CHAPTER 2

Basis of Studies

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Basis of Studies

Studies form the fundamental basis for the progressive decision to invest in developing potential projects. Although the capital, operating and business cost estimates form a major part of the economic evaluation to justify the next phase of exploration, investigation and development, the estimates are *not* the sole purpose for producing a study.

The objectives of each phase of a study differ and are driven by the process objectives shown in Figure 2.1.

As has been noted in Chapter 1 (Table 1.1, a generic study classification guide), various names are used for the different study phases. Therefore, for clarity, the names used in subsequent discussion are shown in Figure 2.1.

Scoping studies are required in the exploration and development stages to justify continued investment. As shown by Figure 2.1, a scoping study is usually followed by one or more prefeasibility studies that reflect the increasing level of technical and economic knowledge gained during earlier stages. These studies then culminate in a final feasibility study that demonstrates the technical and economic feasibility of the project with sufficient certainty to allow a decision to develop the mine.

The objectives of the cost estimates differ for each study shown on Figure 2.1, as described below.

SCOPING STUDY

The scoping study report should establish:

- the potential of the new or expanded business opportunity
- the likelihood that the investment will meet the company's sustainability criteria
- the likelihood that the potential project will meet the company's strategic development policy
- general features of the opportunity
- the range of potential cases to be studied in the next phase
- key business drivers for the opportunity
- potential fatal flaws that may prevent the successful execution and operation of the project
- major risks in executing and operating the project
- the order of magnitude of the costs of the opportunity (both capital and operating)
- technical issues requiring further investigation
- cost of, and time for, further development work needed to complete a prefeasibility study
- the work plan covering the resources, personnel and services required to undertake further work on the opportunity.

PREFEASIBILITY STUDY

The primary reasons for carrying out prefeasibility studies are that they:

- Form a basis for making substantial commitments to a major exploration program following a successful preliminary program. For example, where reserves cannot be proven by surface drilling or where large metallurgical samples are required, a shaft or decline may be developed at an early state of the project. For a world-class project, the cost of a prefeasibility study alone can exceed $100 M.

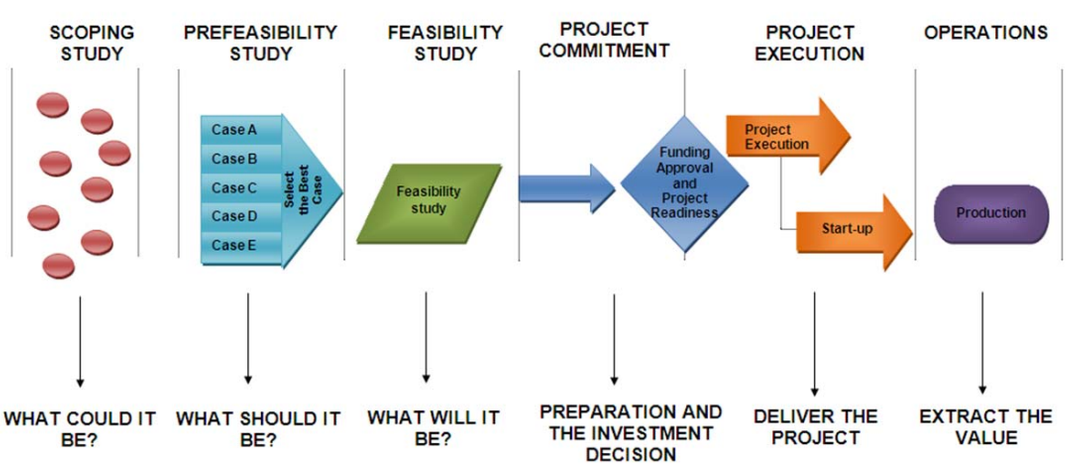

FIG 2.1 - Progress of studies.

- Develop various alternatives and options of project size, configuration, technology, layout and locations. This allows the most viable and best risk-to-reward profile to be selected as the recommended business case going forward to the feasibility study phase.
- Attract a buyer or a joint venture partner to the project, or to form the basis for a major underwriting to raise the required risk capital. A prefeasibility study may also be prepared in full or in part by potential purchasers as part of their due diligence.
- Justify proceeding to a final feasibility study.

The prefeasibility study report should establish, describe and where relevant, recommend:

- likely technical and economic viability of the various opportunities that have been studied
- whether the alternatives considered and the recommended case will meet the company's sustainability criteria
- whether the recommended case will meet the company's strategic development policy
- a ranking of the options available and the option to be studied in the feasibility study
- the preferred optimum mining, process, location, size, layout and project configuration case for the feasibility study
- the optimum capacity case to form the basis for the feasibility study
- the features of the recommended project business case
- the costs and time to develop the project following completion of the feasibility study
- whether there are fatal flaws in the project configuration
- the risk profile of the recommended project configuration related to the key business drivers
- a work plan for the feasibility study including the requirements for further geological, mining, metallurgical, environmental and marketing work
- the resources, services, costs and time required to complete the feasibility study work (as part of the work plan).

FEASIBILITY STUDY

The final feasibility study should be based on the most viable and best reward-for-risk alternative for the project as determined by the prefeasibility study. The feasibility study aims to remove all significant uncertainties and present relevant information with backup material in a concise and accessible way. The final feasibility study has three objectives:

1. demonstrate within a reasonable confidence that the project can be constructed and operated in a technically sound and economically viable manner
2. provide a basis for project delivery including the detailed design and construction
3. enable raising finance for the project from banks, equity funds or other sources.

The feasibility study should:

- demonstrate the technical and economic viability of the business opportunity based on the proposed project as presented in the feasibility study
- report whether the recommended business case will meet the company's sustainability criteria and strategic development policy
- develop only one configuration and investment case and make a clear recommendation for the project execution phase
- define the scope, quality, cost and time of the proposed project
- demonstrate whether the project scope has been fully optimised to ensure the most efficient and productive use of the capital invested, Mineral Resource and human resources applied to the project
- quantitatively assess the risk profile of the proposed project
- ensure no residual or future issues could significantly affect the assessment set out in the feasibility study
- plan the project execution phase of the proposed project and establish a management plan for the operations phase
- provide baselines for the management, control, monitoring and reporting of the proposed execution of the project
- define the basis of equity and/or debt provisions for the project, where appropriate
- deliver a feasibility study report in accordance with these standards
- define the project commitment process between the end of the feasibility study and project approval
- provide the work plan, resources, costs and schedule for any early works to be undertaken prior to project approval.

BANKABLE QUALITY FEASIBILITY STUDY

A feasibility study of bankable quality should have the following features:

- control baseline – can be used as a control baseline for management of the project
- general optimisation – achieved a final stage where technical and commercial elements have generally been optimised
- independent engineer sign-off – can be audited, reviewed and signed off by the lender's independent engineers
- loan basis – capable of forming a project establishment document under loan agreements entered into by debt providers
- risk allocation – sufficient to allow the project equity and debt providers to assess and allocate the risk of implementing and operating the project

- stand-alone status – able to fully describe the project in regards to resource, progress technology, scope, quality, costs and time
- trackable basis – all aspects of the study report can be tracked back to validated and fundamental bases of calculation
- low likelihood of variation – not likely to be varied materially after the project has been committed.

The owners, consultants or engineer preparing a feasibility study can make it of 'bankable' quality, but whether debt providers will lend investment funds depends on the quality of the investment case and ultimately on the quality of the orebody. No amount of effort in creating a report will substitute for a quality orebody and a thorough study.

DEFINITIVE ESTIMATES

A further stage of the cost estimating process, which is not shown on Figure 2.1, is the optional definitive estimate. This is completed after project approval and during a project's execution phase. The basis of definitive estimates and the related definitive schedules are described below.

Basis

Owners and implementation contractors traditionally use definitive estimates and the related definitive schedules as a project management control device during the implementation phase of the project. On the other hand, corporate and financial management have different views as to the use and needs for definitive estimate.

This section presents not only the process and procedures typically followed during the preparation of definitive estimates and schedules, but also the issues from a management perspective. The quality and the basis of definitive estimates are presented in more detail in Chapter 4 – Capital Cost Estimation.

Objectives

The objectives of preparing a definitive estimate are to:

- revalidate (or not) the cost estimate and schedules used for the project investment decisions
- ensure management and stakeholders are fully informed with the best advice on the forecast project outcomes
- allow management to direct the project to adjust the scope, approach, quality and timing of the project to bring the forecast outcomes (ie the definitive estimate and schedule) back to the original investment decision baselines
- allow management to cancel the project at a point when the costs of cancellation are still less than the costs of completion
- allow management to release or reduce reserve, supplementary or corporate contingency funds, originally set aside at the investment decision
- provide a more accurate set of cost and schedule baselines to manage the future work
- allow the project to reset the control budget and control schedule to the definitive estimate, if approved by the owners' corporate management
- provide the owners' corporate management with auditable advice so they can make authoritative public and private statements to shareholders, stakeholders and lenders that the project is on (or off) budget and schedule
- provide the owners' corporate management with sufficiently secure, validated information so they can commit to (take or pay) supply agreements and to product sales agreements
- provide the owners' corporate management information to reset the cash flow requirements of the project and its start-up phase
- allow the owners' corporate management sufficient information to renegotiate any lending arrangements, account for revisions to cost, supplementary or reserve funds, cash flows and schedule, if necessary.

Approach

The recommended approach to creating any definitive estimate is as follows:

- A definitive estimate should be an integrated estimate of the capital; operating costs; and the time to complete construction, commissioning and ramp-up of the project.
- A definitive estimate must present a developed and documented scope of work (the project) intended to be delivered. In particular, the scope of work description should be able to track any discrete item or system through its quality and performance definition by the procurement method, and hence to the capital cost and construction schedule items. As a result, a definitive estimate (for costs and schedule) should be prepared at a detailed individual work item level. The estimate should be presented at equipment or work package level and be able to be summarised to subarea, system or area levels as needed.
- Any project scope changes, adopted after the point of approval of the investment decision, should be documented in the definitive estimate report.
- The quality and performance parameters of the project should be presented along with a description of any changes approved or adopted since the date of the investment decision.
- The documents used to derive the definitive estimate and schedule must be fully referenced in the definitive estimate report and must note the document source and revision code basis.
- A copy of each document used at the revision status stated must be separately available and held securely and separately from other project documents.

- A definitive estimate and schedule must be capable of being independently audited by non-project personnel without the need for explanation or clarification provided by the personnel who prepared the definitive estimate.
- For each work item in the cost estimates and schedules, there must be a trackable path to the source data used in the estimate and the schedule.
- The basis of estimate and schedule should be presented with a commentary on any differences between them and the basis of estimate used for the estimates approved at the investment decision point.
- The definitive estimate and schedule should report on and reconcile any differences to the investment decision estimates and provide commentary on the differences.
- In particular, the transfers of costs from capital to operation costs or vice versa must be clearly described.
- Definitive estimates and schedules are required to be as accurate as possible and reflect the most likely outcomes. Typically, a probability factor of P50 applied to Monte Carlo simulation results is used to determine the final contingency. A higher level of uncertainty, for example P80, assumes a reserve 80 per cent of the simulated risk.
- The use of design or growth allowances within definitive estimates should not be needed, and hence should be excluded unless areas of design have not yet commenced. Similarly, ill-defined, generalised or large provisional or prime cost (PC) sums must not be used if a definitive estimate is to be considered valid.
- The definitive estimate of capital cost should contain appropriate and well-developed contingency provisions; again this is only appropriate for a P50 outcome.
- The definitive estimate must present an accuracy analysis of capital and operating costs and of the schedule. The targeted accuracy should be ±5 to ten per cent.
- The definitive estimate and schedule should involve project-based personnel, but should be led and completed by specialist experts assigned to the task short-term.
- The project manager should approve the definitive capital cost estimate and schedule. The operations manager should approve the definitive operating cost estimate and the commissioning and ramp-up schedule.
- The project director should approve the definitive estimate and schedule for use.