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Mining projects:

six pitfalls that threaten delivery

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Introduction – why the mining industry fails to deliver

Although it's equally true of other industries, it seems that the mining industry doesn't have a great record of on-schedule and on-budget project delivery. Moreover, it also seems that it's not very good at learning from experience either, and a cynical observer might be excused for thinking that the same old mistakes are being repeated time and again.

What are the factors that contribute to sub-optimal project delivery? These tend to include:

- Poorly understood geological and geotechnical aspects of a deposit, leading to inappropriate mine and process flowsheet designs
- Inadequate metallurgical test work
- Funding availability during the investigation and engineering phases
- Overly optimistic development schedules
- Human factors, including over-optimistic expectations that are spurred on by the need to promote project attractiveness to prospective investors
- Insufficient preparation for construction and operations during the Feasibility Study (FS) phase
- Insufficient engagement with local communities, stakeholders, regulators, government agencies and NGOs

This analysis of six major project pitfalls associated with the mining industry is based largely on the author's first-hand experience of mines and project sites around the world, as well as numerous conversations over the years in head offices, project and engineering offices and coffee shops. Unsuspecting contributors include CEOs, project managers, mine operators, project reviewers and, in a few cases, the consulting engineers that were called in to get certain projects back on track. For obvious reasons, the examples and descriptions given are anonymous and generic.

For the purposes of this analysis, a mine development project is best described as the progression, by a series of interrelated activities, from initial discovery through studies, engineering and permitting to the eventual construction and commissioning of a mine and mineral processing facility designed to extract value from a mineral deposit.

Pitfall number one: inadequate geological and geotechnical understanding

The viability of any mining project is normally predicated on the assumption that value can be profitably extracted from the mineral deposit in question. However, with the possible exception of relatively continuous and consistent mineral deposits such as coal, evaporites (e.g. salt, potash) and the Witwatersrand gold reefs, most deposits are surrounded by complex geology with equally complex mineralogy, comprising a mixture of both valuable and deleterious minerals.

The danger of scaling up

In most cases, understanding the essential geological and geotechnical aspects of a deposit is based on geological interpretations, combined with sophisticated modelling and statistical methods which extend information contained in small diameter drill core to the surrounding rock mass. In simplistic terms, this involves scaling up information contained in a few kilograms of core sample to tens or even hundreds of thousands of tonnes of mineral resource.

Skimping on research costs may be a false economy

Because the mineral resource estimate provides the starting point for mine design, the mineral processing flowsheet and, ultimately, project economics, it's critically important that the geological resource is well understood. An accurate definition of mineral resources and ore reserves generally requires significant expenditure on drilling during the early stages of project development, when capital is most difficult to come by. Failure to invest adequately at this stage may ultimately result in a project that fails to deliver the financial performance that the board of Directors was expecting.

Because of past failures, internationally recognised and widely adopted standards for reporting mineral resources and ore reserves such as the JORC code and Canadian National Instrument (NI) 43-101 are intended to reduce both geological and investment risk and improve the transparency of how a project's economics are determined.

Pitfall number two - inadequate project funding

Funding during early project development stages is often limited and may only be made available in finite tranches; this is particularly (but not exclusively) the case for exploration companies and small to mid-tier miners. This sometimes forces project teams to make assumptions which can only be tested and verified during later project stages. Consequently an element of risk is introduced, which may be exacerbated by the demands of optimistic completion schedules which may themselves have been made to attract investment funding.

Commodity price cycle susceptibility limits access to capital

The mining industry has always been susceptible to the effects of commodity price cycles which, among other factors, drive the availability of venture capital. Commodity prices also often drive project schedules, as developers rush to catch the next commodity price upswing. All companies, particularly exploration companies and small to mid-tier miners, are susceptible to variations in commodity prices because of their often limited access to capital. With project gestation periods that may extend over several years - even decades - getting the timing right so a new project comes on stream as the price cycle peaks is sometimes critical to a company's survival.

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Pitfall number three - Feasibility Studies that don't deliver

A major milestone in any development project is completion of a definitive Feasibility Study (FS) report which should be sufficiently comprehensive for a board to confidently make a major investment decision. However, it is not uncommon after spending millions on a FS for a board to require the study to be "optimised" – this generally means that capital and operating cost estimates are too high.

Optimised Feasibility Studies – questions for the board

The need to "optimise" a study's results should raise questions about the quality of the FS:

- Have all options been adequately assessed?
- Was the board sufficiently well briefed during the course of the study so that results came as no surprise?
- Were peer reviews effective?

Other Feasibility Study failings

There are many other failings that may occur during the FS stage and result in sub-optimal project delivery:

- Insufficient time allowed in the FS schedule for an independent cost estimate review and benchmarking (reality checking) of cost and productivity assumptions
- Insufficient metallurgical and geotechnical investigation and test work
- Insufficient time and cost contingency allowances in the capital estimate
- Funding limitations that restrict FS scope and timescale
- Over-optimistic and unrealistic promises made to investors in the early stages of the project
- Failure to engage with local communities, regulators, governments and NGOs with the result that project development is obstructed – or even, in the worst case, prevented
- Under-estimation of the time required to secure environmental permits, which is often linked to the extent and effectiveness of engagement with local communities and NGOs

The need for pre-FS geopolitical homework

Before embarking on a FS, the project team should ideally have a preliminary understanding of the applicable country and sovereign risk, the security and socio-political environment in which the project is to be developed and the stability of tax and royalty regimes. Any one of these may become a show stopper that would be best identified before the commitment of major funds and resources to the FS. Assuming no obstructions are identified prior to the FS - and because boards don't like surprises - the FS phase should be used to carefully assess these latent risks in more detail.

Incidentally, uncertainty around tax and royalties is not a phenomenon unique to less developed economies; some years ago mining investment was significantly curtailed in Western Australia and Queensland when changes were threatened to long standing royalties and mining tax laws, with the result that investor confidence was damaged.

Pitfall number four - poor project execution planning

FS reports are sometimes more focussed on resolving the technical means by which value will be extracted from an orebody, leaving to the next project stage the aspects of how the construction phase - and indeed the transition from the construction to the operation phase - will be managed. Consequently, an essential part of any FS report should be a Project Execution Plan (PEP) which provides the construction and transition management framework. An incomplete or inadequate PEP will result in a scramble during the pre-construction phase to put processes and systems in place which should have been budgeted during the FS. An inadequate PEP may result in frustration, delays, expensive mistakes - and even litigation.

Elements of a professional PEP

In addition to providing a management framework, a good PEP should address, among others, such issues as:

- Owners' contracting and procurement policies and strategies
- Insurance and risk transfer strategies
- Recruitment policies
- Owners' project management and cost control systems
- Owners' organisation structure for both construction and operations

Pitfall number five – the lack of an independent FS review

An independent third party review of a FS report is not always considered necessary if the project management is confident in the quality of the work done by the project team and its consultants. Moreover, independent reviews are expensive and require considerable time to complete towards the end of a study when the completion budget and schedule may already be under pressure.

However, failure to carry out an independent third party review may lead to errors, inappropriate assumptions and even potentially fatal design flaws going undetected. To summarise its purpose, a FS report provides the blueprint for how a future mine and plant will be built and operated. It is also a detailed risk assessment of the proposed investment and is the document on which a board will rely when making an investment decision. The report's integrity and thoroughness are therefore essential.

Pitfall number six – a poor approach to managing the construction phase

There are many potential challenges that may occur during the construction and commissioning stages of a project.

Scope creep

Post-FS changes to basic engineering scope, construction scope and scope "creep" to correct errors or account for conditions not identified during the FS will result in rework, cost overruns and completion delays - hence the importance of diligent peer and independent project reviews.

Inadequate systems

In terms of project management, it may be costly to discover as construction gets underway that management information, cost and document control systems that were adequate for a company's pre-construction activities are inadequate for construction and the transition to full production.

Unbalanced and unfair contracts

The owner's contracting strategy, particularly with regard to construction and service contracts, should ensure that they provide a reasonably equitable share of risk and reward. Where a contract excessively favours one side, the inevitable consequence will be development of an adversarial relationship from which no one but lawyers will derive any benefit. It is also important that contracts are awarded after due consideration of the tenderers' capacity and capability to do the work required. Cheapest is not necessarily best and there are many examples where selection of the cheapest bidder, without due consideration of its capabilities and robustness of its balance sheet, have led to completion delays and expensive litigation.

Ignoring owner responsibilities

The use of turn-key contracts or the appointment of a reputable Engineering, Procurement and Construction Management (EPCM) contractor does not remove the owner's responsibility to oversee contractors' activities and establish proper quality control arrangements. Contractors also make mistakes and even reputable contractors will sometimes cut corners and seek ways to maximize their profit within the constraints of a contract.

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Lack of community engagement

Continued engagement with local communities, government, regulators and NGOs is particularly important during construction, as the true scale of the future mine's impact on its environment begins to become apparent. Project detractors, be they unions, NGOs or local communities, also understand that the impact of the disruption they can cause increases as construction nears completion, when investors financial exposure is at its maximum.

Conclusion – miners' project management skills need to improve

Mining investment is inherently risky; historically, the mining industry has provided investors with occasionally spectacular but all too frequently below average returns. The situation is exacerbated by late, over-budget project deliveries which effectively destroy both project value and investors' trust.

The use of increasingly sophisticated project management software and systems is no doubt contributing to better project delivery. However, project outcomes are still dependent on the quality and skill of experienced project managers - of whom there appears to be a shortage. So the mining industry generally would be well served by focussing on improving project management skills, with the objective of reducing the risk of late and over budget project delivery. This would, in due course, improve investor confidence and encourage new investment.

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