

International approaches to mining projects: Due Diligence, Scoping, Pre-Feasibility, Feasibility Studies



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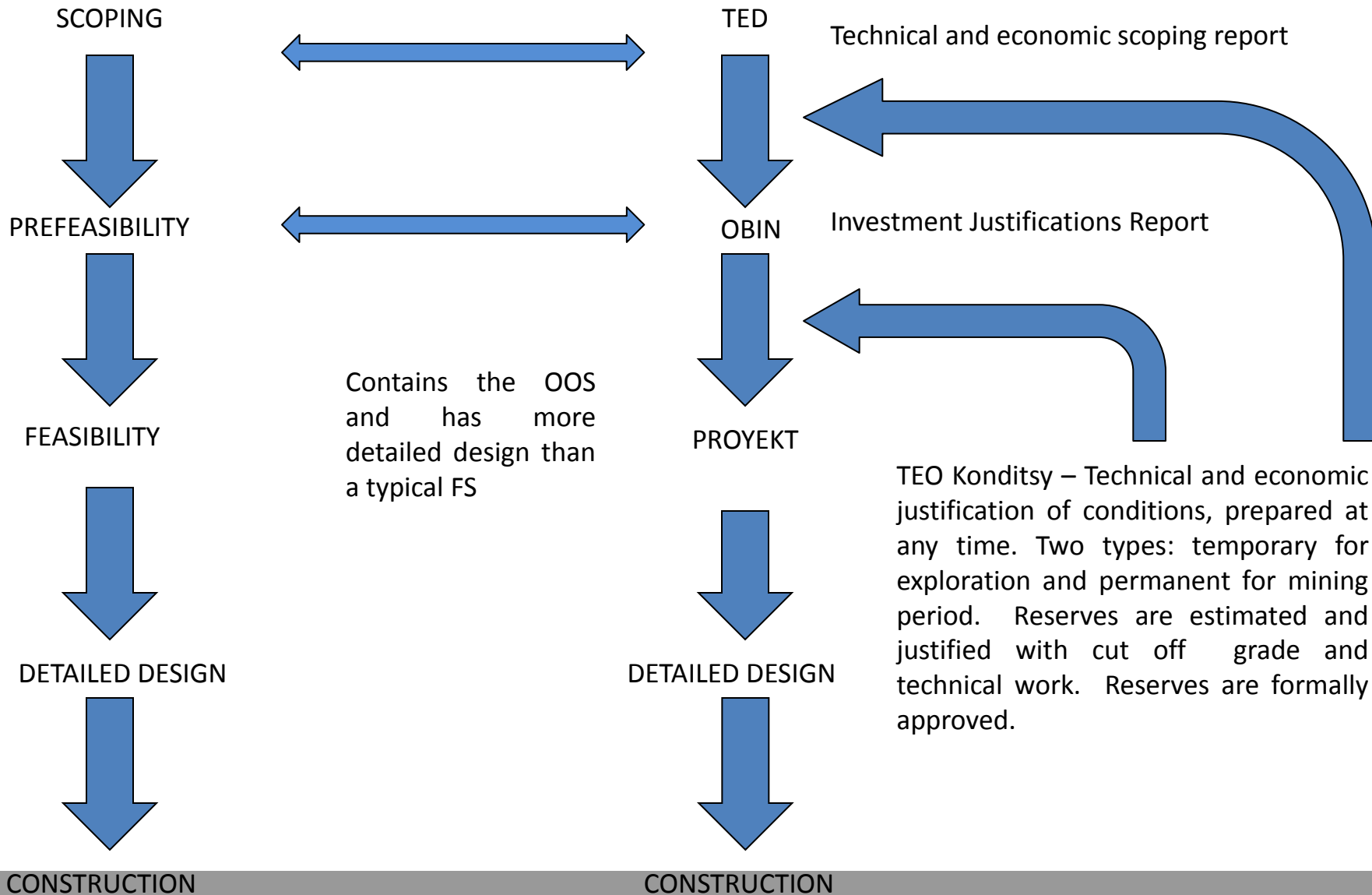
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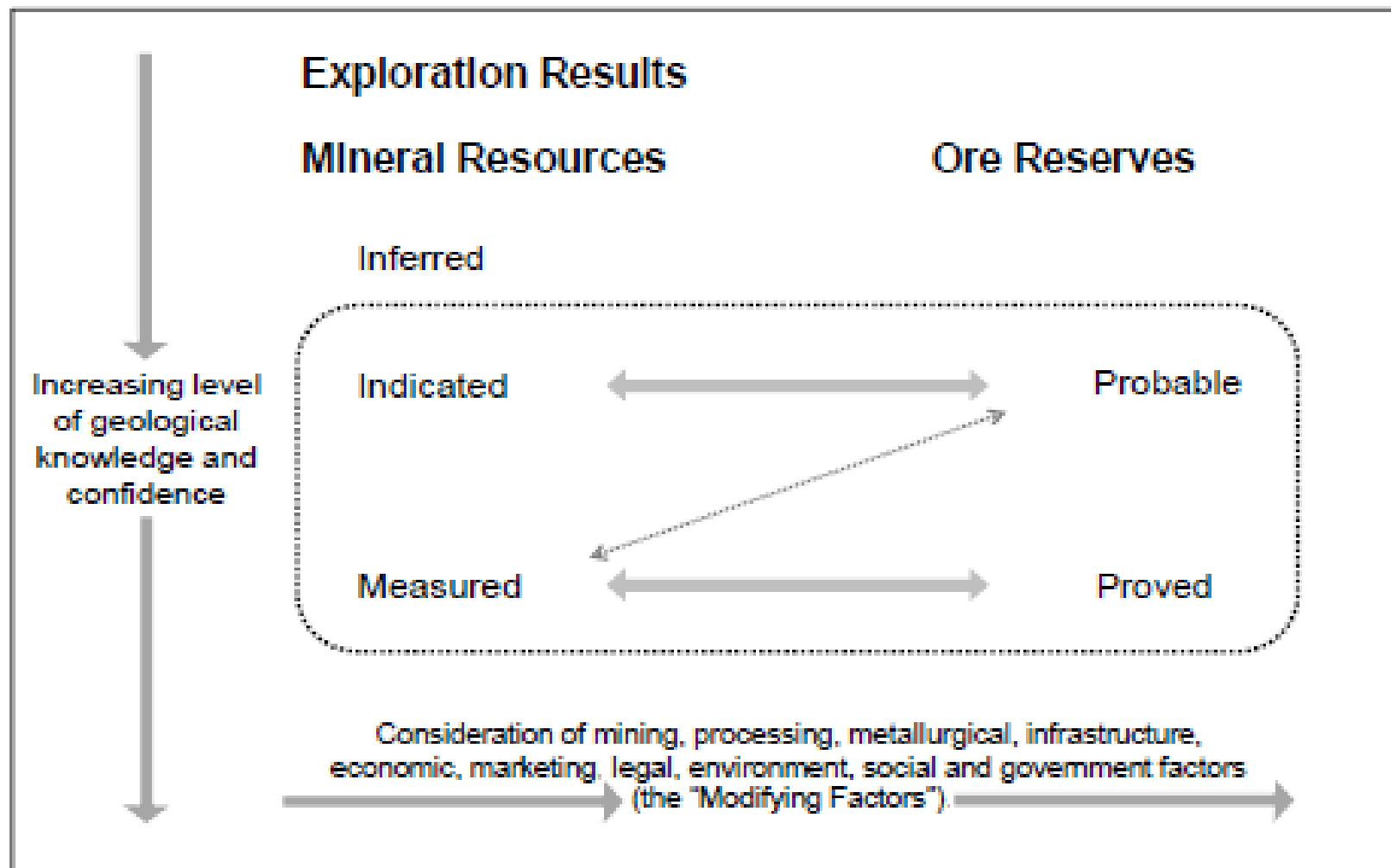
Overview

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- Hydrogeology
- Processing
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- Tailings
- Environmental
- Economics
- Types of analysis
- Key problems

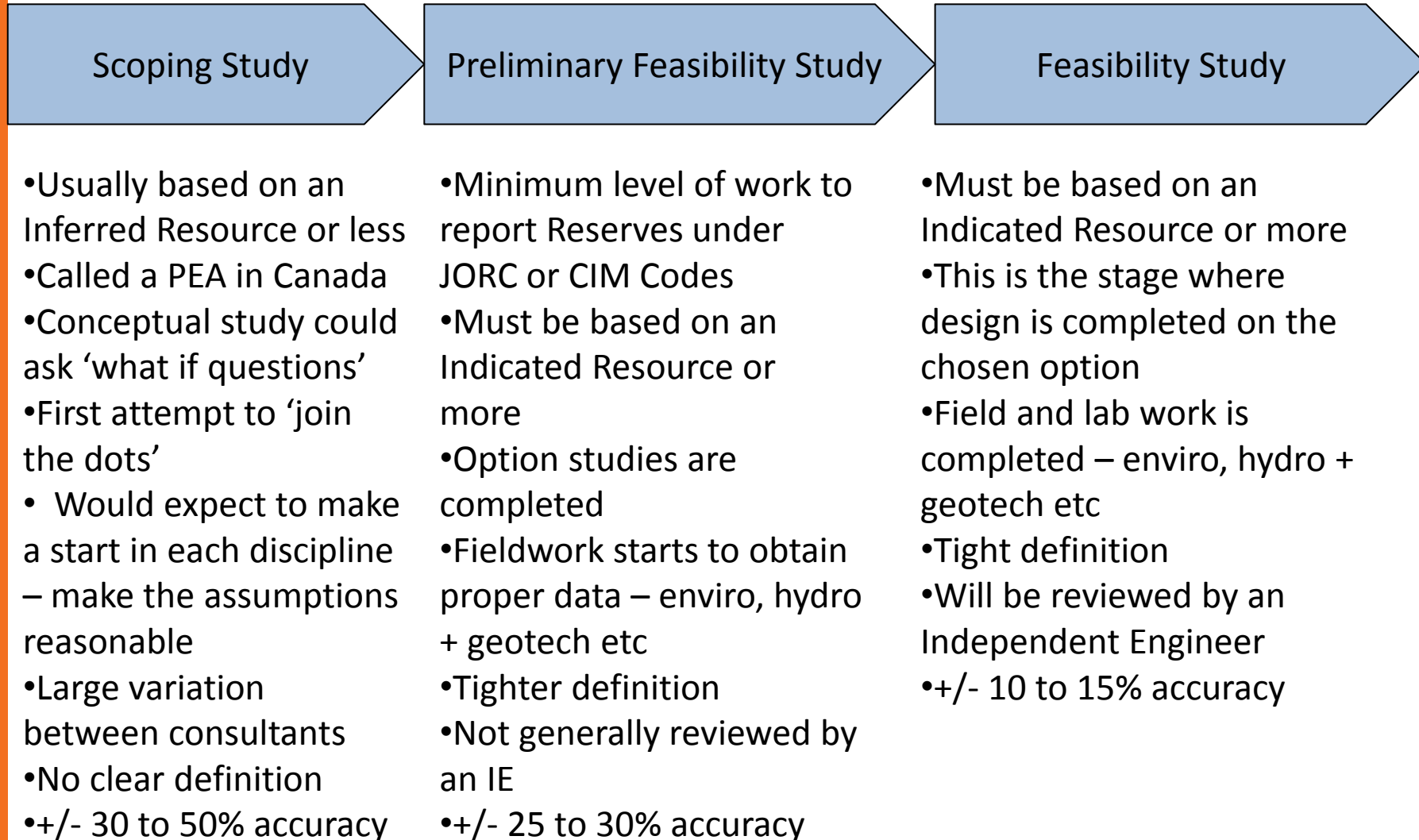
Comparison of Technical Studies



Mineral Resources and Ore Reserves



Key Features of Project Development Stages



First question to ask is 'is there any Indicated?'

What is “Feasibility Study”?

- “a comprehensive study of a deposit in which all geological, engineering, operating, economic and other relevant factors are considered in sufficient detail that it could reasonably serve as the basis for a final decision by a financial institution to finance the development of the deposit for mineral production (NI 43-101).
- On a mining project only Measured and Indicated Resources are used. No inferred is generally included in the base case. It is sometimes included to demonstrate potential

What is a Bankable Feasibility Study?

- No such thing
- It is the project that becomes bankable when it has permits, offtake agreements, ECPM contract etc
- The bank decides what is 'bankable'
- What people mean when they say BFS is a bankable level study
- For SRK there should be not be much difference between what we do for an FS and a BFS – only in environmental matters
- Bankability generally requires an ESIA prepared in accordance with the World Bank Guidelines / IFC performance standards
- Banks want a detailed study that has a proper audit trail
- Not all banks are signed up to the Equator Principles - China



If it says Bankable Feasibility Study on the front and weights less than 1kg, it probably isn't at a bankable level

Geology

- Geology Competent Person classifies the Resource
- Scoping Study (SS): Review of available data, preliminary resource model. Develop the exploration programme, recommendations.
- Require Measured and Indicated Resources for FS / PFS
- A FS may have more up to date drilling results and a revised geological model
- To verify the project economics it is necessary to be able to model the annual production schedule with reasonable accuracy.
- If an annual schedule mines a small part of several polygons each year and if the grades within these polygons varies then the schedule is unlikely to be accurate. If the project is marginal then the CP may judge that accuracy of geological modelling is insufficient for declaring reserves.
- To determine the mining method and to estimate mining losses and dilution, the geological model needs to be sufficiently detailed to determine the variability of width, continuity of ore bodies, the grade of any dilution.

Geotechnical

- FS and international approaches are similar
 - SS: Review of available data, possible site visit, core logging based on photos, limited preliminary analysis and reporting
 - PFS requires a preliminary assessment of - some fieldwork, laboratory tests and analysis is needed. Similar to the TEO Konditsy approach but less detailed.
 - An FS requires a detailed assessment in the same way as a Projekt.
- Technical approach – small differences in protocols.
- International studies focus on local details and rock quality and use computerised software to assess the appropriateness of the design
- CP needs to consider if the slope angle, selection of mining method or mine design parameters are likely to change when more data is collected and a more detailed analysis is done. Are these changes likely to be material?



Mining

- SS would include review of available data, possible site visit, preliminary analysis and reporting, assumptions, mine design option 1, production schedule developed on a transparent basis, cost estimate on the basis of Infomine database or similar projects
- PFS would include an option study and require the annual production schedule and cost estimates for the selected option. This follows the TEO Konditsy approach.
- An FS would be a more detailed design and would probably involve advanced planning software such as XPAC. The Project would typically require 'norms' to be followed.
- Work would typically include:
 - Open Pit: definition of pit limits, detailed mine design including ramps, equipment selection, definition of modifying factors to match the equipment used, production schedule, equipment requirements and costs
 - Underground: selection of mining method, dimensions of stable stopes and pillars, selection of ground support, definition of modifying factors to match the mining method
- Does not have to be optimal, but does need to be reasonable.
- Issues to consider:
 - Mine design must reflect the variability in geology
 - Modifying factors need to be supported

Level of detail that is acceptable depends on project type

Hydrogeology

- Scoping: Review of data, possible site visit, limited preliminary analysis and reporting
- PFS: Drilling on site, logging, sample collection, laboratory testwork, intermediate analysis and reporting
- FS: More drilling, logging, sample collection, laboratory testwork, final analysis and reporting



Processing

- SS would include indicative flowsheet designed and costed. Review of data, some testwork (bottle rolls / batch tests) preliminary analysis and reporting. Infomine for costs.
- PFS normally requires more process and tailings design work than a TEO Konditsy. Requires work on the flowsheet and costing that wouldn't normally be part of a Konditsy.
 - Establishment of probable flow sheet from preliminary test work data; major process flow diagrams; initial determinations of material and heat balances
 - Estimates for unit rates and quantified estimates with some factoring
 - Estimates from historic factors, percentages and vendor quotes based on materials volumes
- The design work for the Proyekt requirements is very similar to FS. The key difference is the way the study is presented.



Tailings

- Scoping: Review of data, possible site visit, limited preliminary analysis and reporting
- PFS: Site selection study, possibly start drilling on site, logging, sample collection, laboratory testwork, intermediate analysis and reporting
- FS: Detailed design on chosen option. More drilling, logging, sample collection, laboratory testwork, final analysis and reporting



Environmental and Social

- SS includes review of available data, site visit, identification of key issues and reporting. Inputs data collection is started
- PFS requires substantially more environmental work than a TEO Konditsy. Requires a scan and baseline work that wouldn't normally be part of a Konditsy eg Public consultation.
- The OVOS work for the Proyekt requirement is similar to FS (there are significant differences) and would be sufficient to cover the JORC reporting of Reserves requirement.



Local and international studies may be significantly different.
CP must decide if environmental issues are material

Financial

- SS includes a generalized model to “join the dots”
- The analysis of cash flows in a TEO Konditsy or Proyekt tends to be less detailed than PFS / FS.
 - Needs annual cashflows based on production schedule
 - Models equipment purchases (new, sustaining, replacement)

Calculation of NPV is sensitive to annual cashflow

Important to estimate initial capital investment, time until initial production and annual cashflows

Greater detail may be needed for marginal projects



Purpose of a Review

To verify the key facts and projections used to enable an investment decision to be made

- Resource-Reserve audit for annual reporting
- Stock exchange listing (CPR) – to raise money
- Debt finance – check if the Feasibility study is prepared to a Bankable level
- Merger & Acquisition – what are we buying?
- Internal investment decision – should we invest in the new project?
- Business Improvement – technical or operational, save costs, improve efficiency

Needs to clearly communicate:

- Available information
- Checks done by the reviewer
- Limitations in the work done
- Reviewer's opinion on the confidence of the projections
- Risks & opportunities
- Any proposed adjustments

Report must be written in clear and simple language

- Avoid jargon,
- Focus on materiality

Competent Persons Report (CPR)

- Objective: to enable investors to understand the:
 - “facts” & projections
 - Orebody type, operational challenges (location, climate, etc.), Mining method, processing method operational capacity, licence details
 - Resource-reserve estimate; Production schedule; Capital investment projections
 - confidence in the company’s statements (conservative / optimistic / aggressive)
 - Produced to present a plan for which finance is sought
 - risks & opportunities (equity investors need to know this) :
 - ensure probability & impact are clearly communicated
 - Risks should ideally be quantified to demonstrate if material or not
- Best for clients to under promise / over deliver to build investor confidence
 - Advise client if projections are unlikely to be achieved
- NPV calculation may not be made public
- Report
 - Long form report: more detailed analysis shown to the client and other advisers but not included in the Listing Particulars
 - Short form report: summarised version of key facts included in Listing particulars
 - Wording often negotiated
 - Whilst / However / But
- CPR should agree with statements in rest of Listing Particulars
 - Need to review rest of LP
 - Client usually has to adopt SRK adjustments

Debt finance

- Similar to CPR but more focused on risks
 - Need to assign value to material risks
 - Adjustments to the FS / LoMp are normally a key deliverable for banks considering debt
 - Key issue is always the FS or LoMp. Are they bankable?
 - A revision to the LoMp may be required
 - Technical improvements / extra work may be necessary
 - No interest in upside
- Bankers apply stress tests
 - Ability to repay debts when prices lower / costs higher / production rates lower/later
 - Mine life > reserves +30%
 - Focused on the confidence in the initial years
 - Project economics may have a bearing on the borrowing costs

M & A

- More focused on scenarios – what issues do the mines have?
Eg dilution, declining grades etc
 - Base Case (targets own projections)
 - Upside
 - Synergy
- Need to assign a value to risks & opportunities
- Results likely to be shared with target to explain reasons for any difference in valuation
 - Model needs to be self-explanatory
 - Parameters need to be obvious and easy to change
 - Be aware of too many parameters changing – final figure changes and reduces confidence in the model.

Internal Investment Decision

- Can be riskier eg client who wants to build a mine based on an inferred resource
- Key objective is to validate the methodology and assumptions used
 - Have the alternatives been considered (including do nothing)?
 - Are the parameters reasonable?
 - Is the method of attributing impact reasonable?
 - If there are alternative solutions the valuation should consider the NPV of each alternative
 - Have the full impact on costs been considered?

Key Issues Encountered from Reviews (1)

- Part of the deposit lies outside the licenced area for extraction. There is no excuse for this.
- The FS or LoMp is been generated without the PFS stage and therefore no option studies have been carried out. Option studies are vital in order to extract the most value from a project.
- SRK disagrees with the Resource estimate. Eg the technical work may not follow the JORC Code even though the author claims that it is. Independent reviews of JORC estimates are vital
- SRK disagrees Reserve estimate. Eg consultants preparing estimates for dilution have no experience of that type of mining. Experienced and qualified professionals should be used
- Head office strategic mine plan has no reflection of the reality at that site. A good life of mine plan should be prepared in consultation with site staff.
- Life of mine plan has a schedule of tonnes and grade but no capital to support it. In order to report reserves there has to be plan detailed to a PFS level.
- Change in ore type eg oxide to sulphide does not have sufficient provisions in the model. Changes need to be planned for.
- LoMp not detailed enough to present development / preparation works required to start the project. Some consultants prepare documents labelled 'bankable' when they are not.

Key Issues Encountered from Reviews (2)

- Costs are not based on quotes or are in a format that cannot be audited. For a project to be considered 'bankable' there must be an audit trail on all data.
- Financial model is not detailed enough to support project financing. The loan payback period needs to be presented monthly or quarterly.
- Metallurgical testwork is not representative of the orebody. In order to design the process flowsheet, the samples must reflect the material that will be processed.
- Insufficient site base fieldwork has been carried out to support the design work. Significant geological, geotechnical, hydrogeological and geochemical fieldwork needs to be completed to support an FS or LoMp
- Project not compliant with local or international environmental laws / best practices. Lenders are highly sensitive to environmental and social issues even if local laws are not broken.



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