

Introduction to Mine Economics and Management

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Course?level overview – suitable for undergraduate mining engineering or mineral economics students

1. Why Mine Economics Matters

Aspect	What It Involves	Why It’s Important
Resource valuation	Estimating the economic worth of a mineral deposit.	Determines if a project is worth pursuing.
Investment decision making	Capital budgeting, feasibility studies, risk analysis.	Guides shareholders, lenders, and government approvals.
Operational efficiency	Cost control, production scheduling, optimization.	Directly affects profitability and competitiveness.
Sustainability & community	Environmental, social, and governance (ESG) considerations.	Influences long?term license to operate and market access.

2. Core Economic Concepts in Mining

Concept	Definition	Typical Mining Application
Net Present Value (NPV)	Present value of cash inflows minus outflows, discounted at a chosen rate.	Primary metric for project acceptance.
Internal Rate of Return (IRR)	Discount rate that makes NPV = 0.	Used to compare projects of different sizes/timelines.
Payback Period	Time required for cumulative cash flow to become positive.	Quick screening tool for high?risk projects.
Cash Flow Statement	Record of cash in/outflows (operating, investing, financing).	Basis for NPV/IRR calculations.
Sensitivity & Scenario Analysis	Varying key parameters (price, grade, cost) to see effect on NPV/IRR.	Highlights critical risk drivers.
Monte?Carlo Simulation	Repeated random sampling of input variables to generate probability distributions of outcomes.	Quantifies overall project risk.

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3. The Mining Project Management (Economic Lens)

1. Exploration & Resource Definition

- Cost categories: drilling, geophysics, geochemistry, data modeling.
- Economic output: Resource estimate (tonnage, grade) ? Preliminary Economic Assessment (PEA).

2. Pre-Feasibility Study (PFS)

- Scope: Conceptual mine design, preliminary cost estimate, early NPV/IRR.
- Goal: Decide whether to advance to detailed study.

3. Feasibility Study (FS)

- Scope: Detailed mine plan, process design, complete cost estimate (CAPEX, OPEX), financial model.
- Deliverables: Definitive NPV, IRR, sensitivity tables, risk register.

4. Construction / Development

- Capital outlay (CAPEX) execution, schedule control, cost variance tracking.
- Economic focus: Managing overruns, securing financing.

5. Operation (Production Phase)

- OPEX management: mining, processing, labor, energy, consumables.
- Production scheduling, grade control, waste handling, reclamation budgeting.

6. Closure & Reclamation

- De-commissioning costs, post-closure monitoring, financial assurance (bond).
 - Economic impact: Final cash flow, legacy liabilities.
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4. Cost Structure in Mining

Cost Type

Typical Components

Timing

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CAPEX (Capital Expenditure)	Mine development, equipment purchase, infrastructure (roads, power, water), process plant, tailings facility.	Upfront (pre-production).
OPEX (Operating Expenditure)	- <i>Mining</i> : drilling, blasting, loading, haulage. - <i>Processing</i> : grinding	