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MINE PLANNING-II

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AK Sir

Mine Planning

- open pit planning
- U/G planning

Open pit planning process

Any planning has 3 stages:-

Project Stage
↓
Planning Stage
↓
Plan detail and Certainty

→ **Project Stage** → ⊛ Includes conceptual study of the project.
⊛ Once conceptual study is over, pre-feasibility study is done.
⊛ Feasibility study (Study on own)
⊛ Long Range and production planning

Assignment

Study of a feasibility Report of any mining project

→ **Planning stage** → There are sub-stages of this stage.

(a) Strategic Planning

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(b) Strategic planning and Long Range planning
(c) Strategic planning and Short Range planning

→ Plan detail and Certainty

Strategic planning:

Strategic mine planning seeks to answer how best to develop an ore body in support of the objective of maximizing net present value. It establishes the potential project value on the basis of :-

(i) identifying what material is to be mined through pit limit analysis (deciding the shape and extent of the final pit)

(ii) Defining the optimal mining sequence (determining the order in which to mine the material)

(iii) Defining the destination for each portion of rock mined (identifying if material is waste or ore and the process stream if ore)

(iv) Establishing the rate at which the deposit should be mined and processed. (Selecting

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the production rate and mine life)

Planning System Interactions

- Strategic planning
  - Pit analysis
  - Production Rate
  - Reclamation principle
  - Cut - off grade
  - Scheduled mining
- Long Range planning
  - Detailed mine plan
    - Layout site
    - Selection of equipment
    - functional mine design
    - Scheduled mining
    - Equipment Requirements
- Short Range planning
  - 12 - month plan
  - monthly plan
  - weekly plan
  - Daily plan

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Strategic planning

↓

Assumed production capacity on the basis modelled resource

↓

Perform pit analysis (cost factor also considered)

↓

Redefine Production rate

↓

Evaluate cut-off grade and development of reclamation principle simultaneously

↓

Mining scheduling

↓

Financial Evaluation

↓

financial viability

NO → Strategic planning

YES → Long Range planning

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Mine planning phases

- → Conceptual study
- → Preliminary or pre-feasibility study
- → Feasibility study

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The planning stage commonly involves 3 stages:-

(i) Conceptual Study → It represents the transformation of a project into a broad investment proposition. Capital and operating cost are usually approximate ratio ~~using~~ ~~to~~ estimate using historical data. The preparation of such a study ~~cost estimate~~ is normally the work of one or 2 engineers. The findings are reported as a preliminary valuation.

(ii) Stage 2 (Pre-feasibility Study) → It is an intermediate level exercise, normally not suitable before an investment decision. It has the objective of determining whether the project concept justify a detailed analysis by a feasibility study and whether any aspects of the project are critical to its viability and necessitate in depth investigation through functional or ~~to~~ support study.

(iii) Feasibility Study → It provides a definitive, technical, environ-

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mental and commercial base before an investment decision. It uses iterative process to optimise all critical elements of the project. It identifies the production capacity, technology, investment and production cost, sales revenue and return on investment.

Conceptual study → 0.1 to 0.3 percent of the total project cost.

pre-feasibility study → 0.2 to 0.8 percent of the total project cost.

feasibility study → 0.5 to 1.5 % of the total project cost.

Content of pre-feasibility study report:

1.) Aim → what knowledge is being sought about the property and ~~by which~~ for guidance ~~and~~ in exploration spending for major feasibility study

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Page _____

2.) Concept → Describes very briefly where the property is located, what is proposed or assumed to be done in the course of production, how this may be achieved and what is done with the product

3.) Findings → Comprise a summary, preferably in sequencid and mainly tabular form of the important figures and observations from all the remaining sections

4.) Ore tonnage and grade → Details of the quality and quantity of the ore tonnage.

5.) Mining and production Schedule → It tabulates the mining program including pre-production work.

6.) Capital Cost Estimate → Tabulates the cost to bring the property to production from the time of writing including the cost of further exploration, research and studies.

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7.) Operating Cost Estimate → Tabulates the cash costs of mining activity, other equipment, ancillary services, administration, etc.

8.) Revenue Estimate → It records the metal or product price, states the realization terms and costs and calculates the net return at the point of disposal.

9.) Financing and tax data → It states that what financing assumptions have been made, all equity, debt or mixes of both, together with the ~~interest~~ interest and repayment terms of loan.

10.) Cash flow Schedules → It presents one or more year by year projections of cash ~~mov~~ movement, in and out of the project.

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Page _____

Content of the feasibility report :-

Functions of feasibility report :-

1.) To provide a comprehensive framework of established and detailed facts concerning the mineral projects.

2.) To present an appropriate ~~stude~~ scheme of exploitation ~~rdid~~ with designs and equipment list taken to a degree of detailed ~~and~~ sufficient for accurate prediction of cost of results.

3.) To indicate to the project owner and other interested party, the likely profitability of investment in the project if equipped and operated as the report specifies.

4.) To provide this information in a form ~~&~~ intelligible to the owner and suitable for presentation to prospective partners or source of ~~f~~ finance.

The ~~D~~ important requirements for valuation and feasibility

reports are:-

1) Reports must be easily to read and their information must be easily accessible.

2) Part of the report need to be read and understood by non-technical people.

It is divided into:-

Layer 1
Layer 2
Layer 3

} Read from Hustrulid chapter 1 and 2

[RK Sir]

Feasibility Report

It is stated in a document why certain options are accepted and why certain options are rejected.

It is a document which projects the:-

- Technically viable options
- Economically and financially feasible option (It should give a return more than the investment and among all options, the selected option should give the maximum return)

objective

- Guideline for undertaking a project (till desired level of production, till desired level of profit is reached)
- Determining the suitability to finance the project (Determines whether the project is worth investing or not)
- Adressing all related aspects of the project.

ex.) Suppose the project is technically and financially good but

1) There is resistance from the land owners, then the project fails

2) The project has an environmental hazard, the project fails.

The financial institution checks whether:

1) The return is adequate or not

2) The project is risky or safe (depends on technical viability of the option)

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Page _____

Project Planning Team:

→ Team leader (Highly qualified and highly experienced person who guides the team and who can ensure that the project gets through at the various levels of scrutiny. He should have a good finance knowledge along with technical)
→ Underground mining specialist
→ Opencast mining specialist
→ Electrical and Mechanical Engineer
→ Civil Engineer
→ Mineral/Coal preparation Engineer
→ Specialist with the knowledge of railways transport system → He is either a railway employ brought on deputation or a company employ who is experienced in this manner. He has the following options:- 1> Designs the railway sidings 2> Designs the loading and evacuation arrangements
→ Finance and Cost specialist

He should be able to assess
1> The current rate of various inputs
2> The consumption rate of inputs
3> The escalation rate of the inputs from today to the date of implementation

Stages of preparing the project feasibility report:-

→ Conceptual Note
→ Pre-feasibility Report
→ Draft feasibility report
→ Feasibility report

Stages of approval for the feasibility Report:-

→ Internal planning team
→ Company Board (outside director, govt directors, representatives of state and railway board)
→ Financial Institution – For funding
→ Ministry of Environment → Public hearing
→ Forestry clearance
→ In case of govt. Companies
→ IMG (Inter-Ministrial group)
→ PIB (Public investment board)

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Preparation and approval of feasibility Report

Process of preparation of feasibility Report

The Conceptual note enumerates / gives a broad outline of:-

1.) Reserve, Geology - in Brief

2.) Daily and annual rate of production. (Estimated)

3.) Proposed Mining alternatives →

All alternatives are examined and the advantages and disadvantages of each is discussed. Then it is stated in detail, why certain alternatives are accepted and why the other alternatives are rejected

ex.) Suppose the alternatives are

- O/C
  - Manual
  - Mechanized
  - semi - mechanized
  - Shovel - Dumper
  - dragline
  - In pit crusher
  - In Mine dumping
- U/G
  - BEP
    - Manual
    - mechanized
    - Sublevel caving
  - L.W.

4.) Relative techno - economic ~~cost~~ merit

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of each alternative → Then a techno-economic study of all feasible alternatives is worked out. We look into 3 matters:

1.) Investment
2.) ~~Cost~~ Cost of production
3.) level of production

Note:- while estimating the cost the entire mine is not taken into consideration. Only the cost in a district/panel is considered since all other costs are common in all alternatives.

ex.) Suppose the conditions are as follows:-

→ 2 - 3.5 m thickness of coal seam
→ 100 - 300 m depth
→ 1 in 4 or less gradient

Then the feasible ~~f~~ and equally viable options are

- Longwall
- Mechanized B&P

So we perform a techno-economic study for both the alternatives.

5.) Mine Entry [affected by HFL (safety); geo mining conditions (technical); and production rate (economic aspect)]

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6.) Mine transport [affected by operating conditions (dip, depth, size of entry), production rate, cost per ton of ore]

ex) Options.

- Conveyor
  - H. Duty
  - light Duty

  (It is suitable for large scale continuous production)
- Haulage (Ruled out if ~~gradient more than 1 in 20~~ production is high like 1000 tpd) Very
- Locomotives (Ruled out if gradient is more than 1 in 20)

The option which gives the required production rate with the lowest cost per ton of ore is selected.

7.) Mineral Evacuation System → Commonly the railways or Merry-go-round system.

Merry-go-round system → Customers have suffered a lot due to railways so the merry-go-round system was introduced. It is a captive railway system dedicated for the purpose of transport from mine to plant. It is highly beneficial, reliable and dependable for mineral transportation to the plants from the mines.

8.) Mineral Beneficiation → we look into the requirement of the customer and the price advantage we can get.

ex.) while washing coal for steel plants, the tailings having ash content < 34%

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After a ~~draft~~ conceptual note has been ~~corrected and prepared~~ discussed a pre feasibility report is prepared. It gives a further detailing of conceptual note. The mistakes of conceptual note is corrected. The ~~fea~~ pre-feasibility report is ~~again~~ ~~to~~ again discussed among the previously mentioned personnels (double check). Certain things are accepted and certain things are not ~~again~~ accepted. These ~~the~~ things are served with one and again corrected (with alternatives) and a draft feasibility report is prepared. The draft report is discussed ~~only~~ ~~the~~ at the higher level ~~and~~, among the company directors and the directors of the planning organization. They are the people who have to defend the report when the ~~pro~~ report is sent to the financial and other institutions for approvals. If they have any doubt or reservation in any matter, they may ~~ask~~ ~~for~~ enquire into ~~the~~ these matters and ask for the required changes to be made. The draft report

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is like the pre-final examination after which the changes that the directors recommend are made and the final feasibility report is prepared / made.

Process of approval:-

After the feasibility report has been prepared for the project, the project needs to be approved at various levels. The planners have a difficult time getting the feasibility report passed through the various levels of approvals. The approval is basically a financial and administrative clearance which gives:-

→ financial sanction

→ go ahead signal to implement the project.

This process takes 2-3 years of time.

The report is first approved by the Internal planning team (Directors of the planning Company). Following which the project needs to be approved by the Company board which includes the outside directors, government directors, representatives of railway and state boards (In case of CIL, this

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includes the CMPDIL Board, Coal Company Board, CIL board).

Often it is found that ~~share~~ loan capital is cheaper than share capital. In such cases we go to the financial institutions for fundings. Based on the feasibility report, the required financial assistance is gained from the finance institution. The project then needs the approval of the ministry of environment. The ministry of environment looks into all the parameters of environmental impact; mitigation and Management; forestry (flora and fauna). The approval has to pass through a process of public hearing. This public hearing is chaired by the district Magistrate and representatives of the State pollution Board, the local NGO(s) and representatives of the local population and the general public which may participate in the hearing process.

This public hearing often turns into a nuisance and the NGO(s) take leverage of it and set forth a lot of requirements to be fulfilled.

Furthermore a forestry clearance is required. For a forestry clearance the following

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matters are looked into:-

→ loss of wildlife

→ loss of forest growth (plants)

→ ~~resettlement and~~ Resettlement and rehabilitation

These losses are to be duly compensated and besides this compensatory forest area is to be alloted.

Additionally in case of government projects (SCCL, NLC, etc) the report has to go through the IMG (Inter-Ministrial group). It consists of the secretaries of ~~Mins~~ Ministries who hear and discuss the report for grant of clearance. The approval is signed by the Minister and finally the report goes for the ~~F~~ approval from the public Investment board (PIB) under the department of revenue, Ministry of finance. ~~It~~ It signs the approval and funds/financially supports the project.

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were transported to powerplants at distances 7,000 Km. This proved to be beneficial and profitable ~~to~~ many coal mines.

9.) Broad Financial Parameter → we look into the Investment and the cost of production and ~~lastly~~ the profit. The idea is whether the ~~p~~ whole process is worthwhile or whether the project is to be scraped.

The conceptual note is circulated among:—

→ Planning team (Planners)
→ Head of the Various departments } (Producers)
→ Production managers (Field) }
→ DGMS (Safety team)

The preparer of the conceptual note has to defend this ~~pla~~ note from the above mentioned personnels.

Then ~~and~~ ~~some minutes are drawn from the discussion~~

the conceptual note is discussed and certain parts are accepted and certain parts are not accepted. ~~They~~ For the parts not accepted, the reasons are stated and the alternatives are discussed. Then some minutes are drawn out from these discussions and we go forward for the preparation of the prefeasibility report.

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