mar. '75	163 / 199	234 / 234	11,0 / 10,6	17,4 / 17,4	191 / 281	137 / 204	19 / 20	10,2 / 9,7	2377 / 3679	L / H
Actual Results 1975												

NOTES: L - Denotes data used (and weighted) to derive average CASE LOW.
H - Denotes data used (and weighted) to derive average CASE HIGH.
Figures underlined indicate derivations (not provided by broker).
The use of arrows serves to highlight constants.

Figure C21

SECTION D

SECTION D

COMMUNICATION OF INVESTMENT ANALYSIS FINDINGS

TABLE OF CONTENTS

SECTION D

COMMUNICATION OF INVESTMENT ANALYSIS FINDINGS

SUMMARY

- THE ULTIMATE PURPOSE OF MONITORING THE MINING SECTOR IS TO BRING FAVOURABLE MINING INVESTMENT (AND DISINVESTMENT) OPPORTUNITIES TO THE ATTENTION OF THE INSTITUTION'S INVESTMENT MANAGEMENT, FOR THEIR DELIBERATION AND ACTION (BUYING, HOLDING, SELLING). COMPANIES PRIMARILY INCLUDE THOSE IN WHICH THE INSTITUTION HAS (OR IN THE ANALYST'S OPINION SHOULD HAVE) A DIRECT OR INDIRECT SHAREHOLDING AND WHICH APPEAR (OR SHOULD APPEAR) ON THE INSTITUTION'S BUYING LIST.

- THE MINING ANALYST COMMUNICATES HIS FINDINGS BY PRODUCING UP-TO-DATE MINING SECTOR AND MINING COMPANY ANALYSES, VIEWS AND RECOMMENDATIONS ON ACTION TO BE TAKEN. THESE REPORTS MUST BE PRESENTED IN A FORMAL FORMAT, STANDARDISED WITHIN BROAD GUIDELINES SET BY THE INVESTMENT DEPARTMENT, BUT TUNED TO THE SPECIFIC NATURE AND CIRCUMSTANCES OF THE INVESTMENT UNDER REVIEW.

- FOR ROUTINE COMPANY ANALYSIS TWO MAIN TYPES OF REPORTS ARE PRODUCED: BY FAR THE MORE DETAILED IS THE ANALYSIS BASED ON THE COMPANY ANNUAL REPORT. THE OTHER IS A SUMMARY ANALYSIS FOLLOWING PUBLICATION OF THE COMPANY INTERIM (HALF-YEAR) AND PRELIMINARY RESULTS.

  THESE DETAILED AND SUMMARY REPORTS ARE REVIEWED WITHIN THE INVESTMENT DIVISION BY THE MINING ANALYST, COMMODITIES ANALYST AND PORTFOLIO MANAGERS, FOR CONSENSUS, PRIOR TO DISCUSSION AT THE WEEKLY INVESTMENT DIVISION MEETING.

- THE INVESTMENT DIVISION MEETING INVOLVES ALL LEVELS AND FUNCTIONS WITHIN THE INVESTMENT DIVISION.

  FIRSTLY, IT PROVIDES A FORUM FOR THE EVALUATION AND DISCUSSION OF RECENT DEVELOPMENTS AND FUTURE TRENDS IN THE ECONOMIC AND FINANCIAL FIELDS IN TERMS OF THE INSTITUTION'S INVESTMENT STRATEGY.

SECONDLY, IT PROVIDES THE OPPORTUNITY FOR SECTOR ANALYSTS, INCLUDING THE MINING ANALYST, TO PRESENT THE RESULTS OF INDIVIDUAL COMPANIES REPORTED DURING THE WEEK. DETAILED AND SUMMARY REPORTS ARE SCREENED AT THIS MEETING, FOR INVESTMENT DIVISION CONSENSUS, PRIOR TO THE GENERAL MANAGER (INVESTMENTS) PRESENTING REPORT RECOMMENDATIONS TO THE BOARD OF DIRECTORS.

- OUTSIDE OF THE REGULAR WEEKLY INVESTMENT MEETINGS, IN-HOUSE INVESTMENT SEMINARS ARE HELD ON A PERIODIC BASIS. SUBJECTS ARE BROADLY BASED AND INCLUDE SECTOR AND COMMODITY REVIEWS AND INVESTMENT PHILOSOPHY. THE OBJECTIVES ARE TO PROMOTE BROAD INVESTMENT KNOWLEDGE AMONG ANALYSTS, REACH CONSENSUS IN VITAL AREAS AND STANDARDISE SHARE EVALUATION CRITERIA.

- THE APPENDICES HAVE BEEN SELECTED TO GIVE THE WIDEST RANGE OF REPORT EXAMPLES AND A GUIDE TO THE PROCEEDINGS OF INVESTMENT MEETINGS.

COMMUNICATION OF INVESTMENT ANALYSIS FINDINGS

1. COMPANY ANALYSIS AND INVESTMENT RECOMMENDATION REPORTS

1.1. Annual Results Detailed Reports (See Appendix 7)(23)(24)

The following schedule provides a guide to the presentation of a mining company analysis(25) supporting an investment recommendation:

. DIRECTORS

Include all full directors, indicating the Chairman and Managing Director.

. INSTITUTIONAL GROUP'S HOLDINGS

Summarise, per portfolio, the type and number of shares, current price, total market value and percentage of issued equity.

. CAPITAL AND RESERVES OF THE COMPANY

Summarise relevant details of ordinary and preference shares, capital and revenue reserves.

. STATISTICS

- Financial Year End

  Indicate in full, e.g. 30th June.

- Turnover

  Round off to first decimal, where applicable.

- Pre-Tax Profit : Turnover

  The guiding principle is to compare like with like. Trading profit after interest : turnover is generally most relevant (i.e. excludes dividends, etc.). It may also be necessary to exclude interest receipts when these are clearly from outside investments (i.e. not from working balances). Express as percentage to first decimal.

- Pre-Tax Profits

  Adjust for non-recurring items and round off to first decimal. When realisation is standard practice, the capital profits should be included. If significant, show two separate figures.

- Tax Rate

  Taxation is to include deferred tax and provision for tax equalisation, as a percentage of the adjusted pre-tax profits less non-taxable income (e.g. dividends), rounded up to the nearest whole number.

- Earnings per Share

  Adjust for all non-recurring items, capitalisation, bonus issues and splits. Round off to first decimal. The earnings must reflect an accurate picture and in certain instances the analyst must use his discretion in calculation, e.g. provision for obsolescence/replacement reserves should in certain instances be regarded as depreciation. Where capital profits are a normal feature, as in the case of mining financials, calculate earnings per share including and excluding such profits. In addition always show attributable earnings per share where calculable. Do not adjust figures for rights issues made during the year, but indicate terms and date of issue underneath the statistics, e.g. 20 for 100 at 350c in May, 1979. (See Appendix 6 for Adjustment of Prices and Earnings Per Share)(26).

- Dividend Per Share

  Reflect the amount that an ordinary shareholder would have received during the full financial year. Note again adjustments necessary in the event of changes in share capital via capitalisation issues, splits, etc., particularly where a capitalisation issue is made after the interim dividend. Express figure to second decimal if necessary.

- Return on Shareholders' Funds

  Express pre-tax profits (after payment of interest) as a percentage of shareholders' funds, which is to include preference and minority shareholders and exclude goodwill and items such as obsolescence reserve, deferred tax, etc. Round off to first decimal.

- Return on Total Funds

  Express pre-tax profits plus interest paid as a percentage of total funds employed less goodwill. Round off to first decimal.

- Shareholders' Interest

  Express total shareholders' funds (i.e. including preference and minorities) less goodwill as a percentage of total funds employed less goodwill. Calculate to the nearest whole number.

- Net Asset Value

  Express ordinary shareholders' funds less goodwill divided by issued ordinary shares. As a general rule use book values of assets, i.e. not market values of share investments, except in the case of pure investment trusts when market values are used. When significant, add a note giving the net asset value (n.a.v.) for the latest year at market prices for the quoted share investments.

- Liquidity

  Express as a ratio, to first decimal, current assets to current liabilities. If this figure is deceptive due to say grouping of relatively illiquid assets under current assets, then make mention of this under the section 'Comments on Company'.

- Quick Assets

  Express as a ratio, to first decimal, current assets less stock to current liabilities. Note comment under 'liquidity'.

- Pre-Tax Profits : Prior Charges

  Express as a ratio, to first decimal, pre-tax profits plus total prior charges to total prior charges. Include bank overdraft payments, and preference dividends in the prior charges figure, adjusted to pre-tax levels.

- Growth Figures

  Calculate using compound interest tables.

- Price Range and Volumes

  Obtain information from Johannesburg Stock Exchange Bulletins. Adjust where necessary for capitalisation issues etc. which may have taken place during any year.

. BALANCE SHEET STRUCTURE (for in-depth analyses)

Express as % of total funds:

- Ordinary shareholders, i.e. issued ordinary + revenue and capital reserves, less intangibles -------- (i).
- Total shareholders, i.e. (i) + issued preference and minority shareholders ---------- (ii).
- Long-term liabilities -------- (iii).
- Current liabilities -------- (iv).
- Total funds (in Rm) i.e. sum of (i) - (iv).
- Land and buildings.
- Plant and equipment.
- Other fixed assets, if relevant, at book values.
- Current assets.

. NATURE OF BUSINESS

Includes minerals mined, beneficiated products, marketing and freehold interests; other industrial and commercial interests.

. COMMENTS ON COMPANY

The following is a guide to the most commonly occurring aspects requiring comment. It is not a format or rule book to be applied uniformly to all companies. The section 'Comments on Company' must contain all items of information, interpretation and analysis of that information that the analyst considers necessary to enable an investment decision to be made.

- Profit History

If relevant e.g. if profits during one of the past 5 years recorded a signficant fluctuation (decrease or increase), the reasons should be noted and analysed - particularly with reference to the possibility of a future recurrence.

Comment that is merely a repetition of the statistics is superfluous e.g. profits have increased at an average 8% per annum over the past 5 years. However, if over the long term e.g. 10 years, there are any significant features, then comment could be relevant, particularly if cycles are discernable. Even where the trend in profits can be gleaned from the statistics, discretion must be applied, e.g. such a comment (plus the reasons) would be particularly relevant if over the same period competitors had shown a markedly divergent trend.

Any anomalous trend, such as a negative or very high average growth rate, would form the basis for detailed discussion elsewhere in 'Comments on Company' under such headings as 'management', 'expansion plans', 'product development', etc.

- Earnings Source

Many companies mine either a single mineral or produce highly integrated products, so that a breakdown of earnings source is meaningless.

For some other companies a sub-division by earnings source would be useful, but is obtainable often only by reasoned guesswork, e.g. Mining Finance Houses by divisions such as gold, diamonds, platinum, coal, base metals, industrial, etc. Whether or not this type of subdivision is feasible will depend on the information available, but in principle an attempt to classify such profit source should always be made.

The third case is that of the true investment company, the investment holding company, or a trading company with significant outside investments. In this instance the classification of earnings source, over 5 years, if available is essential. The published accounts usually provide sufficient data for source statistics to be extracted, but a fair degree of interpretation and allocation is frequently necessary.

Points to be borne in mind for such an exercise are:

Reduction to a common form, preferably e.p.s.

Tax allocation, bearing in mind dividends are not liable to tax.

The obvious value of an earnings source breakdown is that it provides a more reliable basis for determining earnings stability (or quality) and growth potential, e.g. in the case of a company which earns 50 c.p.s.; it will make a very significant difference if these earnings are derived 25c from

copper mining (cyclical metal price) and 25c from industrial operations, or say 15c and 35c respectively. Following from this is the problem of valuation. It is not very meaningful to value this company on say, an overall 20% earnings yield. A combined valuation of, say 25% for mining income and 12% for industrial income, would be more meaningful.

- Attributable Earnings

It is important to estimate attributable earnings, where applicable. The simplest example is that of a pyramid holding company : assume company X has 1 000 shares and earns 10 c.p.s. and pays a dividend of 5 c.p.s.; and company Y (the pyramid company) with an issued share capital of 100 shares, holds 50% of the shares in X as its only asset. Company Y's Profit and Loss Account will show dividend income of R25 (500 shares x 5c) as its sole income. Reported e.p.s. will therefore be R25/100 = 25 c.p.s., but the more meaningful attributable earnings will be

$$\frac{10c \times 1\,000 \times 50\%}{100} = 50 \text{ c.p.s.}$$

Attributable earnings, as in this example, will be included under statistics and not as a comment on the company.

An estimate of attributable earnings is also necessary for the true investment company or the trading company with significant outside investments, i.e. whenever dividend income forms a significant percentage of reported profits.

- Financial Structure

Comments under this heading should interpret the financial statistics (shareholders' interest, liquidity, quick asset ratio, pre-tax profits to prior charges) in relation to the company's financial requirements e.g. the 'standard' liquidity ratio is 2 : 1, but for some companies a very much lower ratio is acceptable. Thus, a mining company whose current assets are largely in mineral stockpile is highly liquid and could report a ratio in the region of 1 : 1 without this indicating a dangerous liquidity situation. On the other hand a developing or expanding mine financed by large loans should maintain a higher level of liquidity to meet its interest payment commitment.

Another feature to be considered is the magnitude of the amounts involved. A liquidity ratio of 1 : 1 may generally be taken to signify a dangerously low liquidity level, but if current liabilities form a very small percentage of total liabilities then clearly the liquidity level may not be a very meaningful indication - and this should be commented upon.

There are two forms of financial gearing, which, while closely related, are sufficiently distinguishable to be considered independently in many cases. Firstly, there is 'capital

gearing', as measured by shareholders' interest. Secondly, there is 'profit gearing' as measured by the ratio of pre-tax profits to prior charges. Example, a company operating at a low level of profitability might have a shareholders' interest of 50% - acceptable 'capital gearing', but a ratio of pre-tax to prior charges of 2 : 1 - an unacceptable 'profit gearing'. No hard and fast rules can be laid down as to what constitutes a good, bad or acceptable financial structure. This will vary according to the type of industry, the company's organisational structure, future capital requirements, etc., and also the current economic climate - availability of credit, etc.

It must be stressed that a discussion of the various financial ratios is not required but an interpretation or analysis of these ratios.

- Management

A company is, to a large extent, only as good as its management, and therefore one of the prime purposes of a company recommendation is to provide sufficient information to enable the reader to form an assessment of management. Every aspect of the company, particularly its historical performance, provides some measure of management's ability.

However, this sub-heading should not incorporate such statements as 'the 20% average growth rate over the past 5 years indicates good management'. Comments applicable under 'management' will include management's business philosophy, recent management changes, etc., where relevant to forming an assessment.

- Future Prospects

This could be sub-divided into 'current prospects' and 'long-term prospects'. It would generally include the analyst's assessment of future growth rate prospects, together with a brief summary of the factors which he believes influences that assessment.

Potential factors which could significantly affect the future prospects are also noted.

The above sub-headings merely provide a suggested format, and any may be excluded at the discretion of the analyst. Likewise, additional sub-headings may be incorporated, example:

- Historical Development

Sometimes vital for a meaningful assessment of the current situation.

- Depreciation Policy

May be sufficiently important (e.g. a significant divergence from the sectoral average) to warrant specific comment.

- Capital Expenditure

  Either incurred or projected, may show sufficient divergence from the company's norm, or follow a predictable pattern, justifying an analysis of the effects on the company's financial structure and operating profitability.

- Dividend Policy

  In the light of current liquidity, planned capital expenditure, etc.

The above comments provide no more than general guidelines. The prime consideration is that the recommendation must sift and analyse all the available information and present it in such a way that management can arrive at an investment decision on the basis of the recommendation.

. CONCLUSION

This must contain:

- An estimate of current year's earnings and dividend.
- The analyst's forecast of the future growth rate of the company in one of the following categories - above average, average, below average, nil/negative; and if possible a quantification of future earnings/dividends.
- The analyst's opinion of whether this is or would be a satisfactory investment for his institution. Cognisance must be taken of factors such as availability of scrip, size of company, quality of earnings.
- The analyst's assessment of the 'fundamental or intrinsic value' of the share.
- The recommendation of action to be taken. This could be a recommendation of inaction, i.e. that the existing holding be maintained.

Example:

- E.p.s. to June 1980 are estimated at 13,5 - 14,0 c.p.s., with an unchanged dividend of 5 c.p.s.
- Forecast of 5 year growth rate : 1984 e.p.s. of $\pm$ 22 c.p.s. (or above average).
- Overall opinion of company : Not an institutional type investment.
- Analyst's 'fundamental' price valuation : 100c (yielding 5% on dividend and 12% on earnings).
- Recommend that the holding be sold above 250c (yielding 2% on dividend and 4,8% on earnings).

1.2. Interim (Half-Year) and Preliminary Results Summary Reports

In view of the J.S.E.'s ruling that all quoted companies must produce half-yearly profit statements, a standardised analysis of the half year's results can be made for those companies in which the institutional investor has an interest. Analysts must watch carefully for interim profit announcements and undertake immediate analyses.

Steps for dealing with interim and preliminary results, to provide investment management with up to date evaluated information for the weekly investment meeting, are as follows:

- As soon as the results of companies, in which the Institution is interested, become available, the analyst fills in the relevant interim and preliminary result form (Figure D1 below) and makes a note of the company's name, type of result and date on a list provided in the Conference Room.
- The analyst extracts his previous analysis and evaluates the fresh results making a note of his views. He also establishes the technical position of the share and the sector in which it is listed.

  Comments on the form include:

  - Reasons for improvement or decline in profits. Performance is related to the Chairman's and Analyst's forecast at the previous year-end.
  - Revised forecast of e.p.s. and d.p.s. for the full year, and any significant facts to change the previous assessment of the company's future prospects.
  - Revised valuation of the share, giving earnings yield and dividend yield etc.
  - If necessary, a recommendation on any action to be taken (buy/sell).

- The interim and preliminary result form, together with the previous analysis are then circulated to the portfolio managers so that the company's results can be fully discussed within 24 hours (preferably the same day) and an agreed view reached.
- The analyst writes up the conclusions reached at this meeting and presents this view at the weekly investment meeting (Friday afternoon).
- At the weekly meeting the analyst makes a note of any further relevant opinions expressed and the decision arrived at by top management. Minutes of the decisions taken will be recorded.

Note:

- Results reported after Thursday noon are carried over to the following week.
- The analyst ensures that several copies of the interim and preliminary result form are reproduced by Thursday afternoon for circulation to Investment Management and for the permanent files of the portfolio managers and himself.
- It is best for all preliminary statistics to be written in pencil to allow future adjustments to be made without difficulty.

INTERIM AND PRELIMINARY RESULT FORM

Last Date to Register | Dividend

Interim: (c)
Final: (c)

COMPANY: _____

Chairman: | Managing Director:

Total Issued Shares (000s) | Market Cap. at
Total Institutional Holding (%) | Value
Total Sector Market Cap. (%) | Market Weighting
Total Portfolio (%)

YEAR END:									
E.P.S. (c)									
D.P.S. (c)									
D.P.S. Growth Over Year (%)									
E.P.S. Growth Over Year (%)									
D.P.S. 5-Year Growth (%)									
E.P.S. 5-Year Growth (%)									
INTERIM:									
E.P.S. (c)									
% of Year E.P.S.									
D.P.S. (c)									
% Growth Over 6 Months D.P.S.									

Nature of Business

Date	Comments:
	Decisions:

Figure D1

2. INVESTMENT DIVISION MEETINGS (WEEKLY)(27)

2.1. Objectives

- To provide a forum for the evaluation and discussion of recent developments in the economic and financial fields in terms of the Institution's investment strategy.
- To reach a consensus view on future financial trends, inter alia the S.A. Economy, Interest Rates and Stock Market.
- To promote communication between Management, Department Heads and Analysts of the Investments and Property Divisions:

Upward	-	To inform Management of views held by specialists.
Downward	-	To clarify investment policy and to disseminate Management's views.
Laterally	-	Interchange of relevant information between different departments.

2.2. Agenda

Friday afternoons at 2.00 p.m.

Part 1	Responsibility for Reporting
• Forecasts (6 Month View)	
- International events relevant	---------- Economist
- R.S.A. Economy	---------- Economist
- R.S.A. Interest Rates	---------- Economist/Investments (Admin.)
Long Term: Gilts	
Semi-gilts	
Debentures	
Short Term:	
- RSA Stock Market	---------- Trader/Technical Analyst
Golds	
Mining Financials	
Industrials	
• Reviews (Where Relevant)	
- Property	---------- Property Division/ Investments (Mortgages)
- Commodities	---------- Commodities Analyst
- Mining	---------- Mining Analyst
- Industrial Sectors	---------- Industrial Analysts
- General	
• Current Investment Criteria	
- Approved Securities	
- Fixed Interest	
- Ordinary Quoted Shares	
- Unquoted Shares	

Part 2

Evaluation and discussion on company reports ---- Analysts

2.3. Procedures

Part 1

Attendance is confined to General Manager (Investments), Investments Manager, Portfolio Managers, Department Heads and Analysts of Investments Division, and representatives from Property Division.

Minutes of the Meeting are taken with particular note being made of forecasts of future trends and conclusions drawn by the meetings. See Appendix 9.

In order not to prolong the meeting, it is imperative that adequate preparation be made. To this end, verbal reports must concentrate on evaluation and not summaries of fact.

Part 2

The second part of the Meeting deals with individual companies which reported results during the week. Emphasis is on evaluation of latest results with the objective of taking a view on the particular share in the light of overall investment strategy. See Appendix 8.

Attendance is confined to Investments Manager, Portfolios Managers and Investments Analysis Department.

3. INVESTMENT SEMINARS (PERIODIC)

The objectives of periodic investment seminars are:

- To develop analysts' knowledge and understanding of all aspects relating to share investment.
- To discuss, evaluate and reach a consensus view on important topics relating to the Institution's investment activities.
- To ensure standardisation of share evaluation criteria amongst analysts.

To achieve these objectives a 6-month program of topics is drawn up and regularly updated. The analyst responsible submits a written report to all analysts as a basis for discussion well in advance of the relevant meeting. He is expected to know his subject thoroughly in order to survive the grilling. A rotating Chairman conducts the meeting.

A 6-month program might include:

Date	Suggested Title of Topic	Responsibility	Chairman
	'Property Investment by the Institution - the Role of Property Shares'	Property Analyst	
	'The Institution's Equity Investment Philosophy'	Portfolio Manager	
	'Prospects for Consumer Durables'	Stores Analyst	
	'Gold in the International Monetary System'	Economist	
	'Gold as a Commodity - and Gold Price Outlook'	Commodity Analyst	Mining Analyst
	'Fundamental Factors Relating to the Evaluation of Gold Shares'	Mining Analyst	
	'Investment Opportunities in the S.A. Motor Industry'	Industrial Analyst	
	'The S.A. Chemical Industry'	Industrial Analyst	Mining Analyst
	'Evaluation of Equities as Long-term Investments'	Portfolio Manager	
	'Future Trends in Retailing from an Investment Point of View'	Stores Analyst	
	'Analysis of Mining Finance Shares'	Mining Analyst	
	'Predicting Commodity Prices - with Special Reference to Copper'	Commodity Analyst	Mining Analyst
	'Technical Tools'	Technical Analyst	
	'Outlook for Coal Shares'	Mining Analyst	
	'Predicting Stock Market Cycles'	Technical Analyst	
	'Outlook for the Building and Construction Industries	Property Analyst	

SECTION E

SECTION E

THE FUTURE OF INFORMATION PROCESSING IN THE INVESTMENTS OFFICE

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SECTION E

THE FUTURE OF INFORMATION PROCESSING IN THE INVESTMENTS OFFICE

SUMMARY

- THE INSTITUTIONAL INVESTMENTS OFFICE WILL NOT REMAIN UNAFFECTED BY THE INTERNATIONAL TREND TOWARDS THE FULLY AUTOMATED OFFICE. DURING THE '80S, SIGNIFICANT PROGRESS TOWARDS THIS OBJECTIVE WILL PROBABLY BE REALISED.

  WITH THIS PROSPECT IN MIND, COMPUTER AND INFORMATION PROCESSING DEVELOPMENTS ARE EXAMINED. THIS PERSPECTIVE PROVIDES THE CONCEPTUAL FRAMEWORK AND MOTIVATION FOR INSTITUTIONAL INVESTMENT MANAGEMENT TO ADAPT THE NEW TECHNOLOGY TO THEIR ANALYTICAL AND ADMINISTRATIVE FUNCTIONS. THEY WILL INEVITABLY BE SWEPT ALONG BY THE SHEER MOMENTUM OF CHANGE - BUT THEIR SUCCESS WILL DEPEND ON EARLY RECOGNITION OF THE CHARACTERISTICS OF THIS CHANGE.

  AS THE CENTRALISED BATCH PROCESSING ERA FAST DRAWS TO A CLOSE, DISTRIBUTED PROCESSING IS MOVING OUT TO INDIVIDUAL USERS. IT IS THEY WHO WILL GENERATE THE RAW DATA AND INTERACT WITH THE COMPUTER AND OTHER USERS. THIS INTERACTION WILL PROVIDE INFORMATION TAILORED TO THE USER'S SPECIFIC NEEDS AND PROBLEM SOLUTIONS.

  THIS DEVELOPMENT IS OF PARTICULAR SIGNIFICANCE IN INVESTMENT ANALYSIS DUE TO THE WIDE RANGE OF SCATTERED SPECIALIST SOURCES OF INFORMATION USED IN ANALYSES. THIS INCLUDES THE ANALYSIS OF COMPANIES, COMMODITIES, ECONOMIES ETC., WHICH CURRENTLY INVOLVES A TREMENDOUS BURDEN OF MAINTAINING PAPER SYSTEMS. SPECIALISTS WILL HAVE TO LEARN TO CO-OPERATE ON A BROADER NATIONAL SCALE AND TO COMMUNICATE ELECTRONICALLY BETWEEN SPECIALISED DATA BASES.

- MANAGEMENT SCIENCES AND TELECOMMUNICATION DEPARTMENTS WILL DEVELOP IN ALL LARGE INSTITUTIONS TO CO-ORDINATE THESE DEVELOPMENTS. THEIR ROLE WILL BE THAT OF A STAFF FUNCTION WITH WIDER RESPONSIBILITIES THAN THAT OF THE TRADITIONAL DATA PROCESSING DEPARTMENT.

IT IS ON THE BASIS OF THIS ORGANISATIONAL ASSUMPTION THAT THE FIVE YEAR OBJECTIVES FOR MS & TELCOM ARE OUTLINED. THIS PROVIDES A PRACTICAL GUIDE TO THOSE EMBARKING ON A DISTRIBUTED PROCESSING/DATA BASE STRATEGY FOR THEIR INVESTMENT ANALYSIS AND ADMINISTRATION FUNCTIONS. THE MINING SECTOR, BY VIRTUE OF ITS COMPLEXITY, WOULD BENEFIT MOST FROM SUCH A STRATEGY.

A WIDE SELECTION OF REFERENCES ARE LISTED IN THE BIBLIOGRAPHY IN CONNECTION WITH FORECASTS FOR THE 1980S PARTICULARLY WITH RESPECT TO THE AUTOMATED OFFICE, DATA BASE AND DISTRIBUTED PROCESSING. THIS IS CONSIDERED JUSTIFIED DUE TO THE ULTIMATE IMPORTANCE OF IDENTIFYING FUTURE DIRECTION BEYOND REASONABLE DOUBT. ERRORS IN THIS IDENTIFICATION CAN BE COSTLY IN MONEY AND EFFORT, AND EVEN IN THE COMPETITIVE SURVIVAL OF THE INSTITUTION.

THE FUTURE OF INFORMATION PROCESSING IN THE INVESTMENTS OFFICE

1. COMPUTER AND INFORMATION PROCESSING DEVELOPMENTS

1.1. The End of the Batch Processing Bureau(28)(29)

The era when the data processing department was an esoteric group inhabiting an ivory tower, but a necessary evil, is coming to an end.

The future will reveal that the end user is neither a bureau customer nor the organisation, nor even a department, but is the individual needing information. It is this individual's needs that must be recognised and satisfied.

The four key elements below will combine, with the boundaries becoming more vague, but certain features are recognisable.

- Micro processors are becoming an integral part of almost every business device (and domestic device) such as typewriters, telephones and so on. Their cost has dropped dramatically, and, for example, we can expect a million bytes of Remote Access Memory for R20 before the end of the 1980s. Chips will certainly replace much of the package software of today; and already voice synthesisers exist.

- The mini-computer already has enough power to handle most routine data processing tasks on a stand-alone basis, and in terms of machine power, will be adequate long before the end of the '80s. Mini-computers linked in either heirarchical fashion or in peer fashion will enable different departments and different branches of organisations to communicate and exchange information.

- In the larger organisations, there will continue to be a need for the larger mainframe, and particularly the large data bases that will be one of the most powerful tools in the '80s.

- The bureau can now be clearly recognised as any free standing data processing facility providing services to end users. The days when the bureau was only a batch bureau are over. Those bureaux offered the user a data processing capability without the problems of establishing a data processing department or learning data processing skills. The bureau of the '80s will continue to exist and will provide three needs:

  - Computer power, mainly at the end of a telephone line,
  - Expertise and guidance to develop and implement new systems, where the user did not initially have the expertise.
  - A large machine centre capable of consolidating multiple files, probably built up by multiple end users in multiple locations. These large files would be manipulated by data base techniques and the information contained in them would be available through sophisticated report writer techniques to both top management and to the originators.

All large data processing departments effectively provide a bureau service. The fact that it is under the umbrella of the same organisation as the end user is irrelevant. In fact the captive end user is often in a poorer position than the end user who pays an outsider for data processing. The end user options in the '80s will therefore not be so much conflicting options, but an opportunity to capitalise on developments in the technology of chips, communications, and software.

However, if management is to successfully manage, three conditions are essential:

- Direct involvement with the new tools.
- Acceptance, but control, of the incredibly rapid rate of change.
- Recognition that the data processing department, and particularly the data processing manager, must be measured by the quality of the information provided.

1.2. The Evolution of Distributed Processing Power(30)(31)(32)

A technological supercylce is ending as computer systems technology leaves the traditional computer room and starts infiltrating every corner of the institution.

This will cause users increasing difficulties in assessing their DP requirements. This supercycle has broken down the rigid hardware systems of the 1960s and evolved into a more fluid form that will be 'retrofitted' to user requirements in the 1980s. However, while this is taking place, our concepts of small, medium and large systems blur - the hardware starts to appear soft and the software hard.

Automation of the factory is already well advanced, and this will now be combined with automation of the office environment. This will place computer power throughout the functional areas of the company, with processing power available to the originators and ultimate users of the information generated by the machines.

The evolution of this process has gone through many steps:

- In the early 1960s, driven by the development of commercial batch processing systems, computers were independent units that stood alone, serving different functional areas of institutional life and based largely on IBM 1410-type machines.

- In the mid-1960s larger centralised computers such as the IBM 360 line came into existence, with some terminal applications. At that time, economy of scale and relatively unreliable communications links favoured the larger centralised units.

- In the 1970s, there was a move to mixed, distributed large and small systems, with smaller processors tied through communications lines to larger units. This led to higher communications costs and larger system overhead. This movement was primarily spurred by the price/performance characteristics of mini-computers and micro-computers.

The 1980s will see the development of computer utilities with many nodes and specialised terminals and processors. Operating through environments like AT & T's Advanced Communications System (ACS) and IBM's Systems Network Architecture (SNA), as well as other packet or value-added networks, these networks will be spurred by lower communications costs and standard protocols.

The arguments about decentralised versus centralised systems will tend to fade during the '80s. The systems will be made to fit the institutional style rather than fitting the institutional style to a particular processing philosophy.

During this period, DP will have to overcome such problems as down-time (now accounting for 5% - 10% of computer time). Since DP will be in every corner of an institution, management will not tolerate such down-time.

Computing will become an extremely complex operation that might fall into a new age of uniprocessors based on such things as Josephson Junction technology, leading to a new uniprocessor synthesis sometime after the 1990s.

EVOLUTION OF PROCESSOR TECHNOLOGY

(DIAGRAMMATIC)

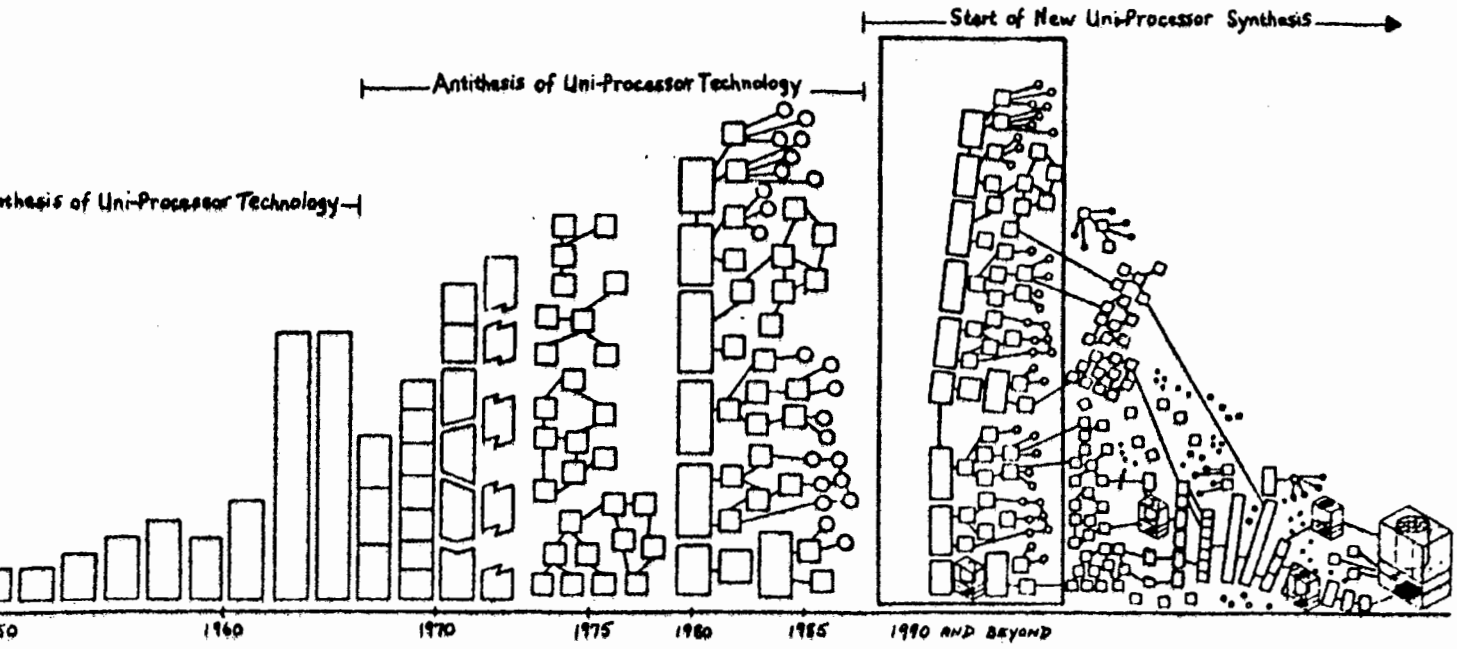


Figure E1

1.3. A Forecast of IBM Control Systems for the 1980s(33)

As IBM has by far the largest slice of world computer sales, it is meaningful to reflect on the future development of their system capabilities.

During the 1980s IBM will increase the number of functions in its operating systems in order to promote ease of use and to generate increasing revenues. This will permit IBM to maintain its 15% compound annual growth rate partially by stimulating a greater demand for other DP equipment - terminals, tapes and disks, for example, and other software products.

At the same time, such a move will help IBM stem the increasing competition from manufacturers of software-compatible processors, such as Amdahl and Itel Corporations, and from the companies that lease IBM 370 mainframes.

Users can expect to see a whole series of improvements incorporated into IBM operating systems in the future, including a wider address space, built-in data security and the ability to provide for multiple views of logical files. Furthermore, the systems of the future will eliminate the need for Sysgens and job control languages, and will have single file systems. There will be user interface prompting in these systems, and they will feature self-diagnosis for easier maintenance as well as interactive source debug programs and automatic documentation.

All of these advanced functions will serve several purposes. They will use more processor cycles, which means users will continue to have to purchase more hardware as hardware prices decrease.

The functionality of the operating system will also use up more control and memory space than do present operating systems, again with the same result. At present, operating systems currently take about 50% to 60% of the machine cycles, leaving 40% to 50% of those cycles available for user code. In the future, the operating systems functions could take as much as 70% to 80% of the machine cycles, leaving only 20% to 30% for user code.

Figure E2 shows the increased functionality of operating systems as mainframe manufacturers put more and more functions into their operating systems.

SYSTEMS SOFTWARE FUNCTIONAL GROWTH

1950s - EARLY 1960s (IBM 701, 704, 7090)	LATE 1960s (IBM 360s)	1970s (IBM 370s)	1980s (IBM E AND H SERIES)
			. Name Space Concept (Unlimited Address Range)
			. Distributed, Special Function Engines
		. Virtual Storage	. Automatic Workload Mgmt. (No JCL) - Self-Tune
		. Some Microcoded O/S Functions	
	. Multiprogramming		. Full Data Security
	. Spooling	. Multiprocessing	. Logical Files with Multiple User Views (Extensive Sharing)
	. Remote Batch	. I/O Device Independence	
. Manual Intervention	. Primitive MP Capability	. JCL	. High-Level Instructions
. Single Application	. Some Workload Mgmt.	. SMF	. Operation & User Prompting
. Assemblers	. Limited Application Protection Mechanism	. Inter-Application Protection	. Fail-Safe Features
. Some Compilers			
	. APL, PL/1, BASIC, etc.	. Large Libraries	. Microcoded Function/Performance Optimization Options
. Auto Job Batching	. Random Access Files	. O/S Subsystems Evolve: TSO, IMS, CICS, VTAM, NCP...	
	. Communication I/O Functions		. Advanced I/O Interface Protocols
		. Error Recovery Mechanism	
		. Limited Data Storage Hierarchies	. Storage Hierarchies (Automatic)
			. Self-Diagnosis
		. Sysgen	. Huge Libraries
			. Complete Data Independence
			. Many Vendor-Supplied Applications Subsystems
			. Extensive Networking and Workload Balancing Capability

Figure E2

1.4. The Automated Office Concept(34)-(40)

The automated office is emerging. A few conferences have been held on the subject, a growing number of firms are actively experimenting with office automation, and a barrage of new products is expected soon. The automated office field will radically influence how all institutions will use computers in the future.

The automated office is known by several names: the office of the future, the automated office and the electronic office. It is a new, structured way of handling business documents and person-to-person communications. It refers to the investment of capital in electronic office equipment, which is connected to a communications network thus forming an integrated, multi-function, electronic office system within a company. In its broadest use, the automated office includes not only this intra-company office network but also connection to an external network for electronic communication with the outside world.

An institution's introduction of word processing equipment, to aid in the generation of paper communications, might be considered their first move towards a more automated office environment. However, as the term is currently being used, the automated office is not a group of stand-alone word processing systems but rather an integrated system. The various components are interconnected by a communication network.

The basis for the automated office is this electronic network. It might connect the following services: word processing for the generation of formal and informal correspondence, electronic message system for person-to-person electronic communication, facsimile for rapid document and graphic transmission, electronic 'file cabinets' for document storage and retrieval, and links to various corporate files and outside services. All of these services would be accessible from electronic work stations.

Implicit in the automated office is the use of computers for controlling every facet of the system. So the automated office is really a multi-function, integrated, computer-based communication system that allows many business communications to be performed in an electronic mode. This new communication mode will enhance paper and voice modes, rather than totally replace them.

Socially and organisationally, the automated office will alter work habits by changing the way employees communicate with each other. It will change the office environment by allowing greater flexibility in where and when people can work. It will also effect the organisational structure by changing criteria for promotion and reward.

The automated office is thus more than the addition of new computerised business application packages - it is a new office environment, based on electronic communication. It will eventually change the way in which offices are run.

The prime reason for installing the automated office is to increase the productivity of office workers, particularly managers.

Management's modes of gathering and disseminating information and making decisions so far have not been much affected by the computer. Most managers still depend primarily on word-of-mouth communication. The automated office will have quite an impact on how managers perform their jobs in the future, and this will increase their productivity.

Three categories of institutions are identifiable:

Group 1 - those that now operate in an automated office environment.
Group 2 - those that are actively planning their future office environment.
Group 3 - those that have not yet thought about their office of the future.

- Group 1 institutions which operate in an automated office environment now, can do so because they have access to a data network that has the following three properties:

  - The network allows cost-effective transmission on a per-message basis, with switching costs exceeding transmission costs.
  - The network uses a standard transmission method. This standard is accessed either through the use of one standard type of terminal/computer equipment or through the use of network interface processors. The processors convert messages received from a variety of computers and terminals into the network standard.
  - The network provides efficient message handling capabilities. When using the network individuals in these automated offices are able to enter, store, query, and distribute data and text in an electronic mode, rather than in a paper mode. Communications with other individuals on the network are entered and retrieved through computer terminals using electronic files. Co-workers (e.g. investment and mining specialists) may be in the same building or across the country - it makes no difference. Thus, a data network, with the accompanying message and file handling facilities, makes an automated office environment possible today.

- The only institutions in Group 2 (planning their future office environment) are the very large corporations. They have formally organised task groups to perform the initial planning for their office of the future. Very large institutions are often leaders in using new technology, because of the high costs. Since no integrated office systems are now available on the market, only very large institutions have the resources to plan for and develop such systems. They work with vendors to develop specifications for prototype systems.

- Group 3 institutions (not yet thinking about the impact of the automated office) comprise all others. While it is true that many institutions now have word processing systems, computer-output-microfilm (COM) systems, and even institution networks, these stand-alone installations do not constitute an automated office - unless

evolutionary integration of them has been planned. It is the coupling of such diverse systems into a computer-based communication system that differentiates the automated office from such stand-alone systems.

1.5. The Investment Analysis Automated Office

The following is a brief review of what the Investment Analysis automated office environment will probably be like.

- The automated office will eventually consist of a large number of terminals or work-stations, which can perform work in a stand-alone manner and which can also be tied into one or more data communications networks. Secretaries will use work-stations instead of typewriters. Investment managers and investment specialists will use work-stations in addition to their telephones.

- A typical work-station will consist of a CRT terminal, perhaps a hard-copy printer, a micro-computer, one or more floppy disk drives, a data communications interface, and a modem. The work-station will be able to perform all the functions needed for maintaining company and statistical files, stored on floppy disks. It will be able to communicate with the work-stations of other specialists, as well as with corporate data services, i.e. Management Sciences, by way of the data communications network. It will also be able to access computer services offered via public networks.

  Each computer-using organisation may well have a central system that performs a message switching function among the work-stations, and that has central indexes to information files.

- Work-stations will be able to perform:

  - Word processing functions.
  - Receiving and sending messages by way of the computer message system.
  - Storing the user's personal files.
  - Providing the user's personal decision support functions.

  The personal files can include: outgoing correspondence, both incoming and outgoing intra company messages, daily calendar, appointment schedule, travel plans, tickler file, work assignment file, and so on.

  In short, much of what is now recorded and stored on paper, and some of what is transmitted over the telephone and by informal meetings, will be handled electronically.

1.6. Integrated Management Information Systems(41)-(44)

The concept of integrated MIS was held, in the late 1960s, to be the keystone upon which all business DP should be built. By and large this promise has not come to fruition because three fundamental abilities were lacking:

The ability to store and manage massive amounts of data.

- The ability to integrate data from disparate sources.
- The ability to respond to rapidly developing and changing user requirements.

The advent of commercially available data base management systems (DBMS), coupled with non-procedural languages, has provided two of the primary requirements for implementing the integrated MIS concept. The successful use and implementation of a DBMS is not as simple as calling a vendor and loading the DBMS to disk.

Like most DP innovations, the DBMS concept suffers from overselling and misunderstanding. The following rules and observations gleaned from those with experience in analysis, selection and implementation of DBMS in an MIS environment provide useful guidelines:

- Unless a competitor offers a free DBMS, choose one that offers a non-procedural, very high-level language. One frequently sees advertisements for DBMS claiming that use of non-procedural language will cut development time by 50% and rewrite time by 80%. Given an orderly environment, these claims are not at all extravagant.

  One should model a system or module four or five different ways before selecting a particular strategy and proceeding with full-scale development.

- Select a DBMS that offers extensive capabilities for validation, audit, rollback and recovery, then add your own redundant recovery capability.

  No matter how sophisticated and capable the DBMS recovery utilities are, you will eventually either lose data or lose the ability to specify which data has been input to the data base and which data has not.

  When this happens, it is imperative that you have at least two distinct sources concerning the exact state of the data base prior to the error. When you can no longer tell a user which constituent data comprises the information on a report, you may as well shut down the system.

- Because you will almost never define all data base design requirements before the data base goes on-line, look for a DBMS that allows schema respecification with no impact on existing data.

  At a minimum the DBMS must allow:

  - Addition and/or deletion of data fields to/from records.
  - Addition and/or deletion of member records to/from owner-member sets.
  - Indexing of a data field after the data base has been created.

- A good DMBS interfaced with a non-procedural language makes control of production software more exacting. With a procedure-orientated language like Cobol, changes to production software require a lot of work.

  When a large system has been written in Cobol, one does not entertain rewrites lightly - they are well planned and managed. With a non-procedural language, the administrative process for changing a piece of software often takes longer to complete than the software change itself. The desire to respond to user requirements, coupled with the ease of non-procedural rewrites can result in lax control over the configuration of the production software.

- A DBMS cannot plan, decide or make value judgements.

  This point seems trivial to experienced DP personnel, but to the user who knows DBMS to the level of vendor literature, it comes as a deep and resented revelation. The DBMS is sometimes oversold to the point that a user expects only to pass disjointed data to the DBMS to make sense of it (e.g. the DBMS will make up next year's budget, decide how to staff each department, etc.!).

  It is incumbent upon the DP personnel to sit down with the users and make it clear that the DBMS will keep track of where data is stored. It is a well-designed data base and properly developed software that makes information (i.e. sense) out of data.

- A DBMS will cause an organisation to decrease the amount of information processing that it does and will cause an increase in the amount of data processing. (If not, either you do not need a DBMS or it has been improperly implemented).

  With a well-run DBMS, there will be very few analytical or management level personnel sifting and collating data to provide information. There will be more data entry personnel providing raw material on the data end of the data-information transformation.

  Make sure the user understands that having a DBMS does not cause an absolute drop in effort.

- You will end up wishing you had a relational DBMS. If the user can ever imagine a need for any two data fields in any two data bases appearing together on a report, he will ask for it eventually.

  Experience with hierarchical DBMS and with a fairly effective relational/hierarchical DBMS utility leads to the conclusion that relational structures hold the most promise for the next generation of DBMS.

  If system overhead can be brought within reasonable bounds (the main problem with the relational utility DBMS discussed above), and if current relational theory can find a simple and elegant manifestation in a commercially available DBMS, the third requirement for fulfilling the promise of the integrated MIS will be available.

1.7. Date Base Management Software(45)

The Management Sciences five-year objectives plan for data base management systems might typically include Cullinane's comprehensive and fully integrated family of advanced software products (See Figure E3).

IDMS is a data dictionary-driven system. Therefore, any component required, regardless of when acquired, is fully integrated with the DBMS via the data dictionary with attendant efficiencies. For example, a dictionary-driven teleprocessing system can be reconfigured dynamically without ever bringing the system down and disrupting operations.

Also, it is now possible to have a fully automated applications development system which will greatly improve programmer productivity.

- Data Base Management

  IDMS is an efficient state-of-the-art data base management system for use in the IBM environment (including the new 4 300 series). It is the nucleus of a completely integrated distributed data base system. The basis for all Cullinane software components, IDMS is the first CODASYL-compatible DBMS and gives a high degree of hardware and programming language independence.

- Data Communications

  IDMS-DC is a data communication system (TP monitor) designed specifically for use in the data base environment. Fully integrated with IDMS, IDMS-DC therefore gives fast response time, economical use of memory and simplicity of use in a sophisticated multi-terminal configuration. IDMS-DC provides a powerful recovery facility, mapping support, storage protection and other programmer productivity and data integrity features.

- Data Dictionary

  IDD is an 'active' data dictionary because it is fully integrated with a data base system. It is a powerful design and control tool for use with IDMS and other Cullinane software components, yet it can be used as a stand-alone system to define and standardise all data resources whether manual or automated, data base or conventional file systems. IDD supports FORTRAN, COBOL, PL/1 and Assembler.

- Report Generator

  CULPRIT can be used to produce even the most complex reports quickly, easily and with a bare minimum of coding. It can access virtually any file structure including conventional files or data bases. CULPRIT is economical. It can produce up to 100 reports with a single pass. CULPRIT can be used as a powerful stand-alone or as a part of a fully integrated data base management system.

- On-Line Query

  On-line query, Release 2.0, is a major new advance in interactive information retrieval systems. Fully integrated with IDMS, it requires no programming in order to be immediately useful upon installation. On-line query provides managers and user departments with a powerful, easy-to-use set of English commands that allow instant access to selected information stored in the data base. Multiple Record Retrieval, QFILE storage and DBKEYLIST command are only a few of the system's advanced features.

- On-Line Program Development

  INTERACT is an on-line system for program development, remote job processing, text editing and word processing. INTERACT is the programmer productivity system. It offers a powerful command repertoire, fast terminal response time, and economical CPU requirements. INTERACT is backed by Cullinane's worldwide network of technical support centres.

- Distributed Data Base

  Cullinane's Distributed Data Base System allows multiple IBM computers to share a common IDMS data base. Distributed data base is a unique Cullinane capability. One can support applications programs at remote sites and allow them to access a central data base with complete user transparency and full data integrity.

  Cullinane Distributed Data Base is a system of the future available today.

DATA BASE MANAGEMENT SOFTWARE

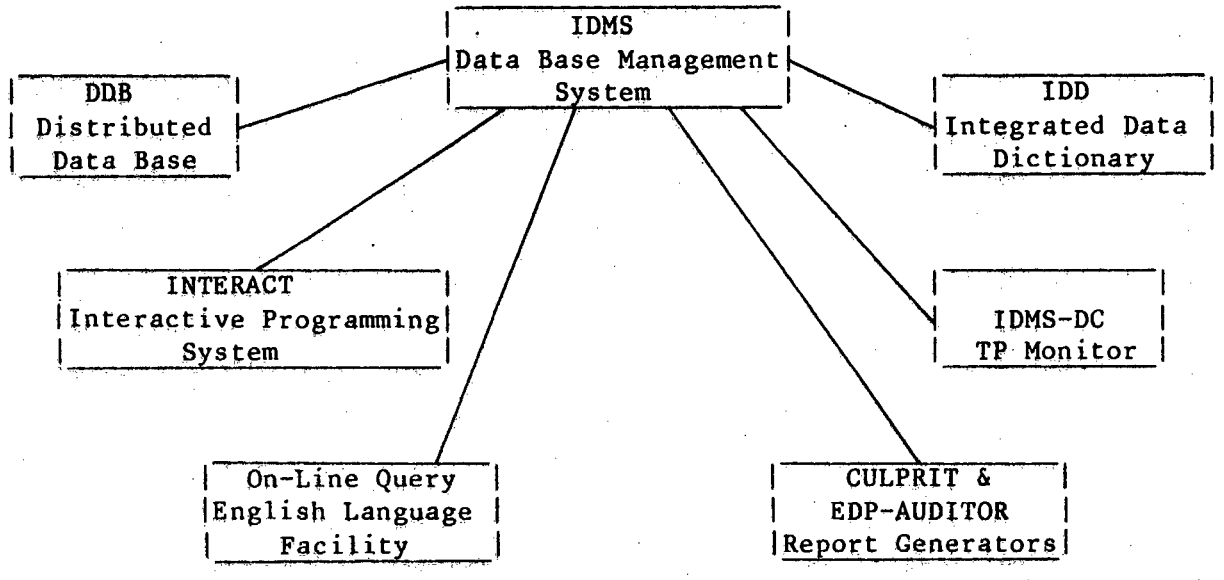


Figure E3

1.8. Tomorrow's Distributed Processing Options Currently Available(46)

Raytheon's MARK I

Ratheon's MARK I is a highly advanced distributed processing system. It will work immediately, without reprogramming or conversion, on a host IBM mainframe. MARK I offers an unparalleled range of applications freedom for data networks.

Thus, when one must configure systems to meet a variety of different needs at a variety of different locations, one can do so with speed, simplicity, modular power, and many configuration options.

Some of the options one can install include:

Option 1 (See Figure E4)

Local Processing and 'Intelligent 3270' Functions

Every Raytheon MARK I system comes with two basic capabilities. One is the ability to do stand-alone local processing. The other is the ability to perform intelligent 3270 on-line functions.

An 'intelligent 3270' has the ability to extensively expand the capability of a 3270-type terminal network by adding advanced features to the network without systems change, and without dependence upon the host processor,

Features such as local format storage, local printing, local data base access, local transaction storage and back-up and the ability to verify data, field-by-field, record-by-record, without going upline to the host mainframe. These capabilities are inherent in the MARK I system. A 3270-type network user gets them immediately. One can access local files, data entry functions, and either interactive or batch communications without complex changes to one's network.

The key to intelligent 3270 operations is the MARK I's stand-alone processing capabilities. A powerful user-programmable controller supports from one to eight CRT operator stations, a 10 to 40 megabyte disk data base, and a variety of printers and other peripheral devices. All systems and network communications software comes with every MARK I, so the user need only develop the applications programs he requires.

Option 2 (See Figure E5)

Interactive, Batch and Source Data Entry

The MARK I can become a multi-function workhorse in still another way. Start with its protocol emulators : 3270 interactive (dumb and intelligent), 2780 batch, or 3780 batch, or HASP remote job entry. On a single MARK I, one can run combinations of these emulators at the same time, allowing one to run both interactive as well as batch lines to the host CPU.

While one is executing both of those functions, a group of one's operators can also perform source data entry functions on the MARK I. The Source Data Entry Package (SDEP) enables users to execute many functions not found in dedicated data capture devices. However, it also does classic data entry functions, such as : automatic cursor skipping; reasonableness checking; crossfooting and arithmetic computation; batch balancing; record searching by number; field or task; table look-up and record insert/delete.

One can install this capability today, and be using it tomorrow, while one continues to execute 3270 or 3780 or HASP batch orientated tasks.

Option 3 (See Figure E6)

Downline Terminals, 'Upline 3270' Tasks

Downline terminal support means that a MARK I controller, in addition to performing its basic local processing and upline 3270 data communications tasks, can also maintain control of a downline multipoint terminal network. Every MARK I can control up to ten drops on its own downline link - under 3270 protocol, using Raytheon's powerful PTS-100 intelligent terminals in 3270-mode.

Downline terminal support from a MARK I controller is the essence of any distributed processing system's ultimate value i.e. the ability to offload busy, costly mainframe computers in the easiest, fastest, and most cost-effective manner.

The MARK I, or a series of MARK I's will control the time-consuming polling of the 3270-type devices. The local MARK I data base will provide the local formats and record storage facilities that tie up the mainframe. The MARK I will communicate upline, selectively, when it must support downline terminals by getting mainframe data for them.

The result is that every component of the system, and all the operators it serves, work faster and better.

Option 4 (See Figure E7)

Mix Small or Large Systems on a Single Network

When one installs a MARK I distributed processing system, one is still at the beginning of one's network expansion capabilities. The MARK I offers a fast, totally compatible migration path to Raytheon's larger MARK II systems.

The MARK II supports multiple job streams. It has a data base capacity of 252 million bytes of local storage. It can support up to 24 operator work stations; all of the protocols available on MARK I; a HASP logical printer; greater numbers of peripherals; and faster memories in support of higher speed operations.

MARK I and MARK II are totally compatible. One can upgrade a MARK I to a MARK II without alteration of one's mainframe system, and without complex conversions.

DISTRIBUTED PROCESSING OPTION 1

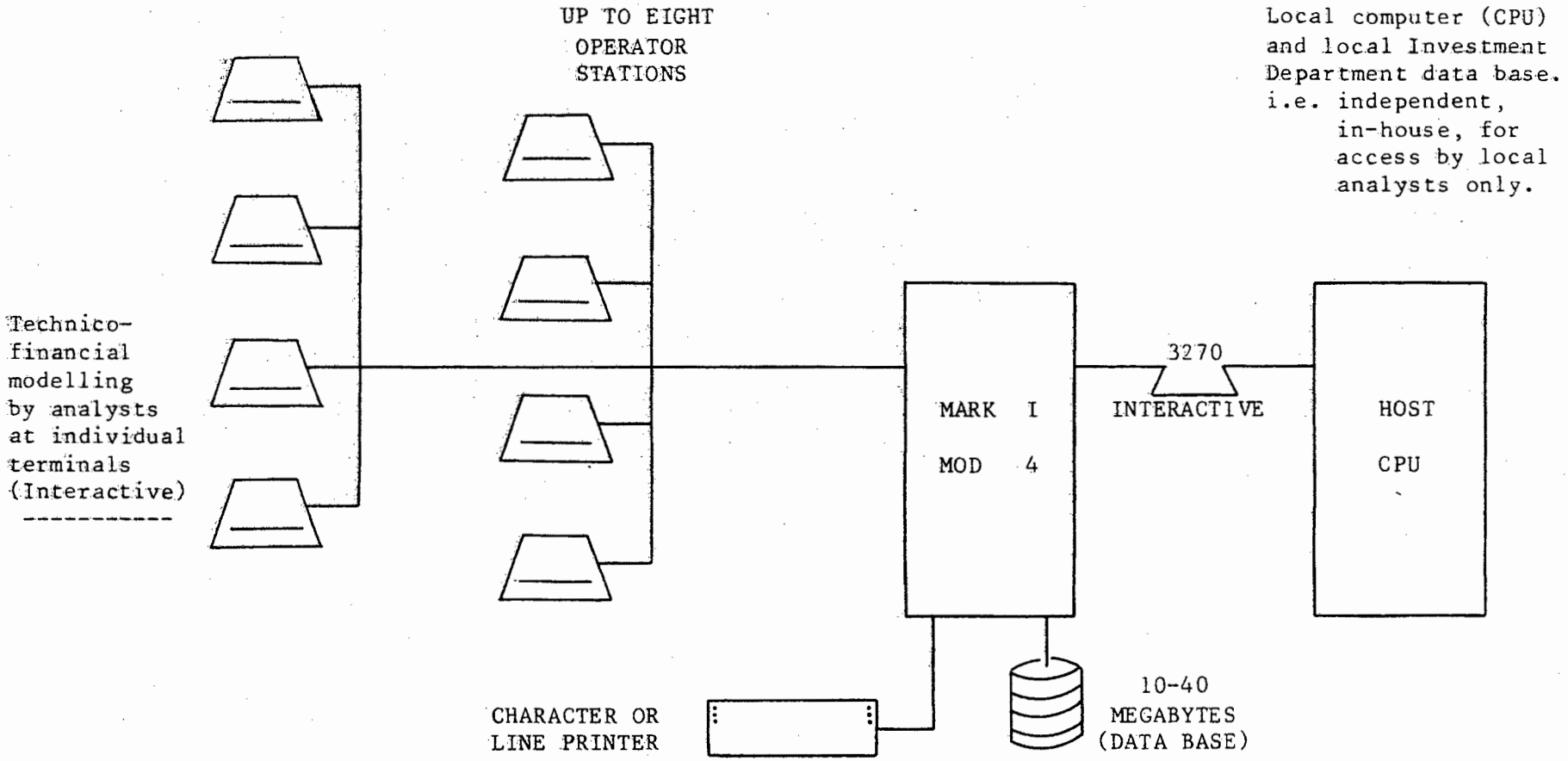
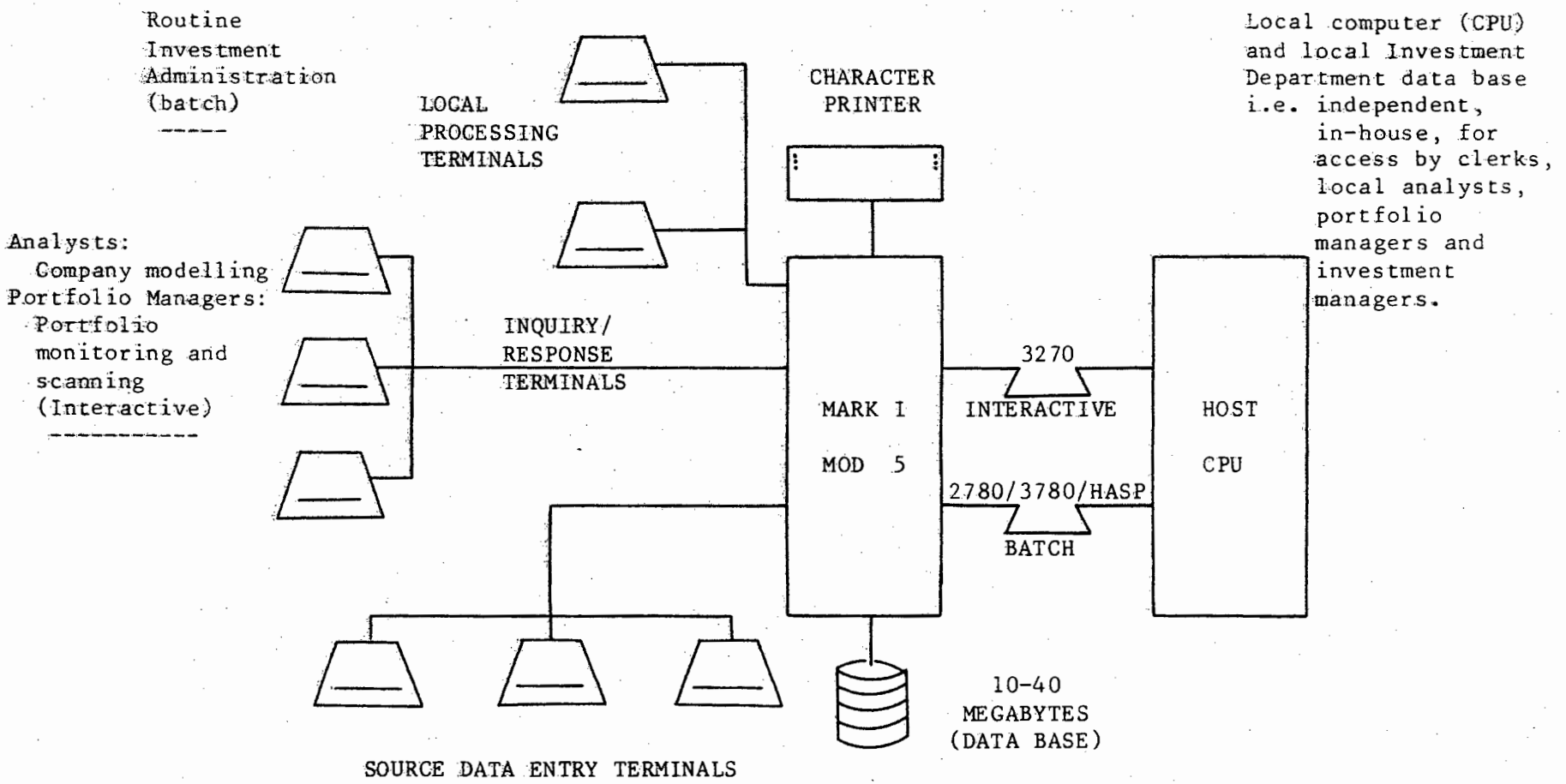


Figure E4

DISTRIBUTED PROCESSING OPTION 2



Analysts & Clerks:

Mining	)	
Industrial	)	Fundamental Data
Commercial	)	(ex accounts, reports etc.)
Economic	)	(Batch)
Commodities	)	-----

Figure E5

DISTRIBUTED PROCESSING OPTION 3

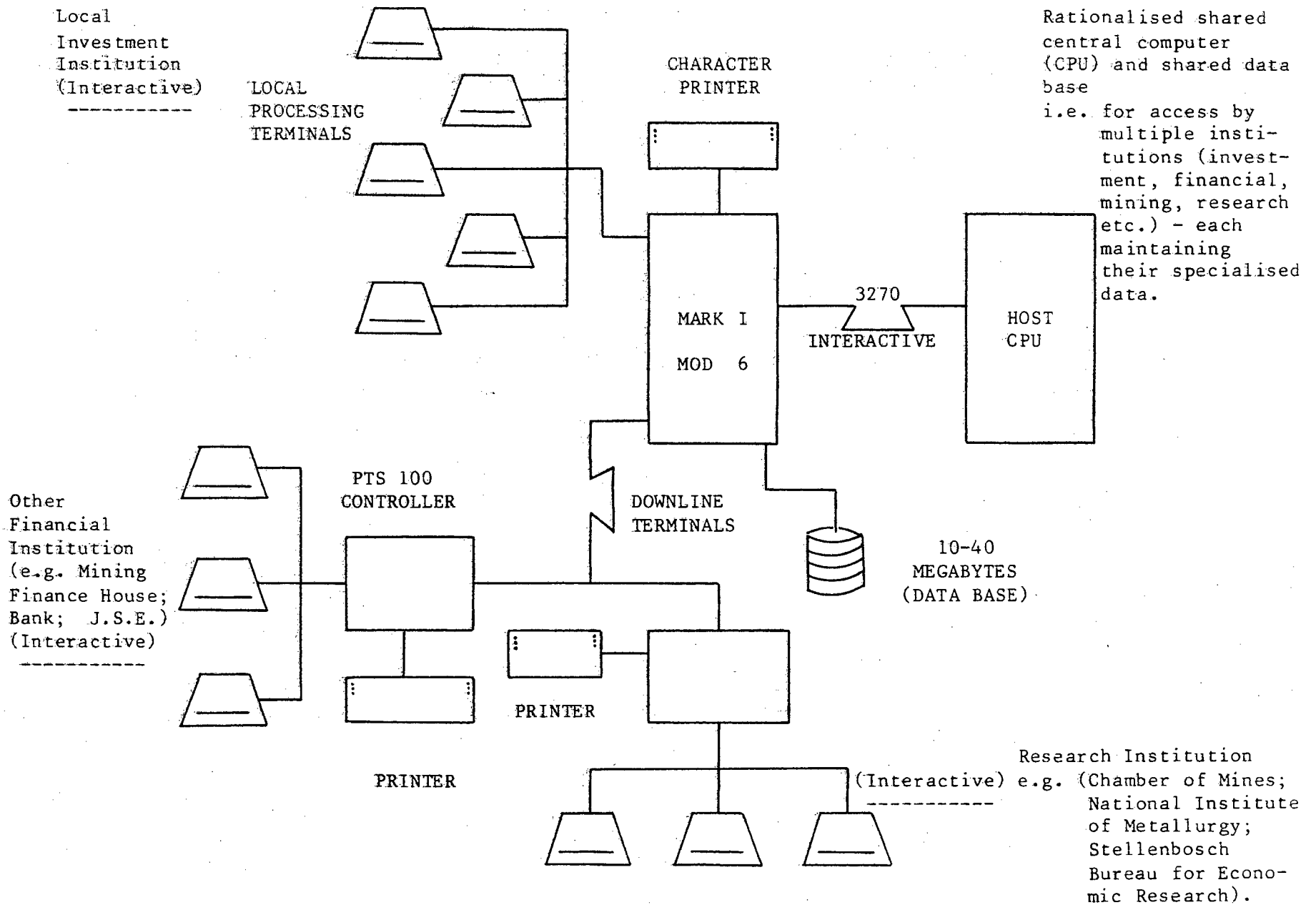


Figure E6

DISTRIBUTED PROCESSING OPTION 4

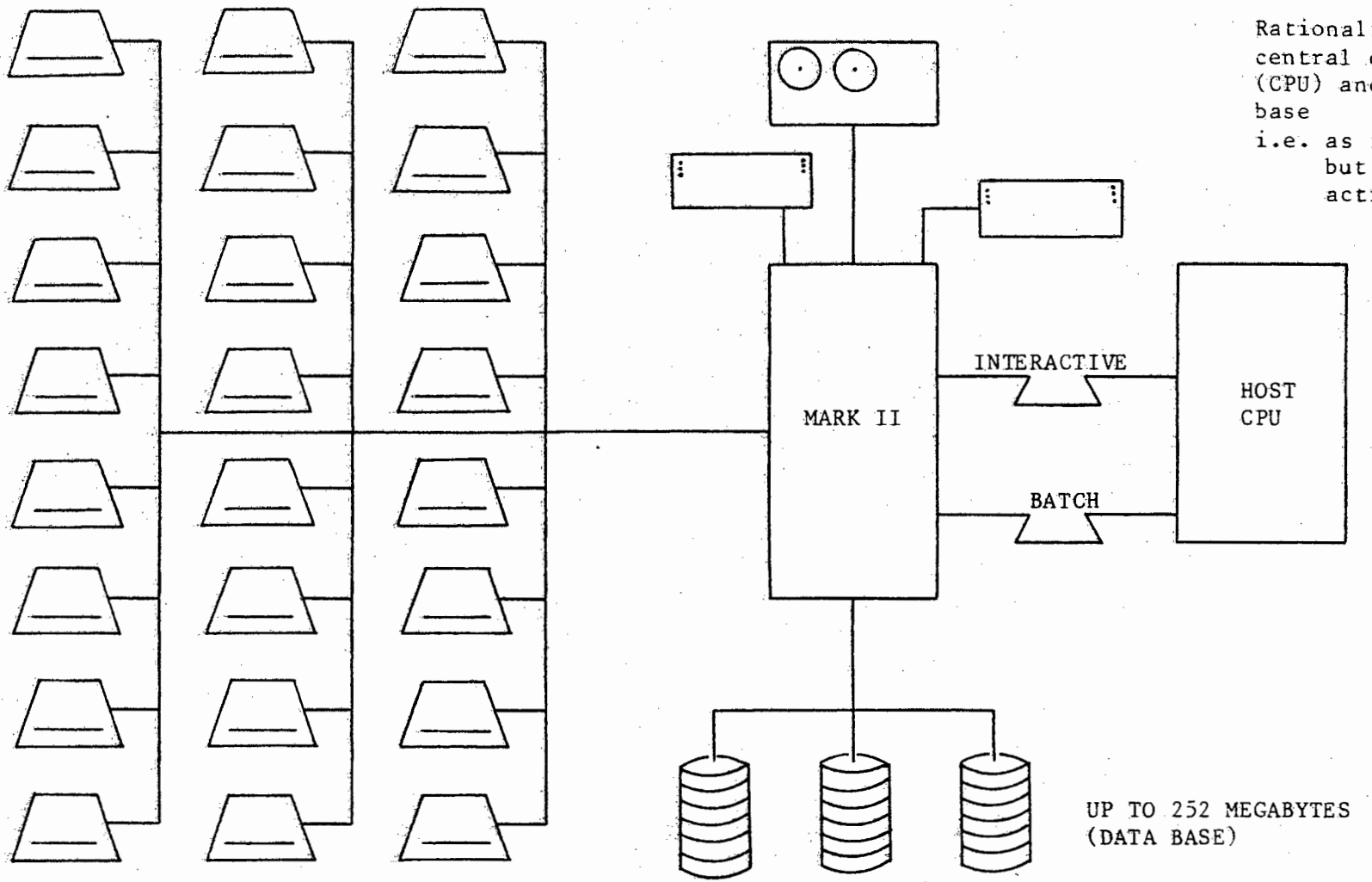


Figure E7

2. A MANAGEMENT SCIENCES VIEW OF 1990

The Management Sciences Division of a major U.S.-based international natural resources corporation, already heavily committed to computerisation, has projected computer trends to 1990. These conclusions are based on analysis of 38 responses to a 1978 MS Trends Survey.

2.1. Computer Hardware

- The largest computer mainframe of 1990 will be faster and have greater capacity than the largest IBM computer today. One such large machine will be the equivalent of more than 9 of today's IBM 3033s.
- The unit cost of computing, in constant money terms, will have declined by about 11% annually so that the cost per computation will be less than 30% of 1978's level.
- Computing speeds, memory, data storage, data communications and networking capabilities will be significantly better in 1990 than 1978.

2.2. Computer Logistics

- Compared to the 460 in 1978, the corporation will have more than 4 800 minis with about 2 800 (58%) of them linked to mainframes and the remaining 2 000 (42%) used in a stand-alone mode.
- The corporation will have a computer network able to share workload or allocate computing among mainframes - such a network having been implemented 2 years earlier.
- Key users throughout the company will have desk top minis or terminals.
  These key users will consist of all sectors of the corporations employees - managers, professionals, technicians and clerical personnel.
- Vendors will offer on-site computing services but the corporation will not use them, preferring to maintain its own in-house capabilities.

2.3. Economy of Scale

- Small computers will have become increasingly cost effective with their unit cost of computation matching or falling below that of large computers. Large computers will be used principally where their large capacities are needed, such as certain processing or massive data bases.

2.4. Hand Calculators

- Professional and managerial employees will have powerful hand calculators able to program and process many routine engineering, financial and business computations.

2.5. Computer Usage

- On-line computing will constitute more than 55% of prime shift and many employees will work with portable terminals at home during non-prime shift.

- About 15% of managers and 50% of professional staff will use terminals for routine inquiry into data bases or to write and run their own programs or use a program library. The ratio between own generated programs and program library usage will be about 40% to 60%.
- Data base applications will use about 50% of computer resources.
- Graphics applications, office automation and voice input/output will be major new uses of computer resources.

2.6. Applications Practices

- Applications for strategic planning will have evolved and systems for investment, allocation and operations planning; operations scheduling and support; control and performance measurement; and reporting in real time will be common place.
- Operations Research techniques will be routinely used in decision support systems and for ad hoc analyses of decision problems.
- Data base applications will be widespread with a large fraction involving shared as well as distributed data bases.
- On-line processing will be widely used in applications as well as for applications development; and general packages will be in use to manipulate and analyse data stored in data bases and structure special reports.
- Applications development process will be characterised by structured development methods, formalized applications planning, use of throw-away prototypes and increased user participation.
- Users will develop an increasing portion of applications on their own.

2.7. Office of the Future

- Word Processing will be widely used, handling about 65% of document preparation.
- Word processing will interface with some data bases.
- Electronic mail, filing and retrieval will be routine and electronic mailboxes will be appearing on the scene.

2.8. MS Management Concerns

- Allocation of MS managers' time will be approximately the same as in 1978 with the exception that more time will be spent in personnel related activities and in such areas as security and governmental impact on MS.
- Personnel costs will be about 60% and equipment costs will decline to about 25% of total MS expense.
- Major problems will be adapting to changing environment, particularly as a result of increased computer literacy on the part of clients and the greater range of options available on how to deliver and organise MS services.
- MS professionals will play an increasing fiduciary role - consulting, advising, and appraising MS usage.

3. MANAGEMENT SCIENCES AND TELECOMMUNICATIONS STRATEGY

5 YEAR OBJECTIVES (1980 - 1984)

3.1. Objectives

A Management Sciences (MS) and Telecommunications (TELCOM) Department will emerge in all large Investment Institutions in response to current problems and future needs. Development of computer applications will proceed under the control of this MS/TELCOM Department.

The following Institutional MS/Telcom objectives provide an overall framework within which the Investment Department and individual Investment Functions (e.g. Mining Analysis, Economic Analysis etc.) should develop specific objectives.

. Primary

Assist user departments/functional areas in making most effective use of available MS resources.

Within each MS/Telcom functional area (e.g. Mining Analysis) improve cost performance in terms of productivity, quality, reliability and service for all resources i.e. manpower, facilities and technology.

. Secondary

- Continuity of Business

  Operate in such a way as to assure continuity of the Institution's business.

- Compatibility

  Standardize equipment, operating practices and procedures commensurate with the provision of efficient MS and Telecom services.

- Career Development

  Recruit key employees. Design and implement career development through a planned program of training, broadened job experience within the function, and rotational assignments with other functions.

- Security

  Implement security measures and practices consistent with the best interests of the Institution.

3.2. Assumptions

3.2.1. Environmental

. Technology

Monitor and exploit advances in areas of computer technology such as networking, distributed computing, and other special purpose computing systems, etc.

. Security

Security must continually be an objective in configuring and operating computer centers as well as in applications systems design. Place emphasis on both physical security of computer installations and data security through:

- Organization for implementation and control of security matters.
- Review of data center security practices.
- Standardization of programming and operating practices.
- Increasing participation by internal auditors during design of computer systems.
- Audits of computer systems.

. Management Control

MS/Telcom activities will be controlled through:

- Capital Approved for Expenditure (CAFE) System.
- Limits of Authority Schedules and other financial review procedures.
- Computer center reviews and applications audits.
- Chargeouts to Investment functions (e.g. Mining Analysis) for computer and systems analyst services.
- Standards and guidelines.
- EDP/Telcom audits.

As computer resources become increasingly accessible to non-MS personnel through advances in distributed and on-line computing technology, methods for controlling MS activity will need to be revised. Investment managers and specialists (analysts, economists etc.) at remote terminals, will bear increasing responsibility for cost/benefit justification of work originating at the terminals.

3.2.2. Computer Hardware

Unit equipment cost of computing, in constant money terms, will drop by a compound annual rate of 10% during the Objectives Period.

Seek ways to improve cost effectiveness with the use of alternative vendor equipment where practical.

3.2.3. Applications and Software

- On-line Applications

  Growing requirements for on-line activities (updating company results, statistical analysis, modelling etc.) will influence new application development.

- Application Software Packages

  The use of in-house developed software versus customized packages will have to be reviewed on the normal basis of cost and utility.

- Information Systems Planning

  Systematic and explicit information systems planning will be increasingly used to define systems with broader, inter-functional applications. This will be especially important where systems involve major development efforts, or offer potential for sharing of common data, or otherwise are large projects of broad scope employing complex technology.

- Standardization

  The complexity of new MS technology will provide added incentives for development groups to apply more structured approaches to the processes of applications planning, analysis design and implementation. These approaches will be characterized by increasing emphasis on standards, controls, guidelines, training and co-ordination.

- Data and Data Bases

  - Data will be increasingly recognized as an important resource requiring professional management and organization to increase its utility and improve the efficiency of its use.
  - Establishment of a formal Data Base Administration function will become increasingly important.
  - Increased emphasis will be placed on the use of Data Dictionaries for more systematic data definition and analysis.
  - Applications will continue to be developed which involve user controlled data capture automatically at the point of origin.
  - Introduction of data base technology will proceed cautiously. Planned new data base applications will be co-ordinated with planned growth of resources. Planning for and development of data base systems will require careful attention during the Objectives Period. New, more structured approaches - characterized by increasing emphasis on standards, controls, guidelines, training and co-ordination - will be applied in planning for and development of data base applications.
  - Integrated Data Base Management Systems (IDMS) and Integrated Data Dictionary (IDD) will be the preferred approach for implementing data base and transaction-orientated systems at the Institutional computer center.

- Applications Development Methodology

  All major applications systems will be developed using the approach specified in the System Development Methodology (SDM) guidelines.

- Operating System

  Conversion from VS-1 to MVS is unlikely to be justified during the earlier part of the Objectives Period.

- Software

  Use of proven, cost effective commercially available systems software will be preferred to in-house development except in those cases where the Institution's investment needs cannot be satisfied by software commercially available.

3.2.4. Data Communications

MS will support data communications needs of the user departments/ functional areas. Data communications will become an increasingly important function in the delivery of computer services. The need for networks linking multiple computers and terminals will increase.

3.2.5. MS Personnel

Increased emphasis will be placed on training and/or hiring of personnel to support new areas of MS technology such as data base, on-line computing, data communications, and distributed processing.

Inter-disciplinary personnel with a knowledge of these skills plus in-depth knowledge of a specialised investment function (e.g. Mining Analysis, Economic Analysis etc.) have a potential major contribution to make to systems development.

3.3. Trends

The following comments highlight some of the developments impacting MS which should be considered when Investment Department and Investment Functions plans and objectives are formulated. The list is not exhaustive and other developments which impact MS should be highlighted in individual functional objectives.

3.3.1. General

- User sophistication and understanding of computers will continue to grow. User staff will increasingly have hands-on knowledge of computers and a better feeling for their adaptability to the business.

  The accessibility of computing power will increase as cheap and powerful means of computing arise. The use of personal computers will increase rapidly. Computer hardware will tend to decrease

as a percentage of the total information processing cost. Personnel costs, both direct and those reflected in the cost of commercially developed software, will become an increasingly larger portion of MS costs.

- The present manpower distribution will change since it is projected that the number of MS data entry and I/O control personnel will decrease as users enter more of their own data. The number of systems programmers will increase due to increased complexity in the software to be used. Manning will be required for the new data base administration function in Institutions utilizing data base techniques. Programming productivity should tend to improve as data base reduces maintenance efforts, and on-line programming increases efficiency.

- More emphasis will be placed on general systems, with organization and methods (O&M) groups emerging to co-ordinate the many facets of Management Sciences beyond computer systems and technology.

3.3.2. Hardware

- Disc Storage

  As a result of increased on-line activities, a large growth is foreseen in on-line disk storage at main computer centers. Influencing this growth will be the continuing trend towards disk rather than tape storage. Vendors will tend to supply fixed rather than removable drives for their smaller computers.

- Mass Storage

  At large centers, the use of mass storage devices may become justifiable during the Objectives Period.

- Terminals

  Terminals with increased capabilities, intelligence and speed will be available. The cost of CRT terminals in constant money terms will decline at a compound annual rate of 10% to 15%.

- Minicomputers

  Minicomputers will continue to be cost effective for some applications and will often be used when they can act as small self-contained computers or communicators with large mainframes.

- Microcomputers

  Microprocessors will be increasingly used in computers and related equipment to make them more cost effective.

3.3.3. On-line Mode of Processing

User direct entry and editing of source data will become more widespread. This will be reflected in faster overall processing of many applications, and increasing demands for this service for diverse types of applications.

The physical and data security problems will grow as this mode of processing increases.

The choice between on-line and distributed computing will continue to be made based on a balance of technological and economic factors.

3.3.4. On-line Programming

As increased low cost CPU capacity becomes available the use of on-line programming will become widespread, and will increase programmer productivity by at least 25%. The average system using this capability should be developed in less time than before.

This feature as well as on-line processing will have a major impact on first shift data center load, and will increasingly be a key determinant of the computer center's equipment requirements. This impact may be partially offset by the use of distributed intelligence for on-line programming.

Users may be involved in on-line programming through the use of languages such as APL or the IBM TSO facility, and this involvement will warrant increased MS attention. User program development may have a major impact on the MS Department in the areas of providing sufficient computer resources, developing guidelines, standards, and procedures for use of these resources, and making provision for future support of user developed systems.

3.3.5. Distributed Computing

Major Institutions will see an increase in the use of distributed computing. This will result in:

- Greater involvement of users in designing and operating computer systems and a greater integration of computers into the daily operational aspects of the business.
- Some reduction in prime shift demand on host computers.
- A need for better procedures to control the proper use of computing resources.

3.3.6. Data Base Management Systems

Data Base Management Systems will usually be used initially in Institutional administrative processing with the longer range objectives of:

- Reducing applications development and maintenance costs.
- Providing a greater availability of data to respond to business queries.

Additional data bases will be developed for other functions, (e.g. Investments) evolving into a co-ordinated data base for an entire Institution. This activity will generate the need for tighter control over data administration and increased skills in systems programming.

3.3.7. Packet Switching Networks

These services which are now available at some locations are expected to expand and further stimulate the use of remote processing. Such networks may improve the economics of off-loading peak service requirements to computers in less congested locations. It could also facilitate computer backup and make it feasible to delay CPU upgrades in special economic or technical situations.

3.3.8. Word Processing/Office of the Future

There will be an accelerating trend toward the automation of traditional office systems, e.g. mail distribution, generation of multiple copies, filing, text editing, etc. The office of the future will incorporate traditional office systems, new office equipment (e.g. word processors) and computer technology.

3.3.9. Security

Emphasis on resources (human, equipment, and data) security will continue. However, special emphasis will be needed for the security of data, with on-line and distributed processing environments.

Risk assessment will play a greater role in allocating security related expenses.

3.4. Guidelines

In preparing the Five-Year Plan, MS will consider the following:

3.4.1. General

- Attention should be called to projects capable of meeting or exceeding the company's return on investment requirements. Costs/benefits analysis should be in accordance with established Institutional financial policy.
- The monetary effects of major planning decisions (major projects, language conversions, reorganizations, additions to communications networks, etc.) should be included in narrative section comments.
- When plan figures of future years depend on results of future studies, use what is considered to be the most likely results from such studies.

- Planning should recognise the advantages of hardware, software and communications compatibility within the Institution and linking with external information centres.
- Objectives, plans, or programs of the Institution's information system, which impact on reciprocal/shared information systems, should be co-ordinated with those units.

3.4.2. Hardware

- Method of Acquisition

For Objectives purposes, i.e. 1980 - 1984, purchase should be the assumed method of acquisition for general and special purpose computers. MS Business objective should provide for the capital required to acquire computer equipment. Rental/lease should be the assumed acquisition mode for peripherals for medium and large computers. These assumed acquisition methods should be used for preparation of objectives data except in those cases where there are specific commitments to another mode or local practice discourages their use. Such cases should be clearly identified.

MS recommendations on the actual acquisition of word processors should suggest rental or short term leasing.

- Capital Budget

The trade-off between lease and rental should be examined to determine if the incentives for leasing are sufficient to offset the advantages of flexibility provided by rental.

Receive general management approval for current year MS capital budget items.

- Residual Values

For plan purposes use the following residual values shown as a percentage of first cost:

Year of Sale	1979	1980	1981	1982	1983	1984
Model No.						
IBM 3031	-	60.	45.	30.	25.	25.

These estimates assum an IBM 3031, announced in 1979 and deliverable in 1981.

For the 370 series, scale the present local sales value in the same ratios as given by the above table. For instance, a 370 computer worth R100 000 in 1979, should be assumed to have a R45 000 sale value in 1981.

- Plug Compatible Equipment

IBM plug compatible equipment can be considered. However, any cost advantage should be evaluated against the managerial, technical and business risk problems of dealing with multiple vendors.

3.4.3. Security

This section covers the current status of computer center security considering the following items:

. Organization Integrity

- Structure
- Personnel
- Procedures and Controls

. Physical Security

- Physical access controls
- Fire protection
- Other pertinent physical hazards

. Software-Data Security

- I/O Controls
- Access Controls
  - Software
  - Hardware
  - Physical

. Contingency Planning

- Off-site Backup
- Alternate Processing Site
- Emergency Plan.

3.4.4. Organization and Methods

To maintain the Management Sciences function as a full service organization, emphasis should be placed on the organization and methods capabilities of MS system efforts in the Plan year.

Following the dictates of the Systems Development Methodology (SDM), the scope of computer projects should be broadened to encompass the total systems aspects of the business problem. In-depth consideration should be given to the before and after procedures supporting the data processing portion of the application.

Additionally, MS project planning should include O & M studies orientated towards clerical workload reduction, paperwork design, form integration, work flow, and to identify and classify the data required for data base(s).

3.4.5. Outline of Narrative

A narrative of the Five-Year Objectives should support data tables. Comments should be concise, to the point, and about 10 to 15 pages in length. Each section should be written in chronological order covering last year actual, current year plan and the five-year objectives period.

4. POSSIBLE FUTURE APPLICATIONS IN THE DATA BASE ENVIRONMENT

- Energy model incorporating non-renewable (oil, coal, uranium) and renewable (solar, wind, wave, hydro-electric, etc.) energy sources.
- National and international economic models.
- Inflation models.
- Total consolidation of individual holdings of Mining Finance Houses in mining investment analysis models.
- Interactive electronic communication between data bases of financial institutions, mining corporations, technical/research consultants, etc.
- Optimising investment portfolios for capital growth and earnings.

CONCLUSION

VIEWED IN TERMS OF THE OBJECTIVES OUTLINED IN THE INTRODUCTION, THE FOLLOWING CONCLUSIONS CAN BE DRAWN:

IDENTIFICATION OF THE PRACTICAL ANALYTICAL AND ADMINISTRATIVE PROBLEMS

INSTITUTIONAL INVESTORS ARE CHARACTERISED BY THEIR VAST INVESTMENT PORTFOLIOS AND STAGGERING DAILY INFLOWS OF NEW INVESTABLE FUNDS. MINING INVESTMENTS CONSTITUTE A LARGE PERCENTAGE OF THESE PORTFOLIOS. INSTITUTIONAL MINING (AND OTHER) INVESTMENT DECISIONS NEED TO BE SUPPORTED BY FORMAL IN-DEPTH FUNDAMENTAL ANALYSES - BUT THIS IDEAL IS NOT CONSISTANTLY ACHIEVED.

THE PROBLEM CAN BE BROADLY IDENTIFIED AS THE INABILITY OF INSTITUTIONS TO THOROUGHLY EVALUATE AND REGULARLY MONITOR THEIR INVESTMENTS. THIS PROBLEM IS PARTICULARLY EVIDENT IN THE ANALYSIS OF MINING COMPANIES, MINING FINANCE HOUSES AND MINING HOLDING COMPANIES.

THIS SITUATION IS PRIMARILY ATTRIBUTABLE TO THE FOLLOWING:

- ANALYSIS BASED ON MANUAL METHODS OF INFORMATION MAINTENANCE, RETRIEVAL AND PROCESSING IS EXTREMELY TEDIOUS AND TIME-CONSUMING. CONSEQUENTLY, THOROUGH AND REGULAR FUNDAMENTAL ANALYSIS IS OFTEN SACRIFICED FOR EXPEDIENT SHORT-CUT METHODS OF DUBIOUS CREDIBILITY.

- COMPLEXITY IS IMPOSED BY THE DIVERSIFICATION OF BUSINESS INTERESTS OF MINING CORPORATIONS. THESE INCLUDE A BROAD SPECTRUM OF METAL/MINERAL VENTURES AS WELL AS MANUFACTURING AND COMMERCIAL INTERESTS.

- INFORMATION, BOTH TECHNICAL AND FINANCIAL, RAPIDLY BECOMES OBSOLETE. PROCESSING OF THE LARGE VOLUMES OF INCOMING DATA (COMPANY ACCOUNTS, NEWS REPORTS, BROKERS REPORTS, PERIODICALS ETC.), WHICH FORM THE BASIS OF THE INFORMATION SYSTEM, IS EXTREMELY TIME-CONSUMING.

- TRADITIONAL INVESTMENT ORGANISATION STRUCTURES INADEQUATELY ACCOMMODATE THE SPECIALISED ANALYTICAL FUNCTIONS AND THE DEVELOPING OFFICE TECHNOLOGY.

- THERE IS INEVITABLY A DEFICIENCY IN ONE OR MORE OF THE FOLLOWING RESOURCES: TIME, MONEY, SKILLS, INFORMATION SYSTEMS AND COMPUTER FACILITIES.

FORMULATION OF THE BROAD FRAMEWORK FOR PROBLEM SOLUTION

THE PROBLEM SOLUTION LIES IN THE FOLLOWING BROAD FRAMEWORK:

- THE INVESTMENT DIVISION MUST ESTABLISH AND MAINTAIN A COMPREHENSIVE (FINANCIAL AND TECHNICAL) AND RELIABLE INVESTMENT INFORMATION SYSTEM (BOTH MANUAL AND COMPUTER BASED) TO SUPPORT ALL ANALYTICAL INVESTMENT FUNCTIONS - INCLUDING MINING ANALYSIS.

- THE INVESTMENT ANALYSIS DEPARTMENT MUST RECRUIT AND DEVELOP MINING ANALYSTS WITH MULTI-DISCIPLINARY PRACTICAL EXPERIENCE AND SKILLS IN: MINING, INVESTMENT AND INFORMATION SYSTEMS/COMPUTERS. THE ROLE OF THE MINING ANALYST IS THAT OF CO-ORDINATOR BETWEEN INVESTMENT MANAGEMENT, THE COMPUTER FACILITY AND THE DIVERSE SOURCES OF MINING INVESTMENT INFORMATION. (SIMILARLY, FOR OTHER SPECIALISED AREAS OF INVESTMENT ANALYSIS EXPERTISE).

- TRADITIONAL INVESTMENT MANAGERS MUST ACCEPT GREATER RATIONALISATION OF RESOURCES I.E. SPECIALISED INVESTMENT FUNCTIONS CO-ORDINATED BOTH WITHIN AND BETWEEN INSTITUTIONS. WHERE FEASIBLE, SPECIALISTS MUST BE DEVELOPED IN-HOUSE; WHERE IMPRACTICAL, CO-OPERATION WITH INSTITUTIONS OF COMPLEMENTARY STRENGTHS MUST BE ENCOURAGED.

- INSTITUTIONAL BOARDS OF DIRECTORS MUST IDENTIFY AND GIVE THEIR ACTIVE SUPPORT TO NEW ANALYTICAL AND ADMINISTRATIVE METHODS BASED ON EVOLVING ELECTRONIC OFFICE TECHNOLOGY.

EXISTING ANALYTICAL AND ADMINISTRATIVE PROCEDURES PRACTISED WITHIN THIS FRAMEWORK

SOPHISTICATED INVESTMENT ANALYSIS REPORTS ARE PRODUCED BY THE LARGE INVESTMENT INSTITUTIONS. THEY PROVIDE THE BASIS FOR DISCUSSION AT INVESTMENT DIVISION MEETINGS PRIOR TO PRESENTATION OF RECOMMENDATIONS TO THE BOARD OF DIRECTORS. THESE TRADITIONAL REPORTS ARE FIRMLY BASED ON HISTORICAL FINANCIAL RATIO ANALYSIS AND EXTRAPOLATION.

THESE TRADITIONAL METHODS ARE OFTEN ERRONEOUSLY APPLIED TO ANALYSIS OF COMPANIES IN THE MINING SECTOR. IN EVALUATING MINING INVESTMENTS, HISTORICAL PERFORMANCE IS OF SECONDARY IMPORTANCE. FUTURE PROSPECTS ARE MORE REALISTICALLY REFLECTED BY TECHNICO-FINANCIAL ANALYSIS, BASED ON THE FUNDAMENTAL (OR INTRINSIC) FACTORS OF THE OREBODY AND THE RELATED MINING AND METALLURGICAL TECHNOLOGY.

INVESTMENT ANALYSIS OF MINING COMPANIES IS FACILITATED BY MINE MODELLING TECHNIQUES. THESE MODELS PERMIT INVESTIGATION OF THE TECHNICO-FINANCIAL ENVIRONMENT OF THE COMPANY UNDER DIFFERENT ASSUMPTIONS AND PERMUTATIONS. PRESENT VALUE (BASED ON DCF) AND PROBABILITY CALCULATIONS ARE AN INTEGRAL PART OF SUCH MODELS.

COMPUTERISED INVESTMENT DATA BASES ARE IN THEIR INFANCY - BUT DO ALLOW LIMITED INTERACTION WITH MINE MODELS. DATA CAPTURE IS STILL A TEDIOUS TIME-CONSUMING CONSTRAINT. DATA BASES TEND TO BE STAND-ALONE WITH LITTLE INTER-DATA BASE (I.E. INTER-INSTITUTIONAL) ELECTRONIC COMMUNICATION.

THE MINING INSTITUTIONS ARE ACTIVELY DEVELOPING MINE MODELS AND TECHNICAL DATA BASES. NON-MINING INSTITUTIONS HAVE AVOIDED THESE AREAS BUT HAVE DEVELOPED DATA BASES WITH EMPHASIS ON STATISTICAL DATA RATHER THAN TECHNICO-FINANCIAL FUNDAMENTALS.

ALL ANALYSES AND REPORTS (IRRESPECTIVE OF TECHNIQUES) ARE DEPENDENT FOR THEIR DATA INPUT ON COMPREHENSIVE AND RELIABLE INFORMATION SYSTEMS. CURRENTLY, EXTENSIVE TRADITIONAL (MANUAL, PAPER) AND MICROFILM FILING

SYSTEMS HAVE BEEN ESTABLISHED BY INSTITUTIONS. HOWEVER, THE STRUCTURE AND CONTENTS USUALLY REFLECT THE IMAGE OF THE INSTITUTION. MINING INSTITUTIONS EMPHASISE MINE TECHNICAL INFORMATION, BUT NEGLECT OVERALL ECONOMIC AND INVESTMENT INFORMATION; NON-MINING INSTITUTIONS VICE VERSA.

GUIDELINES FOR THE DEVELOPMENT OF MORE EFFECTIVE AND EFFICIENT PROCEDURES WITHIN THE CURRENT STATE-OF-THE-ART

FURTHER MAJOR COMPUTERISATION IS POSSIBLE WITHIN THE PRESENT STATE-OF-THE-ART:

- CURRENTLY AVAILABLE MODELLING PACKAGES ARE SUFFICIENTLY SOPHISTICATED AND 'USER-FRIENDLY' TO ENCOURAGE MODELLING (COMMODITY, COMPANY AND SECTOR) ON A BROADER AND MORE AMBITIOUS SCALE - INCLUDING CONSOLIDATIONS.

  WITH EXPERIENCE, MINING ANALYSTS CAN DESIGN A FEW VERSATILE GENERALISED MODELS (E.G. GOLD, BASE METALS) TO EVALUATE THE MAJORITY OF MINES. HOWEVER, MINERAL COMMODITY MODELS (BOTH ECONOMETRIC AND INDUSTRIAL DYNAMIC TYPES) NEED TO BE CONSTRUCTED FOR EACH MAJOR MINERAL.

  CONCURRENT WITH THE ABOVE MODEL DEVELOPMENT, OTHER ANALYSTS MUST DEVELOP MODELS IN THEIR SPECIALISED AREAS:

  ECONOMISTS (FROM INVESTMENT INSTITUTIONS, BANKS AND RESEARCH BUREAUX) MUST DEVELOP ECONOMIC MODELS FOR FORECASTING NATIONAL AND INTERNATIONAL BUSINESS CYCLES, INFLATION TRENDS, INTEREST RATE AND STOCK MARKET TRENDS ETC.

  MINING HOUSES AND GEOLOGICAL/MINING/METALLURGICAL RESEARCH INSTITUTIONS MUST DEVELOP SPECIALISED TECHNICAL MODELS.

  THE INSTITUTIONAL MINING ANALYST MUST HAVE ACCESS (VIA INTERACTIVE DISTRIBUTED DATA PROCESSING NETWORKS) TO SUCH ECONOMIC AND TECHNICAL DATA BASE MODELS.

- SOPHISTICATED DATA BASE AND TELECOMMUNICATION TECHNOLOGY IS CURRENTLY AVAILABLE. HOWEVER, THIS IS A COMPLEX AND RAPIDLY DEVELOPING ENVIRONMENT; AND THE IMPLEMENTATION AND MANAGEMENT OF INTER-DISCIPLINARY INFORMATION SYSTEMS HAS NOT KEPT PACE WITH THE POTENTIAL CREATED BY TECHNOLOGICAL DEVELOPMENTS.

- THE INTEGRATION OF DATA PROCESSING (FOR DATA RETRIEVAL AND MODELLING) AND WORD PROCESSING (FOR REPORT TEXT) FOR DETAILED IN-DEPTH INVESTMENT REPORTS IS CURRENTLY FEASIBLE, BUT IS NOT BEING EFFECTIVELY EMPLOYED AS A TIME-SAVING FACILITY.

FORECAST OF TECHNICAL DEVELOPMENTS OVER THE NEXT DECADE AND THEIR IMPACT ON CURRENT PROCEDURES

REVOLUTIONARY NEW AUTOMATED OFFICE TECHNOLOGY IS ENCROACHING ON ALL ADMINISTRATIVE FUNCTIONS. THE MOTIVATING FORCE IS THE NEED FOR GREATER ADMINISTRATIVE AND MANAGEMENT EFFICIENCY. THE INVESTMENTS OFFICE WILL BE UNAVOIDABLY SWEPT ALONG BY THE MOMENTUM OF THIS CHANGE.

DISTRIBUTED DATA PROCESSING, MINI- AND MICRO-COMPUTERS, AND WORD PROCESSORS ARE THE PRESENT MANIFESTATION OF THIS CHANGE. HOWEVER, IT IS THE INTEGRATION OF THESE INDIVIDUAL ELEMENTS INTO AN EFFECTIVE ELECTRONIC COMMUNICATION ENTITY, AND RELATED MANAGEMENT STRATEGY, THAT CONSTITUTES THE SO-CALLED 'OFFICE OF THE FUTURE' CONCEPT.

CHARACTERISTICS OF THE 'OFFICE OF THE FUTURE' MUST BE IDENTIFIED BY INSTITUTIONAL INVESTMENT MANAGEMENT AND GUIDELINES SET, IF THEY ARE TO REMAIN COMPETITIVE. THIS CONCEPT REPRESENTS A QUANTUM LEAP OF HIGH TECHNOLOGY IN INVESTMENT MANAGEMENT. THIS WILL RADICALLY AFFECT ORGANISATION STRUCTURE, AND THE CREATION OF MANAGEMENT SCIENCES AND TELECOMMUNICATIONS DEPARTMENTS WILL BECOME MANDATORY IN ALL INSTITUTIONS. THEIR RESPONSIBILITIES (IN A STAFF ROLE) WILL BE BROADER THAN THAT OF THE CURRENT COMPUTER DEPARTMENT AND WILL LARGELY SUPERCEDE THE LATTER. MS AND TELCOM PERSONNEL WILL INCLUDE BOTH ULTRA-SPECIALISTS AND GENERALISTS.

ALTHOUGH THIS IS A RAPIDLY DEVELOPING ENVIRONMENT, THE IDEAL OF TOTAL INTEGRATION IS UNLIKELY TO BE FULLY REALISED DURING THE NEXT DECADE. THE MAIN RETARDING FACTORS ARE LIKELY TO BE: SOFTWARE LAGGING BEHIND HARDWARE CAPABILITY; A TIME LAG FOR MULTI-DISCIPLINARY EDUCATION; AND MANAGEMENT RESISTANCE. THEREFORE, DURING THIS TRANSITION PERIOD, CURRENT MANUAL INFORMATION SYSTEMS SHOULD BE MAINTAINED IN A DISCIPLINED MANNER.

RECIPROCAL RELATIONSHIPS MUST BE DEVELOPED BETWEEN INSTITUTIONS (FINANCIAL, INDUSTRIAL AND RESEARCH) TO SUPPLEMENT AREAS DEFICIENT IN SPECIALIST EXPERTISE. THESE RELATIONSHIPS WILL PROVIDE THE BASIS FOR LATER PROMOTING COMMON DATA BASES AND/OR INTER-ACTIVE INTER-CONNECTED SPECIALIST DATA BASES. THIS MANAGEMENT STRATEGY CONFORMS TO THE CAPABILITIES AFFORDED BY THE NEW DISTRIBUTED COMPUTER TECHNOLOGY. IT WILL OPTIMISE INFORMATION RESOURCES (STORAGE, RETRIEVAL AND PROCESSING).

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APPENDICES

INVESTMENT THEORIES AND METHODS FILE

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INVESTMENT ANALYSIS INFORMATION FILING SYSTEM

ECONOMIC AND FINANCIAL AFFAIRS

Filing Code				Category
				International
EIN	-	BAN		International Banking and Credit
	-	CAP		Capital Markets
	-	CMA		Commodity Markets (General)
	-	COM		Comparisons
	-	CUR		Currencies
	-	EUR		Eurodollars
	-	GOL		Gold Price
	-	IFL		Inflation
	-	IMF		International Monetary Fund
	-	INR		Interest Rates
	-	MON		Monetary Affairs
	-	PRO		Profits
				Stock Markets
EIN	-	STM	- AUS	Australia
			- BRO	Brokers Overseas
			- EAS	East African Stock Exchange
			- GEN	General, Comparisons
			- JAP	Japan
			- LON	London
			- OTH	Other
			- RHO	Rhodesia/Zimbabwe
			- USA	U.S.A.
EIN	-	TAX		Taxation
	-	TRA		Trade (World)
				South Africa
ESA	-	BAN		Bantu Homelands and Affairs
	-	BAP		Balance of Payments
	-	BER		Bureau for Economic Research - Reports and Surveys
	-	BOA		Border Areas
	-	BUD		Budget
	-	COA		Coloured Affairs
	-	CON		Consumption
	-	CPM		Capital Market
	-	CPP		Capital Projects
	-	CRE		Credit - H.P. etc.
	-	ECP		Economic Planning
	-	EXC		Exchange Control
	-	ENG		Energy Sources
	-	FIN		Foreign Investment

Filing Code			Category
			South Africa (Cont'd)
ESA	-	FTR	Foreign Trade
	-	GEN	General
	-	INF	Inflation
	-	INR	S.A. - Interest Rates
	-	LAP	Labour
	-	LAW	Law
	-	MON	Monopoly Take-overs and Mergers etc.
	-	MMA	Money Market
	-	NAT	Natural Resources
	-	PBF	Public Finance
	-	SAR	S.A. Reserve Bank
	-	SAV	Saving
	-	TAX	Taxation
			Rhodesia/Zimbabwe
ERH	-	LAB	Labour
	-	SAN	Sanctions
	-	SET	Settlement
EUS	-	GEN	U.S.A.
			E.E.C. Countries
EEC	-	FRA	France
	-	GER	Germany, West
			United Kingdom
	-	UBU	Budget
	-	UCM	Capital Markets
	-	UDE	Devaluation
	-	UGE	General
	-	USV	Savings
	-	UTX	Tax
EJP	-	GEN	Japan
			African
EAF	-	ANG	Angola
	-	BOT	Botswana
	-	KEN	Kenya
	-	LES	Lesotho
	-	MAL	Malagasy
	-	MLW	Malawi
	-	MOZ	Mozambique
	-	OTH	Other African
	-	SWA	S.W. Africa
	-	SWZ	Swaziland
	-	ZAM	Zambia

Filing Code			Category
			Miscellaneous
EMS	-	AUS	Australia
	-	IOI	Indian Ocean Islands
	-	NZD	New Zealand
	-	NEE	Non-EEC Countries of Europe
	-	OTH	Others

INVESTMENTS

South Africa (No Prefix)

			Agriculture (Including Agricultural Commodities)
AGR			Agriculture
AGR	-	COP	- Co-ops
	-	LAB	- Labour
	-	MAR	- Marketing
AGC			Agricultural Commodities
AGC	-	COC	- Cocoa
	-	COF	- Coffee
	-	COT	- Cotton
	-	FRU	- Fruit
	-	GRM	- Grains: Maize
	-	GRW	- : Wheat
	-	MEA	- Meat
	-	RUB	- Rubber
	-	SUG	- Sugar
	-	TEA	- Tea
	-	VEG	- Vegetables
	-	WOL	- Wool
			Financial
FBA			Banking
FBA	-	COM	- Commercial
		FOR	- Foreign Banking
		HPU	- Hire Purchase
		LEG	- Legislation
		MER	- Merchant
FBS			Building Societies
FBS	-	FOR	Building Societies - Foreign
	-	LEG	- Legislation
FIN			Insurance
FIN	-	LEG	- Legislation
	-	LIF	- Life
	-	SHT	- Short Term
FIT			Investment Trusts
FLA			Local Authorities
FLS			Leasing
FPF			Pension Funds

Filing Code			Category
			Property
FPR	-	GEN	Property
	-	LEG	Property Legislation
	-	PTR	Property Trusts
	-	TDE	Township Development
	-	PUT	Property Unit Trusts
			Industrial
IBG			Building
IBG	-	BRI	- Bricks
	-	CEM	- Cement
	-	COM	- Commercial
	-	HVY	- Heavy Construction
	-	HSE	- Housing, Homes
	-	IND	- Industrial
	-	MET	- Methods
IBV			Beverages
IBV	-	BEE	- Beer
	-	SOF	- Soft Drinks
	-	SPI	- Spirits
	-	WIN	- Wine
ICH			Chemicals
ICH	-	EXP	- Explosives
	-	FER	- Fertilisers
	-	PNT	- Paints
	-	PTS	- Plastics
ICL			Clothing
ICL	-	KNT	- Knitwear
	-	TCP	- Textiles - Carpets
	-	TEX	- Textiles - General
	-	TSF	- Textiles - Synthetic Fabrics
IFL			Electrical
IFL	-	LIG	- Lighting
IEC			Electronics
IEC	-	RTV	- Radio and T.V.
	-	COM	- Computers
	-	TLC	- Telecommunications
IEN			Engineering
IEN	-	CIV	- Civil and Mechanical
	-	MET	- Metal Products
	-	SHI	- Ship building

Filing Code			Category
IFS			Fishing
IFS	-	CRA	- Crawfish
	-	GEN	- General
	-	ISO	- Inshore (SA)
	-	OFS	- Offshore (SA)
	-	PRO	- Processing and Factory Ships
	-	SWA	- South West Africa
IFD			Food
IFD	-	DPR	- Diary Products
	-	MEP	- Meat Processing
	-	MIL	- Milling
	-	PLP	- Poultry Processing
IFT			Footwear
IFU			Furniture
IFU	-	MFG	- Manufacturing
	-	RET	- Retailing
ILE			Leisure
IMO			Motors
IMO	-	ASS	- Assembly
	-	COV	- Commercial Vehicles
	-	COM	- Components
	-	DIS	- Distributors' and Sales
	-	LOC	- Local Content Programme
	-	TYR	- Tyres
IPK			Packaging
IPK	-	CAN	- Cans
	-	GLA	- Glass
	-	PAP	- Paper
	-	PLA	- Plastic
IPP			Paper and Pulp
IPP	-	TIM	- Timber
IPH			Pharmaceutical
IPH	-	DIS	- Distribution
	-	MFG	- Manufacturing
IPG			Printing and Publishing
IPG	-	PRI	- Printers
	-	PRS	- Printer's Supplies
	-	PUB	- Publishing
IRS			Retailing and Stores
IRS	-	DEP	- Department Stores
	-	SUP	- Supermarkets

Filing Code			Category
ITB			Tobacco and Match
ITB	-	CIG	- Cigarettes
	-	MAT	- Matches
ITM			Tourism
ITM	-	HOT	- Hotels
ITR			Transport
ITR	-	AIR	- Air
	-	RAD	- Road
	-	RLY	- Railways
	-	SEA	- Sea
			Metals and Minerals

(Excluded from Appendix - See Details in Section 5.3.2.2.)

			Unit Trust - (In-House)
UNO	-	ADM	Administrative Procedures
	-	BRO	Brokers - Dealings
	-	CMM	Committee Decisions and Minutes
	-	DIV	Dividend Analysis
	-	FOR	Formation
	-	INL	Investments - Largest
	-	INP	Investments Philosophy
	-	PAN	Portfolio Analysis
	-	PME	Portfolios - Month-end
	-	PRS	Purchases and Sales
	-	SAM	Sales Managers
	-	SDN	Share Dealing and Negotiation
			Unit Trusts, General
UNG	-	CPO	Comparisons - Portfolios
	-	CPR	Comparisons - Prime Movements
	-	CPS	Comparisons - Sectors
	-	CPG	Comparisons - Graphs
	-	IGO	Intergrow
	-	GDB	Guardbank
	-	NGF	NGF
	-	OMT	Old Mutual
	-	OSF	Off-Shore Funds, etc.
	-	PRC	Press Comments
	-	STS	S.A.T.S.
	-	SGE	SAGE
	-	SLM	Sanlamtrust
	-	STM	Santam
	-	TAX	Tax, State Aid, Foreign Investment
	-	UAL	UAL
	-	UKU	U.K. Unit Trusts
	-	USM	U.S. Mutual Funds

Filing Code			Category
			Johannesburg Stock Exchange
JBS			Bear Sales
JAC			Companies Act
JCA			Company Analysis
JCP			Commentaries and Performance History
JRR			Rules and Regulations
JPI			Share Price Indices
JSA			Stock Exchange Control Act
JEC			Stock Exchange Enquiry Commission
JSE			History, Methods, Investing
JTC			Top Company Comparisons and Surveys
JTA			Transactions Analysis
			Fixed Interest Securities
FIS	-	DEB	Debentures
FIS	-	FDH	Discount House of S.A.
	-	FGE	Gilt-edge Valuation
	-	FIG	Index of S.A. and Foreign Gilts and Semi-Gilts
	-	FSJ	Stock Prices/Jobbers List
Rhodesia/Zimbabwe (No Prefix)			
IRH	-	AGR	Agriculture
	-	BEV	Beverages
	-	BUD	Budget
	-	BUI	Building Societies
	-	CFT	Clothing, Textiles, Footwear
	-	EIS	Engineering, Iron and Steel
	-	FIN	Finance
	-	GEN	General
	-	MIN	Mining
	-	PRP	Printing - Paper
	-	RET	Retailers - Furniture - Stores
	-	TOB	Tobacco
ADMINISTRATION			
			Subscriptions and Services
SAS	-	BKF	Brokfin (Pty) Limited
	-	BRA	Bureau of Financial Analysis
	-	BTB	Business Times Barometer
	-	COM	Comptec
	-	EIU	Economist Intelligence Unit
	-	ESE	ESE Computrend
	-	FIA	Financial Analysis (Pty) Ltd.
	-	FMA	FM Share Assessment
	-	FMS	FM Card Service
	-	GSB	Graduate School of Business U.C.T.
	-	IAS	Investments Analysts Society of S.A.

Filing Code			Category
			Subscriptions and Services (Cont'd)
SAS	-	MAM	Madsen, Antelene and Matthews
	-	MID	Market Indicators Digest
	-	MIS	Miscellaneous
	-	MIX	Micrographix (Cape)(Pty) Ltd.
	-	MOO	Moodies
	-	NAM	Naamsa Statistics
	-	NCA	National Council of C.A.'s
	-	PET	Performance Equity Trust
	-	REU	Reuters - Ticker
	-	SID	Services to Inter-Departments
	-	STM	Stockmaster
	-	SRV	Subscriptions and Services
	-	TRL	Trendline
	-	UAL	UAL - Guide to the Economy
	-	WSJ	Wall Street Journal

PUBLICATIONS SUPPORTING INVESTMENT ANALYSIS

NOTES

Frequency:

D	-	Daily
W	-	Weekly
F	-	Fortnightly
M	-	Monthly
2M	-	Every 2 months
Q	-	Quarterly
4M	-	Every 4 months
H	-	Half-yearly
Y	-	Yearly
I	-	Irregular
5,6 etc.	-	Times per year

Retention:

R	-	Immediate Retention
LR	-	Retention after circulation
B	-	Binding

PUBLICATION	CODING
Accountant	W
AMP Economic Bulletin	I
AMP Economists Info. Circular	I
The Banker	M
Barclays Bank	
- Economic Survey	I
- Overseas Survey	Y
- Review	Q
- Trade Review	M
Beermans Financial Year Book	Y R
Bureau of Census and Statistics	I
Bureau Economic Research Building Survey	
Chamber of Mines Journal (Rhodesia)	M
Chartered Secretary (S.A.)	M
Discount House of South Africa	W R
National Institute Economic Review	Q
Economic and Financial Review (UAL)	Q R
Economic Journal	Q
Economic Spotlight (Volkskas)	M R
Economic Survey - Rhodesia	Y R
Economic Trends	M
Economist	W R
Euromoney	M
Finance and Development	Q
Financial Analysts Journal	Q R
Financial Mail (3 Copies)	W R
Financial Times	D R

PUBLICATION	CODING
First National City Bank Monthly Economic Letter	M R
Foreign Trade Statistics (SA)	M R
Fortune	M
Harvard Business Review	M
International Currency Review	6
International Financial Statistics	Q
Journal of Finanace	5
Journal of Business	5
Journal of Institute of Act.	
JSE	
- Official List (Monthly Bulletin)	M R
- Quarterly Statistics	Q R
- Rules and Amendments	I R
Lloyds Bank Review	Q
London and Dominion Trust	M R
Management	M
Midland Bank Review	Q
Minerals	Q R
Mining Journal	Q R
Mining Journal	WYR
Mining Magazine	M R
Mining Survey	I R
Monthly Digests of Statistics (Rhodesia)	M
Monthly Bulletin of Key Economic Indications (Malawi)	M
Moodies Investment Handbook	Y R
Moorgate and Wall Street	I
Morgan Guaranty Survey	M
NAAMSA Sales Returns	M
Economic Bulletin - Netherlands Bank	M R
Optima	Q
Property and Building	M
S.A. Journal of Econ.	Q
Rhodesia Financial Gazette	
S.A. Banker	Q
S.A. Banking Magazine	M
S.A. Chartered Accountant	M
S.A. Financial Gazette	
S.A. Mining and Engineering Journal	M
S.A. Reserve Bank - All Publications	W, M, Q, Y, R
S.A. Sugar Association Monthly Report	M R
S.A. Sugar Journal	M
Standard Bank Review	M
Statistical Bulletin and News Releases	Q
Three Banks Review	Q
University of Stellenbosch	
- Opinie Opname	Q
- Economic Surveys	I
Volkshandel	M
Volkskas Newsletter	M
Economic Spotlight	M
Westminster Bank Review	Q
World Metal Statistics	M R

PUBLICATIONS RECEIVED DIRECT	CODING
Hill Samuel Quarterly Reports	
London & Dominion Trust Limited - Monthly Bulletins	
Barclays Quarterly Reviews	
Moodies Investments Handbooks	
Focus on Key Economic Issues - From Mercabank Bank	Q
Netherlands Bank of S.A. Economic Round-up - Monthly	
Economic Spotlight from Volkskas Limited	
U.A.L. Economic and Financial Review - Monthly	

GOLD MINE TAXATION

General Principles

There are two general principles governing the taxation of South African gold mines: the first is that the right of mining and ultimately selling gold belongs to the State, and the second is that because a mine is a wasting asset an amortisation allowance is given to mining companies.

If gold is found on private land the owner of the mineral rights (who may not be the same person as the land owner) is allowed to select one quarter of the area to mine himself, and the right to mine the rest is vested in the State which usually leases the ground in return for an annual fee. The area with private mining rights is called the 'Mynpacht Area'. A small rental, called a Claim Licence, is paid to the State in return for the right to occupy the surface area, and half of this rental is paid back by the State to the landowner for loss of use of the surface ground.

The principle of the amortisation allowance is that gold mining companies are allowed in varying ways to set off their capital expenditure against profits; the way in which this is done depends on when the mine was established. The older mines are allowed to write off 27,5% per annum of their unredeemed balance of capital expenditure. For the newer mines capital expenditure is treated as a working cost for tax purposes and losses are carried forward until exceeded by cumulative profits. This means that no tax will be paid in the early years of a mine's life. In the case of the most recent mines there is, in addition to the amortisation allowance, a special allowance of 6% of the unredeemed balance of capital expenditure.

Payments to the State take the form of a lease payment and income tax, in addition there is a 5% surcharge and a 5% returnable loan levied on the income tax. Dividends from gold mines, when paid to non-residents, are subject to a 15% withholding tax which is allowed against United Kingdom tax, for example.

Mines which are in danger of closing down within eight years may be eligible for state assistance. The rise in the price of gold in recent years has diminished the importance of such assistance.

Lease Payment

Where a mining company is leasing the area from the State (which is the case for practically all mines) the fee payable is determined by a lease formula, details of which vary from mine to mine and are agreed with the Government Mining Engineer, who takes into account such factors as the structure and grade of the reef and whether or not a Mynpacht Area is included in the claim area. The formula is:

$$Y = A - \frac{B}{X}$$

Where: Y = % Of working profit, less amortisation allowance and capital allowance, payable as a fee.

X = Working profit, less amortisation allowance, expressed as a percentage of revenue.

A & B Are constants which differ from mine to mine.

(The capital allowance is equal to 5% of any unredeemed capital brought forward, plus approximately 2,3% of the current year's capital expenditure. In most cases the capital allowance represents a relatively small amount).

For some mines there is a minimum value for Y, and in the case of some of the older mines there is an off-set clause which in effect reduces the upper limit of Y.

Income Tax

Income tax is assessed in a very similar way to the lease payment. A formula of exactly the same type is used but X and Y are slightly differently defined.

Y = % Of working profit, less amortisation allowance less lease payment, payable as income tax.

X = Working profit, less amortisation allowance less lease payment, expressed as a percentage of revenue.

Thus it can be seen that the lease payment is allowed as a cost for income tax purposes, and that in calculating the value of X for the lease payment, the capital allowance is taken into account, whereas it is not taken into account when X is calculated for income tax.

Tax Rates

The values of the constants A & B in the lease payment formula differ from mine to mine, but in the case of the income tax formula there are only three sets of values which are as follows:

New Mines: $Y = 60 - \frac{480}{X}$

State Assisted Mines: $Y = 68 - \frac{601}{X}$

All Other Mines: $Y = 60 - \frac{360}{X}$

Implications of the Tax/Lease Payment Formula

Inspection of the formula shows that the proportion of profits paid as tax and lease payment will be zero or very low when capital expenditure is high, and that it will be lower for mines with low profitability than for those with high profitability. The objects are to keep down the initial capital

requirements and to encourage mining operations where the ore grade is low and where the working costs are high. The state policy is to mine as much of the gold in the reefs as possible and this policy is implicit in the taxation arrangements.

The lease and tax formulae can be re-arranged in such a way as to be more meaningful in terms of seeing what proportion of working profits, as opposed to taxable profits, is taken up in payments. To illustrate this we can take the third formula, which is applicable to most of the mines.

If we let: Pt = Taxable Profit for Income Tax
R = Revenue

then, $Y = 60 - \frac{360\ R}{100\ Pt} = 60\ (1 - \frac{6\ R}{100\ Pt})$

and the amount of income tax payable is:

$$Pt.\ \frac{Y}{100} = \frac{60\ Pt}{100}\ (1 - \frac{6\ R}{100\ Pt})$$

i.e. $Tax = 60\%\ (Pt - 6\%R)$ ---------- (1)

Let: L = Lease Payment
A = Amortisation Allowance
Pw = Working Profit

then, $Pt = Pw - L - A$

Substituting this in equation (1) we get:

$$Tax = 60\%\ (Pw - L - A - 6\%\ R)$$

So the total tax plus lease payment will be:

$$\begin{aligned} Tax + Lease &= 60\%\ (Pw - L - 6\%\ R) + L \\ &= 60\%\ (Pw - A - 6\%\ R) - 0{,}6L + L \\ &= 60\%\ (Pw - A - 6\%\ R) + 40\%\ L \end{aligned}$$ ---------- (2)

The final step is to express the lease payment in terms of working profit, amortisation allowance and revenue, so that the whole tax plus lease can be expressed in these terms. The problem here is that, as mentioned before, the constants A & B differ from mine to mine. However, typical of the newer mines are values of 15 and 90 respectively. If the capital allowance (which is relatively small) is ignored, we can arrive at the equivalent of equation (1).

Let: Pl = Taxable Profit for Lease Payment

then, L = 15% (Pl - 6%R)

and since, Pl = Pw - A

then, L = 15% (Pw - A - 6% R)

thus 40% L = 6% (Pw - A - 6% R)

and putting this into equation (2) we get:

$$\text{Tax} + \text{Lease} = 66\% \ (Pw - A - 6\% \ R) \qquad \text{--------} \quad (3)$$

From this equation we see that there is no payment if the amortisation allowance plus 6% of revenue is greater than the profit, and the maximum payment (where there is no amortisation allowance) will be equal to 66% of working profits less 3,96% of revenue. On average the working profit for the newer mines is about 50% of the revenue, which means that the maximum tax rate will work out at about 58% of profits.

COMMENTARY SUPPLEMENTING RELATIVE VALUE INDEX FOR GOLD MINES

(Supplementing R.V.I. of 15.11.1973 - Figure C19)

State Assisted Mines:

The three state aided mines appear to be fully priced with E.R.P.M. the safer of the three for those who believe in a gold price increasing at a steady, say 5% growth rate. Loraine is the better investment for those prepared to gamble on the gold price increasing to $150 and more over the next few years. All these shares have a dangerous downside potential should the gold price remain at or below $100 per ounce for several years when state assistance might be withdrawn.

Short Life Mines (Capital Repayments):

At present Leslie at current prices is the most attractive with a break up value the order of 36c and with potential earnings this year of 24/25c (of which 11,5c has been paid), and potential earnings next year of 12,18c at $80 to $100. Downside potential over the remaining 3 to 4 years would not be great. At 80-85c the share has a speculative appeal for a gold price increasing above $100 over the next 4 years.

Short Life Mines:

On estimates Bracken is the better share in this group. The estimate does not include earnings from uranium, since the benefits from this bi-product may come too late. It would be difficult to estimate the cost of opening the Stilfontein Uranium Plant to the revenue to be derived from treatment in the plant. The uranium bearing slimes dumps of both Welkom and Stilfontein are both major unknown assets, and as such Bracken and Stilfontein could be treated more on a par.

Medium Life Mines:

Uranium has been included in the earnings for all medium and long life 'U' producers, based on $7 in 1978 rising to $10 per lb in 1980. 'U' costs have been escalated at 6% p.a. In this category Libanon, Blyvoor and Western Holdings are better counters, with a little more security in the latter and little more speculative glitter in the former. These three shares at current prices are amongst the best shares for those who remain confident in gold shares.

Long Life Mines:

President Brand and St. Helena are both sound investments with President Steyn and Buffelsfontein both switch sales. Doornfontein's future largely lies in the hands of management and the probability that the company will mine low grade Main Reef, as and when the gold price improves, to extend the life of the mine and thus taking the gilt off earnings at a high gold price.

Long Life New Mines:

Within this group are South Vaal, Kloof, East Driefontein and Western Deep Levels. All mines have potential reserves of well over 20 years with the proviso that the gold price does not remain fixed at the lower levels.

Western Deep Levels, at current share prices has the higher rating. Estimates on this mine take in the probability of increased milling rate in the 1980s (as Blyvoor grinds to a halt) through the use of Blyvoor's mill. Kloof could increase it's rating if the development, on the new lower levels, comes up to expectations with a resultant increase in grade.

Conclusions:

Some 30 mines are included in this study. For those who see gold rising to $175 over the next 7 to 8 years a relative gold price of $150 should be used. With gold at $90 those who wish to be in gold shares should currently select their shares from the $100 scale and switch into the following group.

ESTIMATED DISTRIBUTABLE EARNINGS 1974 (CENTS/SHARE)

Mine	Price(c) @	$80	$100	$120	$150	Life
Bracken	208	23	33	43	55	Short
Blyvoor	660	45	65	85	110	Medium
Libanon	990	43	70	100	140	Medium
Pres. Brand	1500	98	138	188	250	Long
St. Helena	1825	120	160	200	275	Long
Western Deep Levels	1400	75	110	144	190	Very Long

Western Holdings though one of the best shares is a little unmarketable, while Leslie is a short term gamble.

ADJUSTMENT OF PRICES AND EARNINGS (AND OTHER DATA) PER SHARE

Adjust past share prices, past earnings (and other figures) per share in the event of a rights or other issue. It is recognised that in applying the recommended formula certain anomalies appear to arise when adjusting past earnings per share figures.

1. Adjustment of Prices

All past share prices recorded before an issue in which the original shares had a negotiable right should be adjusted by multiplying these prices by an adjustment factor, calculated for the issue in question as set out below.

As there will be a factor for every issue, historic per share information will be adjusted by multiplying each figure by a compound factor which is the product of all the factors arising from the individual issues in question.

The rules to be followed in calculating the factor of adjustment are as follows:

The General Rule.

The factor that is to be used for adjusting past prices should always be calculated according to the so-called 'theoretical method', where the factor is defined as the theoretical price of the share ex-rights dividend by the last market price cum-rights.

In mathematical terms

Let N_a = Number of Shares before the Issue
N_p = Number of Shares after the Issue
P = Last Market Price before the Issue
P' = Theoretical Price Ex-Rights of an Old Share
E = Price of Issue of a New Share
Δ = Difference in Dividend between an Old share and a New Share (where such a difference exists).

The factor of adjustment will then be:

$$f = \frac{P'}{P}$$

where

$$P' = \frac{N_a P + (N_p - N_a)(E + \Delta)}{N_p}$$

In the case of a capitalisation issue or share split with the new shares entitled to the full dividend, the formula is:

$$f = \frac{N_a}{N_p}$$

If the issue is made at the full market price, the formula becomes:

$$f = 1$$

Even in a case where the rights are offered in shares other than the original shares, the theoretical method should be used in cases where the market price of the shares offered is known. In cases where the value of the new shares is unknown until they are actually quoted after the issue has taken place, it will, exceptionally, be necessary to use the 'practical' method of defining the adjustment factor, as the ratio of the ex-rights price of the existing shares to the sum of that price and the price of the right to the new shares. Various influences may affect market prices on the day after the issue, hence the theoretical method is preferred wherever it can be used.

2. Adjustment of Earnings (and Other Profits Figures) Per Share

Where a rights issue is made during the year under review, the earnings per share for the previous and earlier years will need to be adjusted. (The problems here discussed also apply to other profits figures expressed on a per share basis).

The most common practice is to use the same figure for the adjustment of past earnings per share as for past prices; and to use the method discussed in (1) above. The same factor is also applied in calculting the number of share to be used in determining the earnings per share in the year under review.

There is, however, a contrary school of thought: Some analysts argue for a factor to be used when adjusting earnings per share which is not always coincident with the one used for the adjustment of prices. (They also argue that there is no need to adjust earnings per share figures in the year in which the rights issue is made). This approach is based on the fact that the (very common) use of the same factor as is used for the adjustment of prices may lead to some very odd results in certain circumstances; for example, when there are two or more issues in the same year.

Nevertheless, taking into account the fact that the usual method gives acceptable results in most cases, it is recommended that:

- The factor of adjustment should be that calculated in (1) above i.e. as for past prices.
- Earnings per share (and other profits figures per share) for the year previous to the issue, and for all earlier years, should be adjusted by multiplying these figures by the factor as defined.

. In calculating the earnings per share (and other profits per share figures) for the year in which the rights issue is made, it will be necessary to calculate the weighted average number of shares by taking the proportion (according to the amount of the year elapsed) of shares in issue before the rights issue, applying to this figure the appropriate adjustment factor for the issue; and adding the proportion by time of shares in issue after the rights.

When there is a significant delay between the date of issue and the date of dividend rights for the new shares, it is desirable to calculate two different figures per share, one of them weighting the number of shares according to the date of dividend rights, and the other according to the date of issue. The second figure will show the dilution which otherwise will not be seen, because of the decision of corporate management relating to dividends.

It will also be desirable to calculate another figure, 'fully diluted earnings per share', by dividing total earnings by the number of shares in issue at the end of the year.

DETAILED REPORT - MINING FINANCE HOUSE (S.A. MERGER)

CONTINENTAL RESOURCES INVESTMENT CORPORATION (CRIC)

INVESTMENTS ANALYSIS

L.D.R. Interim Dividend: 06.09.1974 (90c)

L.D.R. Final Dividend: 22.03.1974 (70c)

GENERAL MINING AND FINANCE CORPORATION

1. Directors

W.B. Coetzer (Chairman); Dr. W.J. de Villiers (M.D.); W.G. Boustred; H.N. Hart; S.A. Hofmeyr; C.J.F. Human; J. Ogilvie Thompson; H.F. Oppenheimer; Dr. P.E. Rousseau; P.J.F. Scholtz; A.W.S. Schumann; J. Scott; Dr. A.D. Wassenaar; Dr. F.A. Zoellner.

2. CRIC Group's Holding as at 31.12.1974

Type of Shares Ordinary	Number of Shares	Current Price	Total Market Value	Percentage of Issued Equity
Institution	140 600			2,7
Pension Fund	200			-
Fund X	7 300			0,1
Fund Y	37 243			0,7
	185 343	3 000c	R 5 560 290	3,6

3. Capital and Reserves of the Company (R000s)

Authorised (000s)			Issued (000s)	R (000s)
5 500	R2	Ordinary Shares	5 186	10 372
		Capital Reserve		45 598
		Revenue Reserve		36 632
500	R2	6% Cum. Pref. Shares		500
				93 102

4. Statistics (Year to December 31st)

		1969	1970	1971	1972	1973	Forecast 1974
No. of Shares in Issue	(000s)	5000	5180	5180	5184	5186	
Investment Income Per Share	(c)	101,0	112,0	126,6	136,3	203,2	
Net Interest Income Rec./Paid	(c)	-10,9	-17,5	-25,9	-13,6	-23,6	
Realisations Per Share	(c)	27,6	31,1	53,8	21,5	24,9	
Township Profit Per Share	(c)	-	-	7,9	22,6	31,5	
Write-offs Per Share	(c)	23,9	37,3	70,3	34,7	48,5	

			1969	1970	1971	1972	1973	Forecast 1974
x	Company E.p.s. Adjusted	(c)	86,6	81,4	104,2	152,1	190,2	
tx	Adjusted Consolidated E.p.s.	(c)	119,8	150,0	113,5	259,0	264,5	
t	Declared Consolidated E.p.s.	(c)	127	144	159	194	277	383
	Dividend Per Share	(c)	75	80	85	90	120	210
t	Net Asset Value (Market Value)	(c)	2103	1829	1857	2749	4277	
	(Book Value)	(c)	1355	1405	1481	1596	1786	
t	Liquidity	(:1)	1,1	1,3	1,3	1,2	1,2	
t	Quick Assets	(:1)	0,7	0,7	0,8	0,9	0,8	
	Investments Income Growth (5 Years)	(%)				+2	+10,5	
	Adjusted Company E.p.s. Growth (5 Years)						+ 8	
t	Adjusted Consolidated E.p.s. Growth (5 Years)	(%)					+17	
	Dividend Growth (5 Years)	(%)	+1	+3	+4	+6	+11	+23
	Price : High	(c)	2550	1775	1760	2425	2800	4100
	Low	(c)	1250	1190	1280	1600	1950	2450
	Volume (Monthly)	(000s)	19	12	14	11	15	12

x Excluding profit on realisation of investments and before deducting amounts written off.

t Figures arrived at using consolidated accounts.

5. Asset Structure (Consolidated)

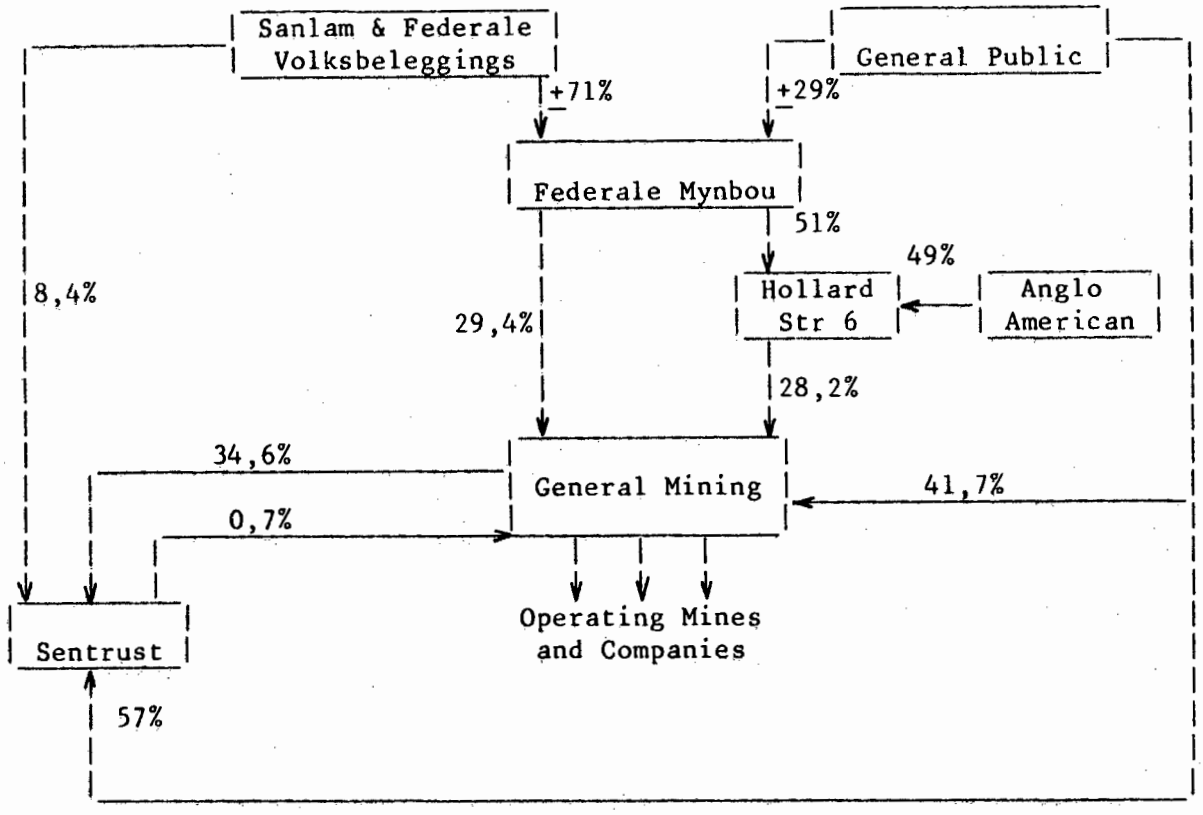
		1969	1970	1971	1972	1973	Forecast 1974 Ø
Ordinary Shareholders	(%)	56	48	44	41	40	33(37)
Total Shareholders	(%)	61	61	59	53	53	43(46)
Long Term Liabilities	(%)	12	13	13	15	12	28(26)
Current Liabilities	(%)	27	26	28	32	35	29(28)
Total Funds	(Rm)	120,3	151,6	173,2	202,7	229,4	307(327)
Quoted Investments (B/V)	(%)	40	31	27	27	26	39(36)
Unquoted Investments (Directors Value)	(%)	12	11	6	4	4	3(3)
Land and Buildings	(%)	6	11	12	11	10	(
Mining Assets, Plant and Equip.	(%)	12	15	17	20	19	(23(22)
Current Assets	(%)	30	32	38	38	41	35(39)

Ø After proposed rights issue.

6. Nature of Business

A major holding and finance corporation, whose consolidated gross assets approximate R430 million. It is a subsidiary of Federale Mynbou. Whilst being predominantly gold orientated, General Mining is also the major producer of power station coal, chrome, fluorspar and asbestos in South Africa, besides being one of the country's principal producers of uranium. The group also has certain industrial (oil, petrol, chemicals, steel, engineering) and commercial interests.

7. Group Structure



8. Size of General Mining Relative to Other S.A. Mining Houses

The respective market capitalisations in July 1974, before the distortions set up by the various offers for Union Corporation, approximated the following:

	R Million
Anglo American	700
GFSA	630
Barlow Rand	340
Union Corp	250
JCI	175
General Mining	175
Anglovaal	60

However, cross-holdings and industrial activities of all the groups make this order of size somewhat irrelevant in the strictly mining context. Furthermore, the relationship between net assets and market value varies significantly.

9. The Genmin Operating Structure

The following schedule illustrates the scope and relative significance of Genmin's activities; the 1973 income allocation has been derived from the accounts, the 1974 allocation has been estimated from various sources. The valuation basis is comparable to that applied to the buying list.

Income Source	Contribution to Total Earnings 1973	1974	Valuation Basis	Valuation R(000)
Gold - Dividend Income (1)	5 047	8 150	12,0% D.Y.	67 900
- After Tax Profits (2)	664	1 800	20,0% E.Y.	9 000
Mining Finance - Sentrust	739	1 592	8,0% D.Y.	19 900
- Other (3)	660	1 160	6,5% D.Y.	17 800
Coal - Dividend Income	1 385	1 388	8,5% D.Y.	16 300
- After Tax Profits (4)	579	600	25,0% E.Y.	2 400
Platinum - Dividend Income	1 027	1 198	(A)	5 300
Industrial - Dividend Income	1 333	1 600	10,0% D.Y.	16 000
- After Tax Profits (5)	3 907	(4 000)	25,0% E.Y.	15 600
Townships - Net Sales	2 093	(2 000)	(B)	8 000
Metals and Minerals				
- Dividend Income	132	170	15,0% D.Y.	1 100
- After Tax Profits	611	(600)	25,0% E.Y.	2 400
	18 177	24 258		181 700
Less: Amortizations and Write-Offs, less Profit on Realisations	920	1 300	15,0%	8 700
Exploration Costs	1 455	1 500	N/A	-
Other Expenses	1 350	1 600	15,0%	10 700
	14 382	19 858		162 300
E.p.s.	277c	383c		3 130 c.p.s.
D.p.s.	120c	210c		
x Covered	2,30	1,82		
			Assuming 2x cover at 80% =	2 500 c.p.s.

(A) Heavy dividend cuts likely in 1975; valued at 15% D.Y. on average projected dividend income of R800 000.

(B) No meaningful information available, very tentatively valued at 4 x 1973 earnings.

(1) Stilfontein and Buffels contribute an estimated ± 50%, the balance from numerous smaller holdings. The valuation rate is a composite rate and includes, e.g. 18% D.Y. for Stilfontein, 11% D.Y. for Buffels, etc.

(2) Barberton Mines.

(3) Included GFSA, S.A. holding of 1 million Union Corp. shares included in 1974.

(4) Afrikander Props.

(5) Primarily Hall Longmore, Sandock-Austral, and Superocla. No basis for 1974 projections, valued on 1973 earnings.

The Impact of the Union Corporation Purchase

The above schedule, and valuation, ignores the impact of the Union Corporation acquisition. This impact, we believe, should be assessed as to:

(1) The impact on the balance sheet.

(2) The short term impact on the P & L Account.

(3) The longer term investment implications.

(4) The repayment of the $85 million loan.

As background to a discussion of these aspects it should be noted that a relatively small amount of buying of Unicorp (less than 1 million shares) took place in Johannesburg, and that this was by and large financed by the disposal of GSFA shares from Genmin's own portfolio. The bulk of Genmin's purchasing, namely 12,7 million out of its total holding of about 13,9 million Unicorp shares was in London at a total cost of $85 million (i.e. an average of $6,70 per share). This amount was raised in the Euro-dollar market at a rate equal to the London inter-bank rate plus 1,75%. The loan is on a roll-over basis (apparently 3 monthly) and the facility will be available for a period of 5 years with repayments scheduled for the last 2 years. We have been told by Genmin that apart from the switch operations in Johannesburg, basically no portfolio realisations have taken place to finance the Unicorp buying. Hence it may be assumed that Genmin is prepared to live for a while with the full loan facility of $85 million.

(1) The Impact on the Balance Sheet

Section 5., 'Asset Structure', illustrated the approximate position anticipated for 31.12.1974. The proposed rights issue of 12 for 100 at R32 will raise an additional R20 million, the effect of which is illustrated by the figures in brackets. In summary, it can be seen that while the proposed rights issue will reduce the impact of the heavy borrowings, the trend towards an increased reliance on external financing continues.

It should be further noted that the future R cost of repaying the $85 Eurodollar will depend on the blocked rand discount at the time of repayment; assuming the current 24% discount applies, locally held securities to the value of R75 million (rather than the apparent R57 million) would have to be sold. Applying R75 million to the balance sheet structure, post rights issue ordinary shareholders' interest would fall to 35%. (It should be noted that all assets are at book values, which included quoted shares at R60 million with an estimated market value of some R200 million - applying this 'excess' of R140 million to shareholders funds would very significantly reduce the gearing to a 55% ordinary shareholders' interest).

(2) The Short Term Impact on the P & L Account

Being 1,75% above the London inter-bank rate (currently 11%) the annual interest charge is variable, but assuming an upper and lower average inter-bank rate of 10% and 12%, the gross charge would be $10,0 and $11,74 million respectively. Allowing for the tax status of the loan (50% of the interest incurred is allowable against tax), the net charge becomes an effective Ø $8,0 and $9,36 million.
This 'best' and 'worst' interest position may now be compared to a 'best' and 'worst' Unicorp dividend payout position which assumes a 30 c.p.s. final in May (as forecast by the Unicorp directors) and either an unchanged interim of 12c, or one increased to 18c, payable in October.

	'Best'		'Worst'	
Net Interest to 30.06.1975	(11,75%)	-$4,0 m.	(13,75%)	-$4,7m
Final Unicorp Dividend	(30c)	5,7	(30c)	5,7
Net Profit		$1,7		$1,0
Net Interest to 31.12.1975	(11,75%)	-$4,0	(13,75%)	-$4,7m
Interim Unicorp Dividend	(18c)	3,4	(12c)	2,3
	Profit:	$1,1 m.	Loss:	-$1,4m

The above table indicates that the short term impact on Genmin's effective profit position is as likely to be positive as negative, with the prospect that (given increasing Unicorp dividends) it will be positive within two years.

Ø No tax is currently payable as Genmin has an assessed tax loss.

(3) The Longer Term Investment Implications

To gain some impression of the new combined investment portfolio it may be useful to look at the asset spread of Genmin as appearing from its most recent accounts (i.e. for the year to 31.12.1973), and then to add on its attributable stake of 25,7% in Unicorp (being 23,9% direct plus 1,8% through Sentrust) at the same date.

	Value[x] of Investments (31.12.1973)					
	Genmin		25,7% of Unicorp		Total	
Gold	R100,5m.	42%	R 43,5m.	40%	R144,0m.	41%
Platinum	15,2	6	21,6	20	36,8	11
Coal	27,9	11	-	-	27,9	8
Metals/Minerals	15,5	7	6,6	6	22,1	6
Mining Financial	40,1	17	15,0	14	55,1	16
Industrial	33,1	13	14,1	13	47,2	13
Property	8,4	4	8,1	7	16,5	5
	R240,7m.	100%	R108,9m.	100%	R349,6m.	100%

x Market or Directors' Valuation

The above table clearly illustrates that, apart from platinum and coal, both Genmin and Unicorp had a broadly similar spread of investments, and that recent (and future) Genmin purchases of Unicorp will primarily increase Genmin's investment in the platinum industry while reducing the stake in coal. There will also be an improvement in the quality of the gold portfolio.

The key to an evaluation of the longer term investment implications for Genmin is an assessment of the 'true' value of Unicorp - so that some attempt can be made to see whether the price paid by Genmin may be justified on purely investment grounds. The following schedule has been derived on the same basis as that applied to Genmin.

Union Corporation

Dividend Income From	Contribution to Total Earnings R000			Valuation Basis	Valuation R000
	Estimated				
	1973	1974	1975		
Gold					
- Dividend Income (1)	10 355	16 300	22 000	11% (2)	148 200
- Unisel	-	-	-	(3)	25 500
Platinum					
- Dividend Income	3 591	5 320	4 380	(4)	46 600
Other Metals					
- Palabora	1 013	1 160	725	(5)	7 250
- Other (Non S.A.)	876	876	700	15% D.Y.	5 840
Financial					
- U.C.I. (6)	1 862	2 793	3 250	10% D.Y.	27 930
- Other (7)	482	580	640	10% D.Y.	5 800
Industrial					
- Sappi (8)	1 222	1 570	1 750	10% D.Y.	15 700
- Other	1 332	1 465	1 600	10% D.Y.	14 650
Property					
- Other	1 184	750	900	(9)	12 200
	21 918	30 814	35 945		309 670
Add: Other Income					
Net Interest & Fees	2 655	3 000	5 000	12%	25 000
Net Realisation Profits	2 668			15%	17 800
	27 241	R34 m.+	R41 m.+		352 500

E.P.S.	47c	59c+	70c+	610c.p.s.
D.P.S.	24c	42c	48c	
x Covered	2,0	1,4 +	1,5 +	

Assuming 1,8c cover, at 85% = 520c.p.s.

(1) 30% St. Helena, 19% Kinross, and 12% Winklehaak.

(2) Equals a 14,8% D.Y. on projected dividend income of R22m assuming a 1975 gold price of $175 per oz.

(3) An assessed valuation of 300 c.p.s., less 40 c.p.s. subscription cost to Unicorp.

(4) Impala. 1973 Effective dividend 61,7c, 1974 91c (14c, 22c, 25c and 30c), 1975 dividend estimate 75c. Valued at 15% D.Y. on projected average dividends of 120c.

(5) Palabora valued at 750 c.p.s., a projected 10% D.Y. on forecast dividend of 75c (120c).

(6) 1974 D.p.s. 36c, projected 42 c.p.s. for 1975.

(7) 20% Increase for 1974 and 10% for 1975.

(8) Projected d.p.s. 18c for 1974 and 20c for 1975.

(9) Largely Capital and Counties - assumed dividend cut and valued at 36 c.p.s., the balance valued on 10% D.Y.

The basis of the above valuation is therefore the sum of the valuation (on conservative assumptions) of the component sectors. This leads to a total valuation of R352 500, or 610 c.p.s. This amount is further reduced (according to a variable formula) to reflect the retentions made by mining houses, and a net price (equivalent to our Buying Price) of 520 c.p.s. is derived. This price is significantly affected by our relatively conservative view on gold shares (viz. our valuation basis) - using current market values the Unicorp gold investments have a valuation of R280 million, an additional R106 million or 180 c.p.s.

To summarise it may therefore be said that Union Corporation shares may currently be valued at between 520 c.p.s. and 700 c.p.s., according to the view on gold, which compares with the net (ex premium) average price of 480c paid by Genmin for its R59 million of London purchases.

(4) The Repayment of the $85 Million Loan

Much has been said about 'true cost' of this loan, both interest and capital, being significantly greater than the nominal $85 million at 1,75% above inter-bank rate; servicing charges of up to 19% and capital repayment at a 30 - 40% premium have been mentioned. The interest servicing position is quite clear

however, Genmin has permission from the Reserve Bank to service the loan at the spot rate which means there is no servicing premium. The capital redemption position is less certain, and while it seems likely that some premium over the official ($85 million = R58 million) rate will be payable, as this will most probably be realised by the sale of gold shares while these are trading at a relatively high level it is difficult to speak of an effective repayment premium. There is no basis for estimating the possible future premium payment, but the following table provides a frame of reference for the magnitudes involved:

	Blocked Rand Discount (%)	RDM Gold Index	'Number' of Shares Sold
February 1973	11	130	100
December 1973	32	180	95
February 1974	12	330	40
September 1974	43	430	47
February 1975	23	360	42
Projection I	30	400	41
Projection II	20	500	31

This table indicates that, to realise a given value in London by the sale of gold shares ex-premium, while 100 shares must have been sold in February 1973, only 42 shares would have to be realised to-day. And assuming the gold share index continues to rise, the 'cost' could be even fewer shares in the future.

Accurate timing of the share selling, to optimise the share price/ blocked rand discount relationship could significantly reduce the effective cost of the capital redemption.

11. Conclusion

11.1. A Summary of the Preceding Analysis

(a) During the year to 31.12.1975 the effective net charge to the P & L Account from the Unicorp purchases will be small, and may even be positive. Over the period of the loan (average 4 years) the net effect is most likely to be positive.

(b) The inclusion of the $85 million loan in the balance sheet will accentuate the already high gearing, and while the proposed rights issue, to raise R20 million, will reduce the impact somewhat, Genmin will remain highly geared at book values.

(c) On an ex-premium basis Genmin's purchases of Unicorp must be rated good value. It is difficult to talk meaningfully of an effective cost in rand terms - if the gold share market improved from its current levels over the next 3 - 5 years the Unicorp purchases will look 'cheap', if the gold market goes badly they could look 'expensive'.

(d) On the basis of the investment structure excluding the Unicorp holding, Genmin was valued at 2 500 c.p.s. The impact of the Unicorp purchases on this price is marginally positive, but difficult to quantify. At the same time the increased gearing and the changed investment orientation has increased both the growth potential and the risk rating of Genmin.

(e) On a similar valuation basis Unicorp was valued at 520 c.p.s. No 'premium' was added for the superior mine management of Unicorp, and the 520 c.p.s. is therefore comparable to the 2 500 c.p.s. derived for Genmin.

11.2. Recommendations

On solely investment criteria both Genmin and Unicorp have appeal as predominantly mining investments with a strong orientation towards gold. Taking a long-term view it seems unlikely that they will remain separate and independent entities, but given the recognised financial expertise (and political pull) of Genmin and the technical expertise of Unicorp the eventual combination may well, despite any short term upsets, emerge a more efficient group - and a major force in the South African mining environment.

It is therefore recommended that:

(a) The current shareholding in General Mining be maintained, and further purchases be made below 2 500 c.p.s. If, for non-investment reasons, it is decided to sell the existing shareholdings, they be sold at not less than 3 000 c.p.s.

(b) That consideration be given to the purchase of additional Union Corporation shares below a price of 520 c.p.s.

INVESTMENTS DIVISION

DETAILED REPORT - MINING FINANCE HOUSE

(INTERNATIONAL DIVERSIFICATION)

CONTINENTAL RESOURCES INVESTMENT CORPORATION (CRIC)

INVESTMENTS ANALYSIS

Issued: 23.10.74

Received: 28.10.74

Analysis: 25.02.75

MINERALS AND RESOURCES CORPORATION LIMITED

1. Directors

Messrs. H.F. Oppenheimer (Pres.); S. Spiro (V. Pres.); F.S. Berning; G.A. Carrey-Smith; J.N. Clarke; Dr. Z.J. de Beer; F.M.F. Ellis; G.C. Fletcher; H.R. Fraser; E.P. Gush; M.P. Hofmeyr; N.K. Kinkead-Weekes; Sir Philip Oppenheimer; B.W. Pain; Hon. Sir J. Pearman; G.W.H. Relly; J.G. Richardson; L.G. Stopford Sackville; J. Ogilvie Thompson; Hon Sir H. Tucker; G.H. Waddell; W.D. Wilson.

2. CRIC Group's Holding as at 31.12.74

Type of Shares	No. of Shares		Current Price	Total Market Value	Book Value	Percentage of Issued Equity
Ordinary, Held by CRIC in London	1 340 280	(Jhb)	260cB	R3,48 m		4,2%
		(Ldn)	212p	£2,84 m	£2,406m	

3. Capital and Reserves of the Company

Authorised		Issued	$000
32 500 000	Ordinary Shares of BD$1,40 each	31 668 899	44 336
	Capital Reserves		120 236
	Revenue Reserves		46 868
			211 440

42 500 000 Additional shares of BD$1,40 each were created on 5th August, 1974.

Authorised	Issued	$000
41 910 618 'A' Ordinary Shares of BD$1,40 each	41 910 618	58 675
8 572 Deferred Shares of BD$1,40 each		
580 810 Ordinary Shares		
Share Premium		86 713
Additional Capital and Reserves subsequent to 30.06.74		145 388

The 'A' ordinary shares were issued to HDD for its EMC interests, and are to participate fully in Minorco dividends only after June 1976, when they became ordinary shares. Until then 'A' shares are only entitled to dividends from EMC, while dividends on the ordinaries will be limited to about 75% of net other earnings.

4. Statistics (30th June)

		1969 x	1970	1971	1972	1973	1974 xx	Projected 1975
Exchange Rate £1 = R			1,714	1,714	1,95	1,75	1,61	
R1 = US$						1,31	1,47	1,48
Pre Tax Profits (Rm)		20,63	28,51	23,50	15,02	13,88	20,3	12
Earnings Per Share	(c)	67,2	93,9	73,5	47,2	43,5	63,8	28
Dividend Per Share	(c)	54	75,4 ϕ	68,6	43,9	42,0	47,7	19
Return on Shareholders' Funds	(%)	31,4	36,8	27,0	14,4	13,8	14,1	
Return on Total Funds	(%)	25,9	33,8	23,2	12,3	12,0	12,6	
Shareholders' Interest	(%)	82	91	85	83	85	88	
N.A.V. at M.V.	(c)	298	405	387	457	490	454	
Liquidity	(:1)	1,6	4,0	2,1	1,7	2,6	4,2	
E.P.S. Growth Over Year	(%)	+52	+40	-21	-36	-8	+47	-40
5 Year E.P.S. Growth p.a.	(%)	+ 5	+12	+ 7	+1	0	-1	
5 Year D.P.S. Growth p.a.	(%)	+ 4	+ 8	+ 7	+1	+2	-2	
Price Range : High	(c)	360	430	445	450	430	280	270
Low	(c)	190	255	265	370	300	240	260
Av. Monthly Volume	(000s)	93	123	147	75	6	3	1

x 1-for-1 cap. issue in December 1968
ϕ Including special dividend of 21,4c
xx 1974 Accounts published in US$ (previously £)

5. Nature of Business

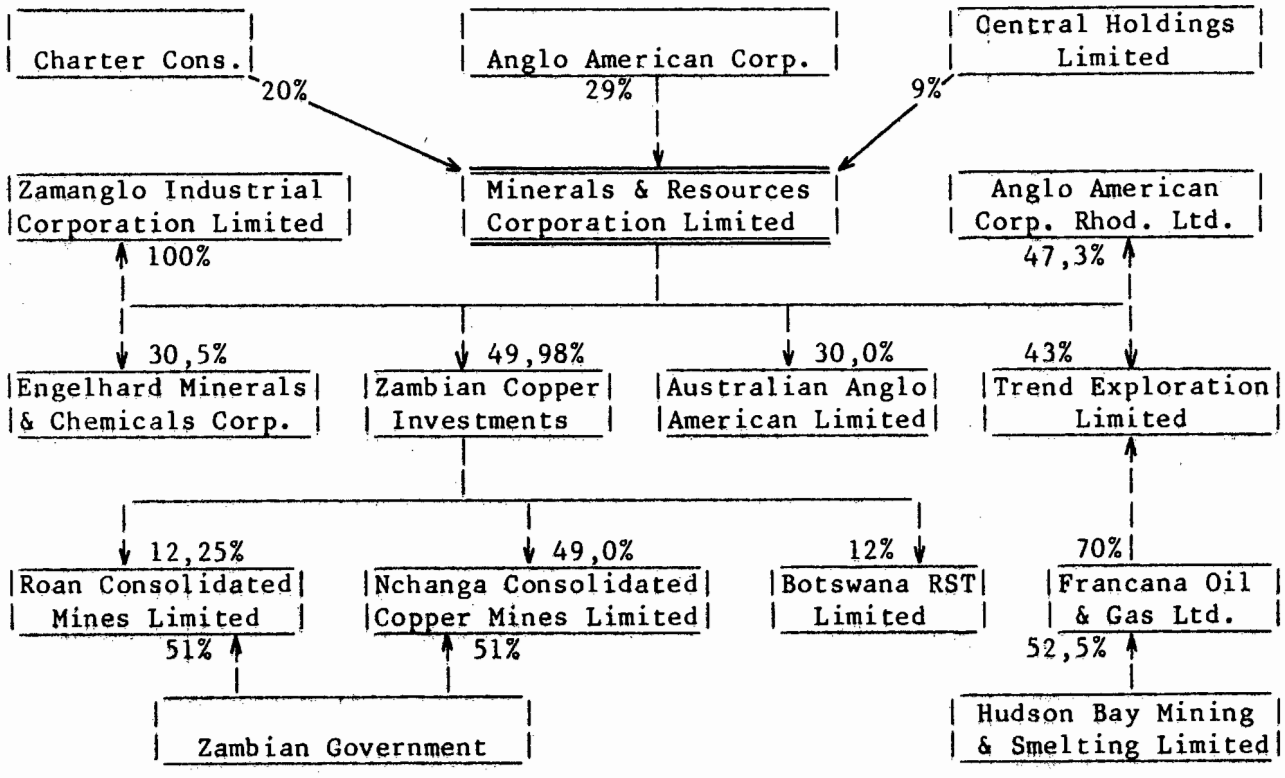
The name of the company was changed in August 1974 from Zambian Anglo American Limited (Zamanglo) to Minerals and Resources Corporation Limited (Minorco). The company is endeavouring to progress as a major international finance company and to develop a balanced range of investments in the field of natural resources.

The company holds a 49,98% in Zambian Copper Investments (ZCI) which was formed at the time of nationalisation of the copper mines, to hold Anglo's minority interests (49% of Nchange Consolidated and 12,25% of Roan Consolidated). In addition the company has interests in Anglo-American of Rhodesia (47,3%), Zamanglo Industrial Corp. (100%), Australian Anglo-American (30%), Engelhard Minerals and Chemicals (30,5%), and Trend Exploration (43%).

Mineral investigations and prospecting are in progress in Australia, Brazil, Indonesia, Phillippines, Peru, Chile, Costa Rica and Panama.

The company is registered in Bermuda for tax reasons.

6. Group Structure



7. Comments on the Company

7.1. Record

Prior to 1970 when the Zambian Government acquired a 51% interest in the copper mining companies, Zamanglo's income was derived from dividends from its interests in Rhokana (53,7%), Nchanga (57,1%), Bancroft (99,4%) and Mufulira (34,4%). In 1970 e.p.s. and d.p.s. were boosted by special terminal dividends paid by Rhokana and Nchanga as part of the nationalisation deal.

Consequent to nationalisation of the copper mines, the company embarked on a policy of diversification into 'new mining projects on a world-

wide basis'. Initially this was financed through externalisation of R17 million in cash resources authorised by the Zambian Government in the period 1970 - 1972. With effect from September 1973 the company received funds totalling $81 million (R55 million) on redemption of its holdings of ZCI loan stock i.e. R72 million was made available for investment outside Zambia and Rhodesia compared to the then current market value of its investments in ZCI of R58 million (now R46 million).

In August, 1974, Minorco issued 42 million shares to H.D. Development for its 30,5% interest in Engelhard Minerals and Chemicals (EMC). Rather than using the cash from the redemption of the Zimco bonds to buy EMC shares, Anglo chose to use this money to further diversify Minorco's interests in areas where Anglo was not represented. This issue merely provides Minorco with some solid assets on which to borrow.

7.2. Source of Earnings

(30th June) (Rm)	1972	1973	1974	Estimate 1975
Divs. from ZCI	10,75	10,72	16,77	7,0
Others	1,40	1,06	1,01	1,5
Interest	5,15	4,19	5,76	5,5
	17,30	15,97	23,54	14,0
Less: Expenses	2,28	2,09	3,26	5,0
Pre-tax Profits	15,02	13,88	20,28	9,0
E.p.s.	47c	44c	63c	28c
D.p.s.	44c	42c	47c (17c) (30c)	19c (6c) (13c)

With LME copper price to mid-1976 fluctuating in the £500 - £600 range, 1976 ZCI dividend income could be at a similar level to that estimated for 1975, with the downside potential due to rising costs offset by the upside potential of higher metal prices.

Dividend income from other sources can be expected to improve slowly over this period as the new ventures pick up.

Interest earnings could be maintained at roughly current levels, for while the build up of liquidity is important in the current climate, spare cash must be channelled at this development stage into bringing assets to the revenue generating stage.

Expenses must rise substantially due to the heavy exploration commitments and additional administrative requirements.

1977 E.p.s. and d.p.s. will be drastically diluted by the 'A' ordinary shares participation in profits - but this disregards the potential profits generated by the new projects.

7.3. Review of Subsidiaries

7.3.1. Zambian Copper

Various changes have taken place in the conduct of operations of the Zambian copper mining industry:

(i) The redemption of the Zimco bonds and loan stock and the consequential repayment of Minorco's ZCI loan stocks, amounting to $81 million.

(ii) Amendments to the taxation and exchange control regulations in respect of the two mining companies which adversely affected the level of ZCI's dividend income, and ZCI's dividend pattern has been altered to conform to the annual dividend externalisation of NCCM (July) and RCM (October). Thus 2 dividend payments a year replace the previous quarterly basis.

(iii) Following agreement between the Zambian Government and Anglo American Corporation (Central Africa)/AMAX, the latter's respective management and marketing functions have been terminated.

The operating companies, NCCM and RCM, are now responsible for their own management while the government has taken over the marketing of metals.

(iv) In February 1975, a reversion to pre-1970 mining taxation arrangements was proposed i.e. mineral tax at 51% of gross profit, plus 45% income tax on net profit after mineral tax and allowances, which are no longer 100%.

ZCI

Source of Earnings

(June 30th)		1971/2	1972/3	1973/4	Estimate 1974/5	
Average Copper Price /Per Ton (£)		436	445	852	590	
(K)		767	743	1 380	910	
NCCM (Y/E 31/3)						
Copper Sales (000 Tons)		420	446	397	380	
Taxed Profit	(Km)	68	77	113	60	
Dividends	(Km)	36	36	67	30	14,70

RCM (Y/E 30/6)

Copper Sales (000 Tons)		242	283	278	250	
Taxed Profit	(Km)	43	47	78	40	
Dividends	(Km)	20,5	31	44	20	2,45
Dividends Due to ZCI	(Km)					17,15

ZCI (Y/E 30/6)

x Net Divs. from NCCM	(Km)	17,6	17,6	28,9 ($42,4m)	11,8	
RCM+	(Km)	1,8	2,8	5,4 ($ 8,0m)	2,0	
Net Profit	(Km)	21,6	22,5	37,4 ($54,8m)	15,6	
Dividends	(Km)	19,4	20,5	33,4 ($49,0m)	14,2	
D.P.S. (122,6m)		15,8 ng (9p)	16,7 ng (10p)	27,2 ng (40c US)	11,6 ng	
Dividends due to Minorco	(Km)				7,10	
	(Rm)				7,40	

x After deducting 20% withholding tax from 31.08.1973
+ As per quarterly/biannual divs. received
1R = $1,48 = K0,96; 1£ = R1,61

ZCI's Profit record should be viewed against the cyclical LME copper price movement. After peaking above £700 in early 1970, prices declined sharply to end 1970, spending 1971/2 in the doldrums at a range £400 - £450, again climbing sharply to an all-time peak of £1 400 in early 1974 but coming off rapidly to £500 by year end. Currently the price is drifting at the £550 level, and is not expected to recover beyond £600 before mid-1976.

LME and other world copper stocks are currently of the order of 500 000 tons. The decision of CIPEC (Zambia, Zaire, Chile, Peru) to cut copper exports by 10% earlier this year did not appear to have the desired effect of reducing stocks and a further 5% cut is planned shortly.

7.3.2. Zamanglo Industrial Corporation (100%)

(30th June)		1971	1972	1973	1974
Net Profits	(K000)	896	990	548	54
Dividends	(K000)	900	250	250	-

The company has a diversified investment portfolio in Zambian industry and agriculture. In 1974 revenue from industrial investments was maintained but losses were recorded in the agricultural division. Overall profit fell 90% and no dividend was paid. Agricultural losses were due to poor climatic conditions and fungal disease in the maize. The large scale vegetable business was abandoned, but the profitable cattle operation was expanded.

7.3.3. Anglo American of Rhodesia (47,3%)

(30th June)		1970	1971	1972	1973
Net Profits	(Rh$m)	1,98	2,12	2,56	3,64
% Increase			+ 7	+ 21	+ 42

The company has a portfolio of Rhodesian Shares with a Book Value of Rh$31,5 million and market value of Rh$53,5 million. Minorco has additional attributable earnings of 5,4c (4,3c) a share from this source, but receives no dividend because of the Rhodesian situation.

7.3.4. Engelhard Minerals and Chemicals (30,5%)

From a previous 2% indirect interest, Minorco in August 1974, acquired a major interest (30,5% ord., 20% conv. pref.) in EMC, whose main business is:

(i) International marketing of a wide variety of ores, minerals and metals (Philipp Brothers Division) - 70% of 1973 turnover.

(ii) Mining and processing of kaolin and other non-metallic minerals (Minerals & Chemicals Division) - 2% of 1973 turnover.

(iii) Refining of precious metals and manufacturing of precious metals products for industry (Engelhard Industries) - 19% of 1973 turnover.

It is a leading developer and supplier of platinum-palladium catalytic convertors for use in automative pollution control and has concluded contracts with 8 international motor vehicle manufacturers.

(31st December)	1972	1973	% Increase	1973 1st 6 Mnths	1974 1st 6 Mnths	% Increase
Revenue ($m)	1930	3050	58%			
Earnings ($m)	36,6	52,5	43%	25,4	52,2	105%
E.P.S. ($)	1,19	1,68		0,81	1,65	
D.P.S. ($)	0,40	0,43			0,50	

The major portion of the dramatic 1st half 1974 earnings improvement was derived from Philipp Brothers, reflecting buoyant world metal markets. However, contribution to Minorco's earnings has been minimal.

Currently depressed base metal and platinum markets should have recovered by mid-1976 when Minorco ordinary shareholders qualify for dividends from EMC.

The earnings record indicates that by 1976/77 EMC's annual earnings might conceivably be of the order of $80 million, paying dividends of $30 million (div. cover is historically high), thus contributing 8c (S.A.) per share to Minorco's attributable earnings (including dilution of the 'A' shares).

7.3.5. Trend Exploration (43%)

An unqouted U.S. company acquired at a cost of about US$48 million (R31,8 million) for Minorco's 43% interest. Trend Exploration has a number of producing oil wells in the U.S.A. and Canada and operates others, on a production-sharing basis, in Indonesia. It is also actively involved in exploration in other parts of the world, and is believed to have a promising future.

Operating revenue increased threefold from $4,6 million in 1973 to $18,5 million in 1974. The trend purchase should not materially affect the original projections for Minorco as the deal was achieved by the buying of convertible debentures, so Minorco's interest income should be little affected.

At current high oil prices, earnings from Trend will help towards offsetting loss of earnings in the base metal investments.

7.3.6. Other Interests

Australian exploration : the outlook for foreign investments in mining operations is uncertain.

Brazilian exploration : prospects are promising.

Botswana : The Selebi-Pikwe copper-nickel project is a financial disaster.

Elsewhere little of quantifiable worth has emerged.

8. Conclusion

The need in recent years to exploit lower grade deposits has increased the physical dimensions of mining and processing operations. This factor together with the severe escalation in capital cost will limit participation in new ventures to those companies which are strongly and broadly based.

While the above philosophy is supported in principle, in terms of return, Minorco's existing 'external' investments have been very disappointing and on the evidence of Charter Consolidated's poor performance in the last few years, Anglo's world-wide investment expertise must be questioned.

The issue of the vast number of new Minorco shares was viewed critically in London investment circles as Minorco shares were issued on a projected 19% D.Y. for EMC on a projected 3%. Furthermore, with Minorco having 32 million shares currently in issue, the effect of an additional 42 million in Minorco shares will mean a severe cut in 1976 dividends. The deal lowered the net asset value from 415c to 310c.

For the next 2 years, at least, profit prospects of the company are likely to remain closely tied to the profitability of the Zambian copper mines. With the low level of copper prices (£500 - £600) envisaged over this period plus the crippling costs of imports grim prospects are in store for Zambia.

At its current price the share is on a prospective 1975 dividend yield of 7,3%, similarly for 1976. Such yields are not adequate in view of the inherent political risk of further Zambian nationalisation and the uncertain prospects of the company's diversification programme.

9. Recommendation

Recommendations to dispose of these shares have been turned down on three occasions over the past two years.

There is not much choice in the matter at present as trading volume is negligible with downside potential in the share price.

Holding Minorco at this stage is purely an act of faith in a change of fortune for Anglo's 'external' investments. The principle is contrary to the condition, for institutional-type investments, of sound fundamentals.

MINING ANALYST

DETAILED REPORT - GOLD MINING COMPANY

CONTINENTAL RESOURCES INVESTMENT CORPORATION (CRIC)

INVESTMENTS ANALYSIS 24.03.1975

FREE STATE SAAIPLAAS GOLD MINING COMPANY LIMITED

1. Directors

D.A. Etheredge (Chairman); G.Y. Nisbet (M.D.); M.W. Dunningham; J.G. Edmeston; E.P. Gush; G. Langton; D.E. MacIver; H.F. Oppenheimer; N.F. Oppenheimer; E. Pavitt; R.T. Swemmer; A. Wilson.

2. Rights Offer

14 040 000 Shares of R1,00 each at R2,50 per share, payable in full on application, to members of President Brand Gold Mining Company Limited (registered 07.03.1975) in the proportion of 1 share for each President Brand share held, with an option to apply for excess shares at the same price.

3. Purpose of Offer

The company has embarked upon an expansion programme at an estimated cost of R81 million, which includes the sinking of a new shaft (No. 3) in the western portion of the lease area. It is estimated that the company will be able to finance approximately R43,7 million of the total capital required out of its existing funds and working profits, and possible borrowings under temporary loan facilities, and the purpose of the offer is to raise the balance.

4. CRIC's Holding in President Brand

CRIC holds no President Brand shares and therefore has no entitlement in terms of the offer. However, the nil paid letters of application, being dealt in from 10.03.75 to 02.04.75 can be bought - dependent, of course, on CRIC's fundamental views on gold investment.

5. Administrative & Technical Advisers, Secretaries and Underwriters

Anglo American Corporation of S.A. Limited.

Underwriting commission 2,5% on total capital to be issued in this offer. Total expenses of issue estimated R1,4 million (incl. commission R877 000). Sec. and tech. fees received: 1972 R59 000; 1973 R118 000; 1974 R262 000.

6. Capital and Reserves of the Company

Application has been made for a JSE primary listing of 28 100 000 shares of R1,00 (issued and to be issued) and for the issue of renounceable letters of allocation.

Application also made for a London Stock Exchange Listing.

This offer is conditional upon granting of these applications not later than 16.05.1975.

All shares (issued and to be issued) rank pari passu.

			R
Authorised:	35 000 000	Shares of R1 each	35 000 000
Issued:	12 491 870	Shares of R1 each (fully paid)	12 491 870*
To be Issued:	14 040 000	Shares of R1 each	14 040 000
x To be Held in Reserve: (Subject to Material Contract)	8 468 130	Shares of R1 each	8 468 130

Capital Reserves:	Current (No Share Premium)	6 021 000*
	Share Premium after New Issue	21 060 000
Revenue Reserves:	Current	2 871 000*
xx Loan Facilities (8% p.a. unsec., no drawings at 31.01.1975)		5 000 000
Assets and Liabilities as at 30.09.74 *		21 383 870
Represented by:	Mining Assets	18 306 870
	Unlisted Investments	206 000
	Loan Levies Recoverable	534 000
	Net Current Assets	2 337 000
		21 383 870
Assets and Liabilities including post-issue capital (28 100 000)		56 483 870

x See also sub-heading 'Material Contract' which follows (7.6.).
xx From President Brand for temporary cash pending capital from this share issue. No other loans or debentures.

7. Offer Particulars and Dates

7.1. The Offer, as outlined earlier (under 2) opened 14.03.1975, and closes 04.04.1975.

7.2. Excess Shares available for allocation represent those shares whose rights are not exercised. Results of the offer and basis of allocation of excess shares will be announced 10.04.1975. These fully paid L.A.s may be dealt in on the J.S.E. from 10.04.1975.

Fully paid renounceable L.A.s for excess shares allocated and/or cheques refunded (no interest) 16.04.1975.

7.3. U.S.A. Registered Members

This prospectus is not registered with the Securities and Exchange Commission, Washington, and accordingly the offer is not being communicated to, nor is it open for acceptance by, persons with registered addresses in the U.S.A.

7.4. Non-Resident Members

May not use blocked rand in subscription either for the shares to which they are entitled or for excess applications.

Blocked rand may, however, be used to purchase renounced nil paid letters of allocation but may not be used to subscribe for the shares arising from such letters.

7.5. U.K. Exchange Control

U.K. Residents must either use investment currency for portfolio investment in foreign currency securities (including the acquisition of rights) or use the proceeds of a foreign currency loan taken for such a purpose under a specific authority given by The Bank of England.

Refunds in respect of unsuccessful excess share applications may be reinstated as investment currency with an option to sell for sterling without the '25% requirement'. Any amounts provided out of foreign currency loans may be restored.

7.6. Material Contract (between the Company and President Brand)

If, following this offer, President Brand and its nominees have a 50% or less of the issued capital of the company, then the company will capitalise sufficient of its reserves and issue to President Brand, credited as fully paid, sufficient capitalisation shares to ensure that between 50% - 51% of the issued capital of the company will be held by President Brand and nominees.

But for this agreement, President Brand would, after the new share issue, own 47,08% of issued shares. Consequently, 1 568 130 new shares will be issued credited as fully paid to President Brand.

Other details of the contract concern handling and treatment of ores and are covered elsewhere in this analysis.

8. Technical and Financial History

- Jun 1955 : Incorporated.
- 1957 - Jun 1959 : Sinking No's 1 & 2 Shafts.
- 1959 : Development on Basal Reef (both Shafts).

. Oct - Dec 1960 : Metallurgical plant trial operations.

. Jan 1961 : Normal milling commenced; at $35 gold price grade 8,9 g/t over 129 cm mined.

. 1st Half 1961 : Development retarded by water-bearing fissures, faulting and unpayable zone near No. 2 shaft; monthly milling tonnage reduced from target 90 000 to 70 000; working loss recorded.

. 1961 - mid 1964 : Development and extension of ore reserves retarded by water problems.

. Jun 1964 : Basal Reef ore reserves fully developed; at $35 gold price 1,3 million tons at 8,23 g/t over 129 cm i.e. 1 062 cm-g/t (reserves just over 1 year's production).

. 1964 : Working results seriously affected by an underground fire; this plus adverse geological conditions (change of strike, large barren zone, high temperature water) restricted stope face availability i.e. production.

Salient operating results for the 3 years ended 30.06.1964:

	1962	1963	1964
Tons Milled	764 308	852 305	940 756
Grade - g/t	9,44	9,49	8,45
Working Profit/(Loss):			
Gold	R313 635	R381 838	(R133 205)
Ore Reserves:			
Tons	781 998	1 307 261	1 329 941
Width - cm	128	128	129
Value - g/t	8,57	8,37	8,23
- cm g/t	1 097	1 071	1 062

. Jun 1965 : Ventilation problems and underground fire against restricted stope face availability; mill grade declined to 8,19 g/t (8,45); increased working loss incurred R382 000; accumulated loss R1,7 million.

It was clear at this stage that in the face of declining mine grade, static gold price and ever increasing production costs, viable mining operations could not be continued.

Measures became necessary to reconstruct the companies capital and relieve it of the obligation to repay loans beyond its means.

. Sep 1965 : President Brand Gold Mining Company Limited made an offer for the entire issued capital of the company as reconstructed.

. Oct 1965 : Company became a wholly-owned subsidiary of President Brand under the following scheme:

. From Jan 1966 : President Brand undertook to deliver, by pipeline, milled ore (high grade) at cost of production from its mine to F.S. Saaiplaas reduction plant at a rate of not more than 45 000 tons/month until maximum 3,5 million tons had been delivered. In conjunction, at least 5,3 million tons of ore was to be milled by F.S. Saaiplaas from its own lease area at a rate approximately 68 000 tons/month. The scheme succeeded in putting the company on a profit-making basis.

. Oct 1972 : This scheme terminated. The company has subsequently been treating milled ore from President Brand (max. 75 000 tons/month) on a toll basis (cost of treatment + 20c/ton).

. 1972 - 1974 : Results of mining operations in the last 3 financial years:

	1972	1973	1974
Tons milled - mine production	1 162 000	1 215 000	1 112 500
Milled ore purchased from Pres. Brand - tons	543 600	51 175	-
Total	1 705 600	1 266 175	1 112 500
Yield : g/t - mine	7,49	6,41x	5,31x
- combined	11,14	6,85x	-
Cost per ton milled	R7,51xx	R7,85xx	R10,68xx
Working profit - gold	R9 361 000	R5 894 000	R7 491 000
- uranium	R 93 000	R 93 000	R 20 000
Ore Reserves:			
Tons	1 677 000xxx	1 937 000	3 260 000
Width - cm	132,8	133,9	132,1
Value - g/t	7,74	6,32	5,82
- cm g/t	1 028	846	769

x Profits at the low mine yields indicated were derived from average gold receipts of $79 (1973) and $150 (1974).

xx The reduced rate of development due to the planned curtailment of mining operations caused working costs per ton milled to be lower than normal during the period under review.

xxx This was tonnage available for stoping only as the ore blocked out of the mine could not be considered payable if treated alone and the company had no ore reserves in the accepted meaning of that term. From 1973 to date, the rise in the gold price has enabled the company to calculate and publish ore reserve tonnages.

. 1975 : Authorised capital was almost trebled to current levels.

9. Uranium Potential

In earlier years uranium revenue was an important contributor to mine profits.

1963 - 1970 : High grade uranium slimes (equivalent to 363 tonnes uranium oxide) delivered to Virginia O.F.S. Gold Mining Company Limited for production of oxide.

Oxide sales are now the responsibility of Harmony Gold Mining Company Limited and F.S. Saaiplaas is entitled to 40% of profit from any sales of the 363 tons. Since 1963 profits from this source total R2,1 million.

No further uranium sales contracts have been negotiated, but slimes and tailings have been stockpiled. This will continue pending arrangements for uranium production at the President Brand plant, currently on a care-and-maintenance basis. By December 1974, high grade uranium-bearing slimes stockpiled totalled 7,7 million tonnes at average grade 0,20 kg/t i.e. 1 540 tonnes uranium oxide with a potential revenue value of the order of R23 million to R30 million (at average U308 price $10 - $13/lb).

10. Earnings and Dividends Record

Amounts in R000	1970	1971	1972	1973	1974
Earnings Before Tax					
From mine production	867	1 674	2 154	4 885	7 491
From milled ore purchased from Pres. Brand	5 31	4 371	7 207	912	-
From toll charges on ore milled on behalf of Pres. Brand and Pres. Steyn since 1.11.72	-	-	-	97	508
Sundry	297	320	453	453	551
	6 475	6 365	9 814	6 347	8 550
Less Tax	-	1 037	5 257	3 106	1 540
Earnings After Tax	6 475	5 328	4 557	3 241	7 010
Less Capital Expenses	-	216	-	512	4 751
Earnings after tax and capital expense appropriations	6 475	5 112	4 557	2 729	2 259
Dividends	6 246	5 621	4 060	1 999	1 999
Dividends (c)	50	45	32,5	16	16
Dividend cover	1,04	0,91	1,12	1,37	1,13

11. Effect of Higher Gold Price on Recent Conduct of Operations

In December 1971, it was estimated that mining operations would cease in June 1973. However, during 1972 it became clear that, in the light of the increased price of gold, it was possible that ore to the north and west of the present workings might become payable and it was decided to undertake further prospect drilling and development into these areas.

It was realised that, should the exploration programme indicate that it could be economic to mine the area, a new shaft would have to be sunk. At the end of 1972, it was thought that there was likely to be a break in production between March 1974 (when existing mining operations were expected to cease) and 1978, which was the earliest estimated date for production to commence from the new shaft.

It was therefore tentatively planned to use the F.S. Saaiplaas plant to mill and treat, for the 4-year period, ore from President Steyn, which company was planning to increase its production.

By December 1973, the higher level gold price then made it possible to consider mining into 1977. This necessitated the revision of the tentative arrangement. President Steyn is now expanding its own plant capacity, and F.S. Saaiplaas, in order to assist that company in the iterim, is milling and treating on a toll basis 25 000 tons/month of President Steyn ore for 1 year from April 1974. The President Steyn tonnage will be replaced in April 1975 by production from F.S. Saaiplaas.

12. Prospecting and Geology

Diamond drilling to evaluate the northern and western areas of the lease area commenced early 1973.

Three old holes were re-opened for deflections and 2 new holes drilled. Data from these holes plus older holes together with the known geology, disclosed by current mining operations, confirm the probable extension of economic gold and uranium values in the western portion. See attached plan and section.

Details of Basal Reef:

Dip : E of F.S. Saaiplaas fault 5° NW;
W of F.S. Saaiplaas fault 14° E.

Depth : 1 600 - 2 150 metres.

Hanging wall: Shale, the thickness of which may present some mining problems in the west.
No. 1 Shaft = 0 cm; No. 2 Shaft = 35 cm;
No. 3 Shaft = 35 cm (E) - 130 cm (W).

Faults: Apart from major faults along the boundary and other smaller faults, there are only 2 known major faults with displacements of 100 - 250 metres.

Water: Expected to be intersected in all major faults and dykes.

Methane Gas: Will be released when the water table drops below the level of the workings.

The Directors claim that neither water not methane is expected to pose abnormal mining problems.

13. Economic Potential

Mill potential of
No. 3 shaft area : 38,0 million tons at av. grade 6,0 g/t.

Planned milling rate: No. 2 Shaft - 50 000 x)
No. 3 Shaft - 150 000) 200 000 tons per month.

x Grade slightly less than 5 g/t in No. 2 Shaft area.

Life of mine: 19 years.
Uranium: Relatively high values indicated to persist in the new western area and expected to make a significant contribution to overall mine profits. (For details of stockpile potential refer back to earlier Section 9).

Other Reefs: Although average grades are obviously too low, no mention is made of the possibility of selective mining of pockets of higher grade gold intersected in the A & B Reefs (Kimberley Zone) or Leader Reef. These reefs must therefore be completely disregarded.

The decision to sink a new shaft and expand the mines milling and treatment facilities follows exhaustive feasibility studies. It was found that the return was roughly twice as sensitive to proportionate changes in level of revenue as to changes in capital expenditure, reflecting the fact that the project is a low-grade, large-tonnage proposition.

14. Project Details

14.1. No. 3 Shaft

Depth 2 225 metres; diameter 9,1 metres; up- and down-cast ventilation; hoisting rock, men and materials; sub-hoist in bottom 425 metres; capacity 188 000 tons/month (176 000 reef); 5 000 persons; 200 material cars; 12 stations; connection to 2 shaft on 13 level - 2nd outlet legal requirement; material transfer; initial development during sinking phase.

14.2. Milling and Treatment

Capacities extended to 200 000 tons/month (current mill cap. 100 000, treatment cap. 145 000).

14.3. Labour

Progressive increase 4 000 to 7 500 (+ accommodation); an adequate supply assumed.

14.4. Progress to Date

Pre-grouting in progress; pre-sinking completed; preparation for construction of concrete headgear (slide technique) commenced; erection of temporary hoists in progress.

14.5. Planned

2nd Half 1975	-	Shaft sinking commences.
Early 1978	-	Shaft sinking complete.
Late 1978	-	Equipping completed.
1979	-	Shaft commissioned.
Mid 1980	-	Production start-up.
1981	-	Full capacity.

14.6. Mining Method

Upper Section	-	Selected scattered mining.
Deeper Section	-	Semi-longwall mining.

110 cm - 120 cm Width stopes with optimisation of productivity and mechanisation within geological limits of the orebody.

14.7. Capital Expenditure

Estimates to bring the mine to a milling and treatment rate of 200 000 tons/month (1981):

	R Million
In 1974 terms	62
30% Escalation provision (prices and contingencies)	19
Total estimated capital cost	81

A capital redemption allowance of 100% of capital expenditure incurred each year is applicable in calculating taxation and State's share of profit.

15. Present Value Based on Prospective Dividends

(a) Max Pollak & Freemantle

Gold Price in 1975 x	$150			$175			$200			$225			$250		
Year	75	76	77	75	76	77	75	76	77	75	76	77	75	76	77
E.P.S. (c)	4	6	10	14	18	22	24	28	34	32	40	48	42	50	60
D.P.S. (c)	2	3	5	7	9	11	12	14	17	16	20	24	21	25	30
P.V. (c)	215			278			356			444			540		

x Gold Price increasing by 15% p.a. from 1975 base price.

(b) Fergusson Bros.

Discount At	Present Value (c) Gold Rising From $175/oz.		
	At 0% p.a.	At 7,5% p.a.	At 15% p.a.
10%	0	280	2 920
15%	0	84	1 540
D.P.S. (c)		10 - 30	

(c) Simpson, Frater, Melrose & Stein

At gold price of $180/oz., 1975 E.P.S. = 20c, D.P.S. = 10c. Assuming working costs rise no faster than gold price, 1981 E.P.S. ≈ 23c i.e. at full production.

Dividends (or increased issued capital) are based on the Directors estimate that, in spite of the heavy capital expenditure programme, the company should be able to distribute about half the annual profits as dividends during the construction period.

Depending on the gold price, tax and lease liability should not be incurred before the mid-1980s.

The average of above views would seem to indicate a dividend in the 10c to 30c range, covering both the short and longer term i.e. construction and full production phases. This gives a yield range, on issue price, of 4% - 12% and, on present value, of 3,6% - 10,7%.

Present value is, more conservatively, considered to be about 280c (see circled values in tabulations for criteria) which is only 12% above the issue price.

However, the gearing in this share is phenomenal. A doubling of the rate of gold price increase from 7,5% to 15% p.a. might increase the P.V. tenfold.

16. Trading in Nil Paid Letters of Allotment

The rights should, on P.V. considerations, command a price of 30c each, but taking account of the fact that 'blocked rand' may not be used to take up the rights it is considered that foreign shareholders in President Brand are likely to be sellers of their rights thereby creating an initial excess supply and consequently the L.A.s could be depressed.

This is borne out by initial dealings. NPLAs opened at 10c, moved up steadily to a level of 28c, and subsequently moved back, gyrating at the 15c - 18c level before declining to 8c.

300 000 BPLAs changed hands on 11.03.1975 and 950 000 on 12.03.1975. Rumour has it that a considerable proportion of the rights sold were those that would have been offered to American shareholders. It is suggested that in a bid to compensate them for their inability to take up the rights, the sponsors themselves sold the rights and will remit the proceeds to the U.S.A.

On Friday 21st Johannesburg was still absorbing London selling at a new low of 8c.

17. Investment Criteria

The preceding comprehensive summary serves to throw into perspective the changing fortunes of F.S. Saaiplaas and the historical arrangements at rationalising operations between F.S. Saaiplaas and President Brand, and to a lesser extent President Steyn.

The history of technical problems and production rationalisation renders the financial record somewhat irrelevant in quantifying past performance with a view to evaluating future potential in the new expansionary phase.

In an attempt to derive an investment rating, the following factors are highlighted:

A. Negative Factors

(i) Scrutiny of the record reveals poor mining performance due to considerable faulting, with attendant water and methane gas problems, and low grades.

(ii) The physical environment has not changed (and must thus remain suspect) and, while technology may reduce the water and fire hazards, this can only be accomplished at an inherently higher cost.

(iii) The thick shale hangingwall, yet to be encountered, poses an additional potential cost or grade-dilution burden.

(iv) Grades in the new area at 6 g/t are low, although marginally higher than the 5 g/t residual ore at no. 2 shaft. While Union Corporation mines orebodies grading 4 g/t at Grootvlei and Marievale, their costs are historically low and the mines are shallow. These grades must be compared with an industry average in excess of 12 g/t. CRIC rejected the Unisel (grade 12 g/t) offer because of the 'speculative nature of gold'.

B. Positive Factors

(i) The decision to embark on a capital expansion of this nature indicates confidence by Anglo American in the future course of the bullion price, which currently has a strong support base at $170.

(ii) The enormous uranium stockpile and the relative high grade of in situ ore could start making a significant contribution to profits in the late '70s or early '80s. This contribution appears to have been largely disregarded in the brokers' P.V. evaluations.

(iii) The very high gearing largely offsets risk on the basis that there is phenomenal upside and limited downside potential in the share price.

18. Conclusion

This is a low-grade, large tonnage venture particularly vulnerable to rising costs and stagnant gold price.

On the strength of the company's record and disclosures, plus dividend yield considerations, this is obviously not a gold share for the institutional investor.

If additional 'inside' information is available, then F.S. Saaiplaas should be re-evaluated taking into account such information (disclosed in terms of source).

Because of the importance of the uranium element in profitability more details should be gleaned concerning contracts, potential annual sales and processing costs etc.

If this investment is to be considered, then a technical on-the-spot evaluation of the mine by the mining analyst would be prudent.

However, if CRIC is to invest directly in gold mines a prior consideration would be a consensus on gold investment criteria and the subsequent objective, systematic ranking of all gold mine shares.

Market response to the NPLAs suggest that there is little advantage in taking up the NPLAs as shares will probably be available well below 300c in the market.

19. Analyst's View on Gold

The analyst's pessimistic view of the West's political and monetary system, and bullish outlook for gold remains unchanged. F.S. Saaiplaas would be included in a personal portfolio purely on the basis of a cheap entry into a highly geared share, with gold price risk well compensated for by uranium potential.

MINING ANALYST

DETAILED REPORT - COAL MINING COMPANY

CONTINENTAL RESOURCES INVESTMENT CORPORATION

INVESTMENTS ANALYSIS 20.05.1975

APEX MINES LIMITED

1. Directors

R.A. Hope (Chairman); L. Boyd; M.B. Forsyth; J.S. Hammill; D.J. Holliday; Ian MacKenzie.

2. Secretaries & Technical Advisers

GFSA.

3. Nature of Business

The company owns freehold property and coal and mineral rights in the Witbank, Brakpan and Benoni Districts and other mineral and coal rights in the Ermelo district.

Coal mining operations are carried on at the Greenside Colliery at Blackhill in the Witbank district. Four seams are being mined - No.s 1, 2 and 4 seams provide steam coal, No. 5 seam metallurgical coal.

Greenside mine has a 412 000 tons per annum (17%) participation in the Japanese low-ash coal export contract.

Blend coking coal is processed for sale to Highveld Steel and Vanadium Corp. Ltd., in terms of a long term contract (30 years, commencing 1968).

Bellevue Colliery Company (Pty) Limited, for several years a wholly-owned inoperative subsidiary, has been struck off the register of companies.

4. Capital & Reserves

Authorised		Issued		R000
2 270 000	Ordinary shares of R1 each	1 950 000	fully paid	1 950
90 000	5,5% Red. cum. pref. shares of R2 each (red. at Companies discretion at R2,10 each)	90 000	fully paid	180
				2 130
Capital Reserves				9 109
Revenue Reserves				35
				11 274

Authorised capital was increased and reorganised (28.12.73) preparatory to rights issue (11.01.74), R2,4 m being raised towards the low-ash coal project. Construction of the plant is proceeding satisfactorily.

5. Statistics

Year (31st December)	1969		1970		1971		1972		1973		1974		% Growth	
Seam	Nos. 1 & 2	No. 5	Nos. 1 & 2	No. 5	Nos. 1 & 2	No. 5	Nos. 1 & 2	No. 5	Nos. 1 & 2	No. 5	Nos. 1,2 & 4	No. 5	1 Yr (74/73)	5 Yr (p.a.)
Tons Hoisted (000)	1 321	497	1 382	613	1 607	559	1 486	748	1 572	813	1 647	832	+ 5 + 2	+ 4 +11
Discards (% of Tonnage Hoisted)	15,6	38,0	16,8	39,1	20,6	38,4	21,1	42,9	25,3	41,7	27,2	41,6	+ 8 + 0	+12 + 2
Total Tonnage Sold (000)	1 114	308	1 150	373	1 276	344	1 172	427	1 174	474	1 199	482	+ 2 + 2	+ 2 + 9
Working Profit (R/ton Sold)	0,48	1,31	0,39	1,07	0,35	0,65	0,41	1,30	0,36	1,39	0,36	1,61	+ 0 +16	- 6 + 4
Working Profit (R000)	539	402	454	401	444	224	476	554	422	659	428	776	+ 1 +18	- 5 +14
Working Profit of Combined Seams (R000)	941		855		668		1 030		1 081		1 204		+11	+ 5
Pre-tax Profit (R000)	905		815		603		1 010		1 094		1 357		+24	+ 8
Tax Rate (%)	-		-		21		33		27		-		-	-
E.P.S. (c)	69		62		36		51		61		69		+13	0
D.P.S. Ord. (c)	30		30		30		30		30		30		0	0
Pref. (c)	11		11		11		11		11		11		0	0
Return on Shareholders' Funds (%)	15,6		12,8		8,5		13,3		13,5		12,0		-11	- 5
Return on Total Funds (%)	13,8		11,4		7,7		12,3		12,2		11,0		-10	- 4
Shareholders' Interest (%)	82		84		84		89		91		91		0	+ 3
Liquidity (:1)	2,7		1,8		2,1		1,8		2,2		2,9		+32	+ 2

6. Comments on Company

6.1. Review of Statistics

As the selling price of coal is controlled, the profitability of coal mines is cyclical, with rising costs reducing profits until the next price increase - historically retarding steady growth.

While the 6 year statistical record may not highlight this profitability cycle as well as a longer record, the following observations clearly emerge regarding recent Apex history:

- Tons Hoisted

  There has been a steady increase in mining output - metallurgical coal to a greater extent than steam coal.

- Discards

  In both No.s 1, 2 & 4 seams and No. 5 seam there has been an increase in the percentage of coal discarded. This increase is minimal for No. 5 seam due to the high margin obtained for this type of coal. The increase in steam coal discards, on the other hand, is pronounced due to the greater quantity of poorer grade material of low margin rendered unprofitable under the effects of cost escalation. The wastage is quite evident and cannot be permitted to continue indefinitely - a good argument to support a realistic coal pricing policy.

- Total Tonnage Sold

  All coal hoisted, less discards, is ultimately sold.

- Working Profit

  The steady 4% per annum compound growth in working profit per ton sold for metallurgical coal reflects the strong long-term demand for this type of coal, which is in world-wide short supply. In contrast, the dismal performance of the steam coals reflects the adverse effect of the Government's price fixing policy on the low margin grades.

  The real contribution of the metallurgical sales to total working profit is illustrated by the 5 year 14% p.a. growth in working profits of metallurgical coal. However, because annual metallurgical tonnages sold have varied between only 30% - 40% of steam coals, the beneficial effect is diluted to 5% per annum growth in working profit for the combined No.s 1, 2, 4 & 5 seams - even this is an enviable record for the S.A. coal industry.

6.2. Prices, Sales and Working Costs

The rise in oil price has increased the demand for steam coal. However, the 1974 increase in steam coal sales was only 2,1% up on 1973

sales. This disappointing performance was experienced fairly generally throughout the coal mining industry, primarily due to the inability of the railways to transport the coal. Rail tonnage moved was significantly down on 1973, and road transport was greatly increased. Representations to Government to solve the railage problem continue.

Highveld Steel & Vanadium Corporation's requirements of No. 5 seam coal increased markedly in November 1974, as a result of the commissioning of an extra furnace.

The September 1974 increase in the controlled price of coal has been severely offset by the marked increase in working expenditure, particularly Black labour charges, which rose by almost 50% over 1973.

Working revenue from sales of steam coal were offset by an equivalent increase in expenditure which resulted in only a minimal increase in working profit.

75% Of the increase in revenue from metallurgical coal was offset by the increase in expenditure.

6.3. Profitability and Dividend Expectations

1974 Coal mining profits were 11,3% up on 1973 due to:

- Higher tonnages sold; and
- An increase in the controlled price of coal.

As there was no tax liability (due to heavy capital expenditure) net profit (after tax) was up 36,0%.

Historically, a static 30c dividend with high cover (more than 2x in non-tax paying years) has been maintained, although pre-tax profits have shown a healthy 8% per annum growth. Heavy retentions, supplemented by a rights issue, have financed heavy capital expenditure. High liquidity has been preserved throughout.

The alarming increase in cost of stores and other costs will inevitably erode profitability of sales both to the domestic market and Highveld. Nevertheless, because of the conbsiderably higher price to be received from sale of low-ash coal to Iscor, the profits for 1975 are expected to be substantially higher than for 1974, but an increase in dividends will be restrained by the heavy capital expenditure program.

Financing of expenditure: 1974 net assets increased by 38,7% of which more than 0,75 represented an increase in fixed assets. 76,0% of the increase in net assets was financed by the net proceeds from the increase in equity capital, and the balance out of profits.

6.4. Efforts Towards Increasing Profitability

- Pressured persuasion is being brought to bear on the Government to introduce a more realistic pricing policy.

- Double-washing technology has upgraded the lower grade/lower price coals, but high capital expenditure is initially involved. (85% of 1974 total R2,4 million capital expenditure was spent on the Low-Ash Coal Project. Estimates for 1975 capital expenditure of R5,7 million indicate 65% on this Project).

- Export coal rapid loading appliance and rail link to Richards Bay line is scheduled for completion January 1976 - in time for trial coal deliveries to Richards Bay.

- Mechanisation has commenced on 4 seam with an expected beneficial effect on costs.

- The standard and quality of colliery ventilation has improved.

- A Black Worker's Liaison Committee has been operating successfully.

6.5. Factors Favouring a More Rational Coal Pricing Policy

- There is an urgent need to increase the productive capacity of coal washing facilities, to meet S.A.'s increasing demand - by construction of entirely new washeries and extensive renovations to existing plant. Under current coal price-fixing policy and profitability there is little incentive to commit risk capital.

  It seems that both Government and traditional users of coal must urgently re-examine their attitudes to the domestic price of coal, especially in the context of the average cost of coal and electric power in S.A. industries having been estimated to be less than 3% of total cost. A realistic doubling of the price of coal would therefore add little to overall costs and, it is argued, would cause much less damage to S.A. industry and the S.A. economy as a whole than a persistent and increasing shortfall in the supply of coal for the domestic market.

- The poor stope extraction rates (as low as 40%) have been widely recognised as unnecessarily wasteful. Technologically up to 80% extraction by underground methods is possible.

- The wasteful discarding of low-margin poorer grade coal is indefensible.

- The pressure for better wages and accommodation for Blacks will be sustained.

- Coal is no longer viewed simply as furnace fodder, but as a base material for the production of sophisticated products - food, plastics, liquid fuels, gas etc.

7. Future Prospects

. 1st Half 1975	No significant change in colliery output. The higher controlled price of coal was expected to outweigh increases in expenditure in 1975 with higher profitability from steam coal sales. However, March 1975 quarter net profit is 40% down on the previous quarter! (Difficult geological conditions and late deliveries of spare parts and equipment resulted in decreased output).
. July 1975 to April 1976	Low-ash coal production has been sold to Iscor. Low-ash blend coking coal commands a high price compared with that of steam coal, and with the production and sale of this product, substantially increased profits can be expected from no.s 2 and 4 seam operations.
. April 1976	Export deliveries (for 11 years) to Japan commence. Thus an overall increase in sales of coal from No.s 2 and 4 seams is expected in the 2nd half 1976.
. Late 1977	Increased demand for metallurgical coal due to further expansion at Highveld Steel, which will exceed existing contractual maximum tonnage.

A life of mine of ± 30 years is indicated.

8. Conclusion

The coal share boom has taken off earlier than anticipated by the market. Coal, in an era of expensive energy and resource shortages, has taken on a new image. It is no longer regarded simply as furnace feed but as a base for production of sophisticated products. The large-scale entry of the oil companies into the coal industry provides the necessary catalyst for exciting developments. These factors automatically place coal in a more favourable commodity price light in the longer-term. On the short-term those collieries that are able to provide internationally scarce metallurgical coals or provide low-ash coals (by upgrading of the less profitable traditional steam coals) for export must score heavily especially as the high margins on these quality coals guarantee a more competitive performance in inflationary times. Apex is such a colliery.

9. Recommendation

Failure to act on an earlier recommendation to buy into the coal industry at 7% - 8% dividend yields represents a lost ground floor investment opportunity.

With the coal sector average currently at 5,7% D.Y., Apex at 4,8% D.Y. might appear a little expensive, but buying at current levels is still recommended on both short- and long-term growth prospects.

MINING ANALYST

SUMMARY REPORT - MINING COMPANY INTERIM RESULTS

(Plus Supplementary Tables to Assist in Equity Buying Decisions)

Last Date to Register		Dividend
Interim:	30.06.74	11,5c
Final :	13.12.74	23,5c

COMPANY: SOUTH AFRICAN MANGANESE LIMITED

Chairman: F.H.Y. Bamford

Managing Director: M.G. Wilson

Total Issued Shares (000s) 21 600 @ 20c ---- Market Cap. at 27.11.74 (410c) = R88,6m
Total Institutional Holding 30.09.74 (%) ---- Value R5,9 million
Fund X: 6,6
Total Sector Market Cap. (%) 0,50 Market Weighting
(Manganese Sector)
Total Portfolio (Institution) (%) 1,97

YEAR END: 31st December	1969	1970	1971	1972	1973	1974	1975 Est.		
E.P.S. (c)	17,77	20,42	29,23	34,87	35,77	62,24	67,20		
D.P.S. (c)	11,25	11,67	14,58	16,67	20,00	35,00	42,00		
D.P.S. Growth Over Year (%)		4	25	14	20	75	20		
E.P.S. Growth Over Year (%)						74			
D.P.S. 5-Year Growth (%)						26			
E.P.S. 5-Year Growth (%)						29			
Div. Cover	1,58	1,75	2,00	2,09	1,79	1,78	1,60		
INTERIM:									
E.P.S. (c)					16,20	24,42			
% Of Year E.P.S.					45	39			
D.P.S. (c)					8,75	11,5			
% Growth Over 6 Mths D.P.S.						31			

Nature of Business: Owns and mines extensive deposits of manganese ore in the Postmasburg - Kuruman districts of the Northern Cape.

Date	Comments:
August '74	Equity Buying List - Max. Buying Price 400c. Well Managed, Consistant growth record. Iscor making merger overtures. Decisions: Decision deferred until Bamford sounded out.

ESTMENTS ANALYSIS

INSTITUTION'S EQUITY BUYING LIST - MINING SECTOR

COMPANY	YEAR END	MARKET CAPITAL-ISATION (RM)	MARKET VALUE OF INSTITUTION'S HOLDING (RM)	% OF EQUITY	1974/5 PRICES (C)		MAXIMUM BUYING PRICE (C)	YIELDS ON MAXIMUM BUYING PRICE				COMP. DIV. GROWTH (%)			DIVIDEND (C)		E.P.S. (C)		RETURN RE-QUIRED (%)
								CURRENT		PROSPECTIVE		LAST 10 YEARS	LAST 5 YEARS	FORE-CAST 5 YRS	LAST	FORE-CAST	LAST	FORE-CAST	
					HIGH	LOW		DY (%)	P/E	DY (%)	P/E								
ING																			
. Mang	12/74	91,8	6,1	6,6	520	300	400	8,75	6,4	10,5	5,9		+ 26	+10	35	42	62,2	67,2	15
ns Natal	6/74	40,2	1,4	3,6	167	90	83	8,4	6,0				+ 1	+ 5	7,0		13,7		13
MONDS																			
mint	12/73	230	11,0	4,8	4500	2300	3700	6,5	15,1	7,6	12,1	+12,5	+ 12	+ 7	240	280	244	304	13
Beers	12/73	920	27,6	3,0	525	240	370	6,6	5,6	6,6	6,2	+12,5	+ 13	+ 7	24,5	24,5	66,5	60	13
. FINANCE																			
los	12/73	637	50,0	7,9	840	445	487	4,9	12,2	9,1	9,5	+ 9	+ 11	+ 9	24	28	40,0	51	13
olo	12/73	998,8	5,9	0,6	6400	3450	3225	4,5	17,0	7,75	9,3	+ 6	+ 21	+ 6	145	250	190	345	13
lo-Vaal	6/74	51,7	1,6	3,0	2860	1000	1450	5,2	6,3	6,2		+ 7	+ 8,5	+10	75	90	231	270	15
t Prefs.		11	0,4	3,6	1200	500	870	(50% Anglo-Vaal + 80c)							47,5	55			
. Min.	12/73	145,1	5,2	3,6	4100	2450	3000	4,0	18,9	7,0	10,3	+ 5,5	+ 11	+ 9	120	210	159	290	15
. Myn.	12/73	49,5	0,3	0,6	780	370	540	(20% Gen. Min. Less 10%)											
.S.A.	6/74	640,3	12,8	2,0	5550	3200	3600	4,2	17,8	6,25	12,0			+ 8	150	225	203	300	13
nnies	6/74	133,0	2,3	1,8	4100	1600	2400	5,6	7,8	6,25	7,5	+ 7	+ 7	+ 9	135	150	306	320	14
d. Sel.	9/74	489,2	13,2	2,7	1850	980	1400	5,0	13,3	5,75	10,2	+ 5,5	+ 10	+ 9	70	80	105	137	13
. Lands	9/74	69,4	1,4	2,1	2000	900	1050	5,25	10,4	5,7		+17	+ 30	+10	55	60	100,6	134	14
on Corp.	12/73	421,2	17,6	4,2	760	405	670	3,6	7,2	6,25	10,3	+ 9	+ 17	+10	24	42	43	65	15
PPER																			
amin	12/73	215	6,2	2,9	1425	795	750	17,0	5,1				+ 14		127,5		146		

INVESTMENTS ANALYSIS

13TH JUNE, 1973

SECTOR BREAKDOWN OF ORDINARY SHARES QUOTED ON J.S.E. (MARKET CAPITALIZATION)

COMPARISON BETWEEN TOTAL MARKET (1963 AND 1973) AND INSTITUTION'S HOLDINGS

SECTION	MARKET CAPITALISATION AT 30.03.1973		MARKET CAPITALISATION AT 31.03.1963		INSTITUTION'S ORDINARY SHAREHOLDINGS AT 30.03.1973 *		INSTITUTION'S UNIT TRUST ORDINARY SHAREHOLDINGS AT 30.03.1972	
	SECTOR TOTALS (R000)	% OF TOTAL	SECTOR TOTALS (R000)	% OF TOTAL	SECTOR TOTALS (R000)	% OF TOTAL	SECTOR TOTALS (R000)	% OF TOTAL
Mining - Gold	3 676 731	15,57	1 657 603	27,61	5 621	1,46		
Mining - Coal	160 554	0,68	177 138	2,95	755	0,20	714	1,39
Mining - Diamond	3 546 105	15,02	572 706	9,54	92 427	24,02	4 576	8,94
Mining - Copper	734 448	3,11	)		12 484	3,24		
Mining - Manganese	113 384	0,48	)		6 311	1,64		
Mining - Platinum	434 942	1,84	) 519 544	8,65	42	0,01		
Mining - Tin	17 998	0,08	)					
Mining - Other Mineral	69 677	0,30	)					
Mining - Finance	4 993 331	21,15	1 491 731	24,85	122 535	31,83	5 312	10,38
Industrial Finance	1 758 530	7,45	215 282	3,59	38 961	10,12	7 406	14,47
Mutual Fund Management	34 425	0,15						
Investment Trust	219 989	0,93	45 249	0,75	7 784	2,02	790	1,54
Insurance	440 818	1,87	1 073	0,02				
Property	613 067	2,60	8 489	0,14	939	0,24		
Beverage and Hotel	435 864	1,85	98 149	1,63	11 412	2,97	4 504	8,80
Building and Allied	535 007	2,27	137 791	2,30	7 949	2,07	930	1,82
Chemical	394 489	1,67			5 809	1,51	559	1,09
Clothing and Knitwear	134 117	0,57	66 505	1,11	905	0,24	1 028	2,01
Fishing	142 763	0,60	)		755	0,20		
			) 214 066	3,57				
Food	413 835	1,75	)		14 461	3,76	4 273	8,35
Footwear and Leather	22 448	0,10						
Furniture and Appliances	182 029	0,77	10 748	0,18	296	0,08	1 379	2,69
Iron, Steel, Engineering	732 141	3,10	225 885	3,76	9 556	2,48	3 208	6,27
Motor and Transport	362 019	1,53	53 339	0,89	1 486	0,38	2 597	5,08
Paper, Pulp, Packaging	317 507	1,34	126 635	2,11	4 913	1,28	54	0,11
Pharmaceutical	98 931	0,42			4 167	1,08	453	0,89
Printing and Publishing	84 838	0,36			3 134	0,81	825	1,61
Stores	495 397	2,10			3 349	0,87	4 191	8,19
Sugar	266 687	1,13			8 470	2,20		
Textile, Carpet	129 854	0,55			597	0,16	1 044	2,04
Tobacco and Match	370 570	1,57	52 643	0,88	2 261	0,59	4 221	8,25
Wholesale and Retail	80 054	0,34	121 966	2,03	228	0,06	735	1,44
General	94 704	0,40	49 876	0,83	1 303	0,34		
Banks	1 500 135	6,35	157 270	2,62	15 945	4,14	2 375	4,64
TOTAL	23 607 388	100,00	6 003 688	100,00	384 855	100,00	51 174	100,00

* Consisting of holdings of ordinary shares of the Institution, Fund X, Fund Y and Pension Fund.

NOTE: In 1963 certain sectors were combined e.g. Stores with Wholesale and Retail.

NEWS REVIEW, TECHNICAL CHARTS, STATISTICS

AND FORECASTING FOR WEEKLY INVESTMENT MEETING

INVESTMENTS DIVISION

REVIEW AT 31ST JANUARY, 1975

INTERNATIONAL EVENTS OF IMPORTANCE

Gold and International Monetary Affairs

28th Fourcade, French Finance Minister

- Called for a return to fixed parities, pointing out that generalised floating although 'in vogue' amongst finance ministers will not reassure people.
- Forecast U.S.A. will revalue gold stocks before end of 1975.
- Stated that the dollar was no longer a reserve currency and it must be replaced in the system by S.D.R.S. and major trading currencies.

24th I.M.F. $6b Recycling Fund

Kuwait's oil and finance minister doubts whether the I.M.F. will raise the money because

- Western estimates of oil exporters surpluses of $60b far too high, being based on today's oil prices but ignoring ± 20% increase (1973) and over 25% (1974) in prices of imports.
- Interest rate offered on funds too low.

N.B. - Kuwait will use half $7b 1975 oil surplus on domestic budget and after grants to non-oil Arab countries and to Africa will have little left to recycle.

- Gatt reports that potential of Arab countries to import capital goods was seriously underestimated. Exports to Arabs of 7 industrial nations in first 6 months of 1974 were 58% higher at $12b.

Interest Rates and Monetary Policy

24th Bank of England reduced minimum lending rate to 11% from 11,25%.

24th U.S. Budget

Simon, U.S. Treasury Secretary, outlined June 1975 to June 1976. Spending $348b, receipts $298b, deficit $50b biggest in peacetime (compared with estimated $35b to June 1975). Increase in national debt of $109b to June 1976.

Borrowing 1975

Direct Government $70b, Federal Agencies $10b, new corporate issues $30b (1974 $25b). U.S. Government will be raising more new money in 1975 than all borrowers in 1974, therefore one must question whether decline in interest rates will continue.

25th Bank of Montreal lowering Prime Lending rate from 10,5% to 9,75%. Bank of America reduced prime rate from 10% to 9,5%.

28th U.S. Treasury Bill rate fell to 5,8% from 6,4% - lowest since February 16th 1973.

29th Belgium cut Bank rate from 8,75% to 8,25%.

30th Chase Manhattan cut its prime rate from 9,5% to 9%.

Oil Price Freeze

27th OPEC reached virtual agreement to freeze the price of oil for 1975 and then raise it by 80 - 90% of industrial countries inflation for two years; after that the price would fully reflect any increase in cost of imports.

N.B. Industrial countries now have vested interest in high oil price to protect their own huge energy programmes against dumping of cheap oil.

Currencies

Following large U.S. deficit 1974 $3,1b (1973 $1,3b; 1972 $6,4b) and huge German surplus (1974 50,7b DM; 1973 33,0b DM) the U.S. dollar was very weak on exchange markets.

27th Swiss imposed further restrictions on forward dealings in Swiss francs. Most commentators, however, regard Dollar's weakness as temporary and see a steady revival over the year.

SOUTH AFRICAN EVENTS OF IMPORTANCE

27th Rand Adjusted Upwards Against the $ from 1,45 to 1,47 (+1,38%)
History of Managed Float Started on 30th June, 1974

21.06.1974	R = $1,5		11.09.1974	R = $1,43	+ 0,7%
13.08.1974	R = $1,47	-2%	08.11.1974	R = $1,44	+ 0,7%
17.08.1974	R = $1,45	-1,4%	18.11.1974	R = $1,45	+ 0,7%
05.09.1974	R = $1,42	-2%	27.01.1975	R = $1,47	+ 1,4%

27th Diederichs promised to review problem of joint taxation of married couples.

27th Zambia decided to stop using Mombasa for imports and exports and has made alternative plans to reroute 30 000 tons of stranded imports through Tanzania.

29th Post Office Announced Increased Rates to Take Effect from 1st April

Faced with deficit of R6,2 million 1973-4, R11 million 1974-5, Minister hopes to raise R37,8 million in 1975-6, an increase in revenue of 7,64% over 1974-5 of R442 million. Main increases are:

- 28,5% Increase in trunk calls
- 16,6% Increase in telephone rentals
- 50% Rise in telegram rates
- Substantial increases in postal rates for newspapers and magazines.

Mine Labour

Threat of strikes by white mine labourers demanding a 5 instead of 5,5 day week. De Beers announced that it was employing less migrant black labour at its Kimberley mines.

29th U.N. Commissioner for Namibia announced that he would seize exports from S.W.A. unless there were clear signs of negotiations with S.A. on freedom and independence for S.W.A.

30th Report of Stellenbosch Bureau of Economic Research

Levelling off which occurred in the economy in third quarter of 1974 continued into fourth quarter and can be expected to continue into the first quarter of 1975. Most firms still consider trade to be satisfactory so decline in activity not serious.

Western Province Manufacturing Firms Experience in 4th Quarter 1974 Compared with 3rd

Orders - 30%. Delivery periods - 19%. Stocks of finished goods +56%. Stocks of raw materials + 21%. Sales +9%. Volume of production + 7%.
A 7% overall decline in business conditions.

Main Comments

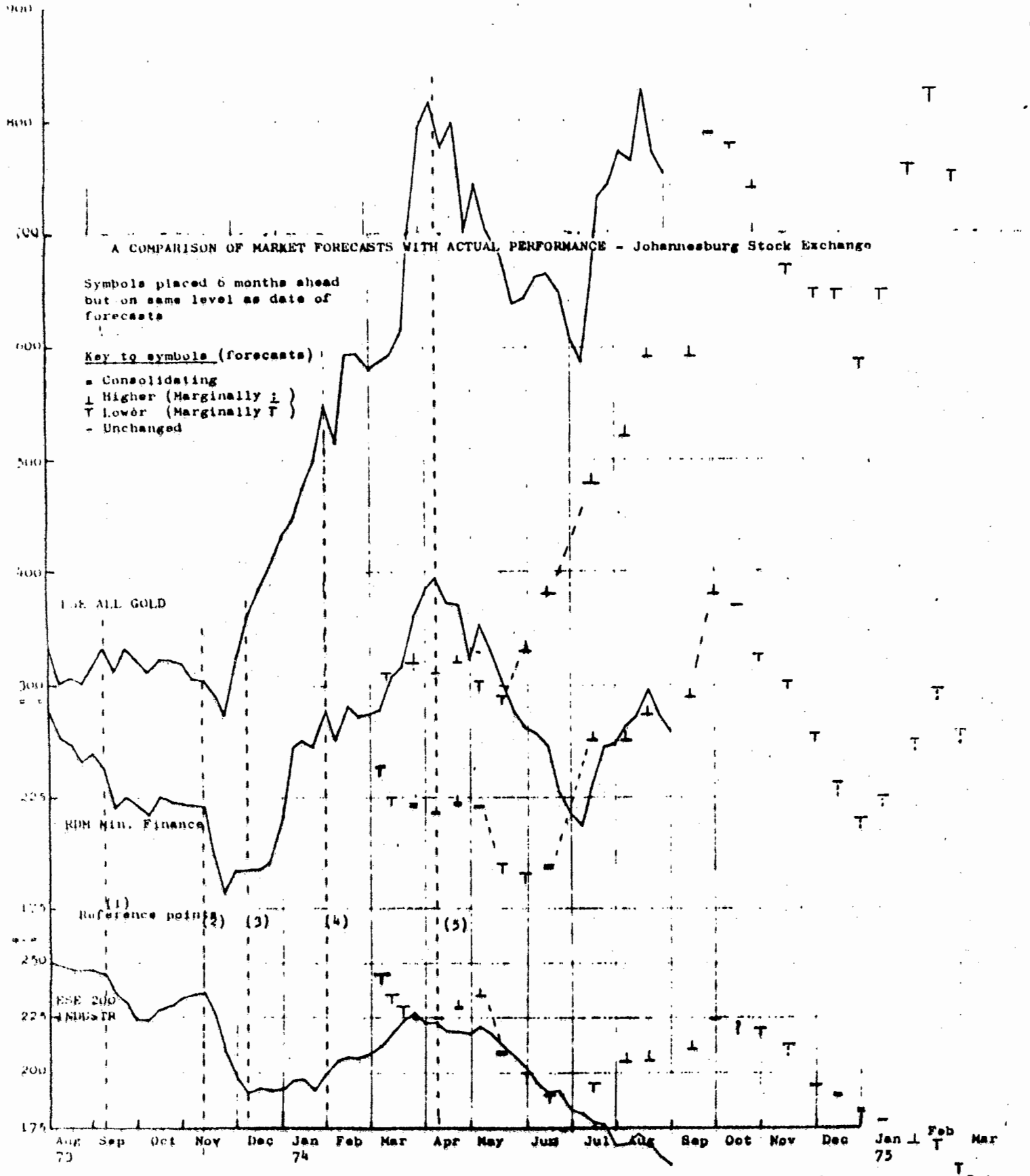
- Cooling off will ease bottlenecks and may avert danger of demand inflation being superimposed on cost inflation.
- Floor for gold price $153.
- Country's visible trade balance will improve with imports rising less sharply.
- Decreases in short term interest rates and to a lesser extent long term rates can be expected in first quarter with consequent pick up in property market and residential construction.

Worst feature was acceleration in buying and selling prices despite slowing in economy.

INVESTMENTS ANALYSIS	STATISTICS FOR WEEKLY INVESTMENT MEETING								31ST JANUARY, 1975
SHARE MARKETS	HIGH		LOW		6 MONTHS AGO	LAST WEEK	THIS WEEK	FORECAST 6 MONTHS AGO	D.Y.	E.Y.
U.K. (FT.)	543	May '72	146	Jan '75	263	197,1	235,0		8,3	22,7
U.S.A. (DOW JONES)	1051	Jan '73	578	Dec '74	788	656,8	706,0		5,4	
RHODESIA (INDUST.)	355	Aug '74	293	Jan '75	338	293,3	299,1		5,8	10,3
S.A. GOLD (RDM.)	460	Aug '74	176	Nov '73	433	327,0	339,9	LOWER	7,7	
MINING FINANCE	330	Nov '74	172	Nov '73	259	208,2	223,7	MARG. EASIER	5,9	8,9
INDUSTRIALS (RDM.)	292	Jul '73	154,4	Oct '74	189	183,2	199,6	FIRMER	8,1 (FM)	22,0 (FM)
INTEREST RATES	HIGH		LOW		6 MONTHS AGO	LAST WEEK	THIS WEEK	FORECAST 6 MONTHS AGO	DATE CHANGED	
LONG										
U.K.	16,5	Jan '75	5,5	Sep '63		15,3	13,7			
U.S.A.						6,24	6,25			
RHODESIA (GILT)	6,5		6,25	(1968)	6,5	6,5	6,5			
S.A. (GILT)	9,5	Jan '75	8,05	Jan '74	9,25	9,5	9,5	9,5	Dec '74	
S.A. (SEMI-GILT)	10,75	Aug '74	8,03	Jan '74	10,25	10,75	10,75	10,5	Dec '74	
S.A. (AAA DEBENTURES)					11,5	13	13	13,5	Jan '75	
SHORT (90 DAY NCDS)										
U.K. (CDS)						11,6	11,8			
U.S.A. (TREAS. BILLS)			5,606	Jan '75		6,4	5,606			
RHODESIA (NCD)					3,65	4,5	4,5			
S.A. (NCD)					11	9,5 - 10,5	10,5 - 11,25		Jan '74	
EURODOLLER (90 DAY)	14,125	Aug '74	7,875 - 8,375	Jan '75	12,875	8,375 - 8,875	7,75 - 8,25			
	HIGH		LOW		6 MONTHS AGO	LAST WEEK	THIS WEEK	FORECAST 6 MONTHS AGO	ANNUAL % CHANGE	
GOLD PRICE $	198	Dec '74	129	Jul '74	141	174	177,25	120 - 160 (Dissent 150 - 180)		
COMMODITY INDEX	1480	Feb '74	1134,5	Jan '75	1292	1135	1102			
GOLD AND FOREIGN EXCHANGE RESERVES	1254,5	Jul '73	729	Aug '74	763	716	726			
MONEY AND NEAR MONEY (DEFLATED ANNUAL % CHANGE)	14,6	Sep '73	1,8	Sep '74	4,7 Jul '74	6,1 Oct '74	8,3 Nov '74			

REAL GROWTH (GNP)	5 YEAR AVERAGE (1968 - 1972)	1973	1974	1973 (I)	1973 (II)	1974 (I)	1974 (II)	FORECAST - 1975
U.S.A.		5,9	-2,2	6,9	2,7	-2,75		-2,0
U.K.		5,4	-0,5	8,4	0,4	-6,0	4,5	1,75
FRANCE		6,1	4,75	6,9	5,5	4,75	4,5	3,0
GERMANY		5,3	-0,4	6,0	4,5	1,5	-0,5	2,5
ITALY		5,4	4,75	4,2	9,8	2,5	0	-0,25
JAPAN		10,3	-3,25	12,9	3,1	-6,5	4,5	2,0
TOTAL OECD		6,5	0,25	8,1	3,0	-1,5	2,75	0,5
RHODESIA (GDP)		10,1						
SOUTH AFRICA (GDP)		4,1	7,0					4

INFLATION (CPI)	5 YEAR AVERAGE (1968 - 1972)	1973	1974	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	FORECAST 1975
U.S.A.	4,9	8,8	12,2	11,8	11,1	12,1	12,2	12,1	12,2	10,0
U.K.	7,4	8,6	17,75					18,3		18,0
FRANCE	6,4	7,3	15,5					14,9		11,5
GERMANY	4,5	7,2	7,0				6,5	7,1	5,9	6,75
ITALY	4,7	10,8	25,25					24,7		14,5
JAPAN	6,5	11,8	26,75					25,8		11,5
TOTAL OECD		7,2	15,5					14,6		11,0
RHODESIA (EUROPEANS)		3,6		8,6	8,7	8,9	8,6			
SOUTH AFRICA	4,6	9,5	11,6		13,2	13,8	13,6	13,6	14,1	10,0
U.S.A.										



Ref. point	General comment	Forecasts: GOLDS	MIN. FINANCIALS	INDUSTRIALS	Date
1.	First Meeting 7 Sep 73	Uncertain	Continued drift	Continuing weakness	
2.	Prior to big sell out(Industrials)	Weaker	Consolidation	Firmer	9 Nov 73
3.	Bottom of Industrial Market	Remaining firm	Steady at curr levels	Weaker	7 Dec 73
4.	First dissenting views (AS & SDM)	Firmer	Firmer	Slightly firmer (Dies: Drifting)	1 Feb 74
5.	All markets topping out	Firm	Firmer	Unchanged	5 Apr 74