MICA
Minerals Intelligence Capacity Analysis

FACT SHEET

Feasibility Study

A Feasibility Study (of a mine proposal) is an evaluation of a proposed mining project to determine whether the mineral resource can be mined economically

Scope (conceptual model & main characteristics)

A Feasibility Study (of a mine proposal) is an evaluation of a proposed mining project to determine whether the mineral resource can be mined economically. A Feasibility Study is usually based on the most attractive option for the project as determined by relevant studies which normally include: orebody size and quality, geotechnical, mining, mineral processing, mine waste disposal, environmental and social options. The aim of the study is to remove all significant uncertainties and to present the relevant information with supporting material in a concise and accessible way. The Feasibility Study has a number of key objectives:

- to demonstrate with reasonable confidence that the project can be constructed and operated in a technically sound and economically viable manner;
- to provide a basis for detailed design and construction; and
- to enable the raising of finance for the project from banks or other sources.

CRIRSCO defines a feasibility study as a comprehensive technical and economic study of the selected development option for a mineral project that includes appropriately detailed assessments of applicable Modifying Factors together with any other relevant operational factors and detailed financial analysis that are necessary to demonstrate at the time of reporting that extraction is reasonably justified (economically mineable). The results of the study may reasonably serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project. Financial projections are typically presented with an accuracy of ± 10%.

Contexts of use, application fields	-> contexts (e.g., environmental, economic, social assessment) -> which types of stakeholder questions are concerned? -> link to published studies that implement the method

A Feasibility Study is an economic assessment of a proposed (mining) project. A Feasibility Study will provide the basis for securing investment capital and will outline the preferred engineering option and budget for the project.

Input parameters	-> which parameters are needed to run the method

See next section

Type(s) of related input data or knowledge needed and their possible source(s)	-> which types of data are needed to run the method, from which sources could they come… -> could be qualitative data or quantitative data, and also tacit knowledge, hybrid, etc.

A Feasibility Study would normally require studies of the following topics:

1. An ***Ore Reserve Statement*** (a statement of the ore reserves and resources, calculated using a CRIRSCO aligned code).
2. A report on the proposed mining method including geotechnical considerations including a schedule of the mining equipment and supplies (fuel, explosives, cement, aggregate etc.) required for the operation.
3. A hydrogeological report assessing groundwater issues in the area of the proposed mine and the impact that the mine may have on these resources and other users of the resource.
4. A report on the proposed method of processing the mined ore including a schedule of the plant and supplies (reagents etc.).
5. A mining schedule for the life of the mine – more detailed for the first two years of production.
6. A report on tailings and other mine waste disposal proposals.
7. Rights required – planning, mining and environmental permits
8. Land access issues.
9. Construction considerations.
10. Infrastructure required – including transport, power, accommodation.

11. Environment matters – including mitigative measures to be taken to eliminate or reduce any environmental impacts.
12. Resource usage – including manpower and water.
13. Social issues – including 'Social Licence to Operate'.
14. A viable ***Closure Plan*** and financial sureties to ensure its implementation including early closure for whatever reason.
15. Market studies for the commodity under consideration.
16. Economic evaluation and analysis including assumptions and cash flow projections.

Normally engineering design would be carried out to 60%

Model used (if any, geological mathematical, heuristic…)	-> e.g., geological model for mapping -> e.g., mathematical model such as mass balancing, matrix inversion, can be stepwise such as agent -based models, dynamic including time or quasidynamic specifying time series… -> can also be a scenario

The modelling processes involved in a feasibility study uses:

geological modelling;
mine modelling; and
economic modelling;

to assess the potential for viable extraction of the proposed commodity.

System and/or parameters considered	-> **the system can be described by its boundaries**. These can refer to a geographic location, like a country, or a city, the time period involved, products, materials, processes etc. involved, like flows and stocks of copper, or the cradle-to-grave chain of a cell phone, or the car fleet, or the construction sector, or the whole economy… -> **parameters** could possibly refer to geographic co-ordinates, scale, commodities considered, genesis of ore deposits and others…

The system considered comprises the physical extent of the deposit, the proposed extraction and processing methods, the natural environment of the region and the social context within which the deposit is located. This system must be considered within the parameters of the specific commodities available and their economic outlook.

Time / Space / Resolution /Accuracy / Plausibility…	-> to which spatio-temporal domain it applies, with which resolution and/or accuracy (e.g., near future, EU 28, 1 year, country/regional/local level…) -> for foresight methods can also be plausibility, legitimacy and credibility…

Feasibility studies focus on the near future temporal domain as they are limited by current and near future technology for extraction and short to medium term future economic projections for specific commodities.

Rule of Thumb confidence intervals for technical studies (at assumed 90% confidence) **Noppé 2014**			
Measure/Item	**Scoping Study (PEA)**	**Pre-feasibility study**	**Final feasibility study**
Cost accuracy	± 25%-50%	± 15%-25%	± 10%-15%
Cost contingency	30-50%	15-30%	<15%
Proportion of engineering complete	<5%	<20%	<50%
Resource categories	Mostly Inferred	Mostly Indicated	Measured and Indicated
Reserve categories	None	Mostly Probable	Proved and Probable
Mining method	Assumed	General	Optimised
Mine design	None or high-level conceptual	Preliminary mine plan and schedule	Detailed mine plan and schedule
Scheduling	Annual approximation	3-monthly to annual	Monthly for much of payback period
Risk tolerance	High	Medium	Low

Indicators / Outputs / Units	-> this refers to what the method is actually meant for. Units are an important part but that is most of the time not sufficient to express the meaning. For example, **the indicators used in LCA express the cradle-to-grave environmental impacts of a product or service**. This can be expressed in kg CO_2-equivalent. But also in €. Or in millipoints. Or in m^2year land use. -> for foresight methods the outputs are products or processes

Feasibility studies provide a number of economic metrics including:

- Net present value (NPV)
- Internal rate of return (IRR)
- Return on investment(ROI) – as a percentage of the original capital outlay
- Payback (time to recover the initial capital outlay)

These are then used by an investor or developer as a guide to making an investment decision or to guide further studies so that decision to invest may be made.

Treatment of uncertainty, verification, validation	-> evaluation of the uncertainty related to this method, how it can be calculated/estimated

Feasibility studies are carried out by appropriately qualified persons, resulting in verification and validation. For example, ore body estimation is covered by various international reporting codes for mineral resources, e.g NI 43-101, JORC and PERC. Specific caveats surrounding predictive methods address the uncertainties involved in the process.

Main publications / references	-> e.g. , ILCD handbook on LCA, standards (e.g. , ISO) -> can include reference to websites/pages -> references to be entered with their DOI

http://inspire.ec.europa.eu/codelist/ExplorationResultValue/feasibilityStudyForMiningDecision

CRIRSCO (Committee for Mineral Reserves Internatioanl Reporting Standards), was formed in 1994 under the auspices of the Council of Mining and Metallurgical Institutes (CMMI) and is a grouping of representatives of organisations that are responsible for developing mineral reporting codes and guidelines in Australasia (JORC), Brazil (CBRR), Canada (CIM), Chile (National Committee), Europe (PERC), Kazakhstan (KAZRCA), Mongolia (MPIGM), Russia (NAEN), South Africa (SAMREC) and the USA (SME).
http://www.crirsco.com
Noppé, M.A. 2014. Communicating confidence in Mineral Resources and Mineral Reserves. Jour. Sth. African Inst. Min. Metall. Vol. 114. p213-222.

Related methods	-> List of comparable methods, their particularities… -> link to one or several other existing fact sheet(s)

Related methods include block modelling, economic forecasting and mine engineering.

Some examples of operational tools (CAUTION, this list is not exhaustive)	-> e.g., software… Only give a listing and a reference (publication, website/page…) -> **should be provided only if ALL main actors are properly cited**

Spreadsheet software.

Key relevant contacts	-> list of relevant **types** of organisations that could provide further expertise and help with the methods described above.

Consultants, CRIRSCO and their associated aligned code organisations, stock exchanges, and bankers.