srk news
Mining Project Evaluation

Managing sustainability disclosures in project evaluations

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SRK is working with mine project evaluation teams to ensure responsible sourcing initiatives are considered

Robert G Eccles (Forbes, 2021) asks us to imagine a world in which there were no standards for financial accounting. He compares what happened before the establishment of the US Securities and Exchange Commission (SEC) in 1934 as the Wild West! Well, the same can now be said for sustainability reporting.

There are accusations of 'greenwashing' and, with a historical lack of standards, it is no wonder investors are demanding relevant, reliable and comparable information on both accounting and sustainability matters.

SRK's Environmental, Social and Governance (ESG) teams are working with mine project evaluation teams to ensure increased expectations from investors and market-driven responsible sourcing initiatives are considered when valuing a project. For climate change, this includes understanding clients' decarbonisation strategies and climate change adaptation plans. Discussions around carbon pricing are key and sensitivity tests may be needed.

The financial market is keen to de-risk investment decisions and 2022 will be pivotal when it comes to improving sustainability disclosure, particularly that associated with climate change.

…continued

Managing sustainability disclosures in project evaluations *(continued)*

There are many factors driving this, including:

- The International Financial Reporting Standards Foundation Trustees announced at Climate Change Conference of the Parties (COP26) that the Climate Disclosure Standards Board and the Value Reporting Foundations (formed by the Integrated Reporting Framework and the Sustainability Accounting Standards Board) would be consolidated into a new International Sustainability Standards Board (ISSB). One of its first actions was to issue two proposed standards for consultation on general sustainability-related disclosure and climate-related disclosure. The latter builds on work with the Task Force on Climate-related Financial Disclosures (TCFD).
- Worldwide, green taxonomies are being established (including in the EU, UK, China, South Africa and Malaysia). These will define what constitutes environmentally sustainable economic activities with the aim of stopping 'greenwashing'.
- Consultations are ongoing for several reporting standards to clarify ESG expectations such as the US SEC and Australasia's Joint Ore Reserves Committee (JORC); and the Canadian Institute of Mining, Metallurgy and Petroleum recently issued a consultation paper on its proposed ESG Guidelines to support NI 43-101 reporting.

Although current investor focus is on climate change, the new taxonomy laws also highlight the need to accurately account for and disclose material risks associated with pollution prevention and the protection of biodiversity. These are relevant to mining projects as they have the potential to result in material costs. Management plans for these challenges need to be reflected in development studies and costs included in the associated financial models. Social aspects are less well covered by the taxonomy laws. However, they are strongly picked up in the expectations of responsible sourcing and industry-specific sustainability standards. They must be handled in a similar way when it comes to transparently evaluating risks, opportunities and material costs.

Addressing sustainability is not just a matter of doing an environmental impact assessment or preparing an annual report, it is about integration of ESG into every business decision from initial exploration through to post mining.

Related articles in this issue: Material ESG promises must feature in project evaluation and Mining project evaluation for supply-chain clients.

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Fiona has nearly 30 years' experience in the management of environmental, social and governance (ESG) issues. Fiona has worked as both a regulator at the UK's Environment Agency (8 years) and as a consultant in SRK's South African and UK practices (>20 years). Fiona's E&S experience spans preparation and management of ESIAs, input to project engineering studies, management planning, closure planning, risk management, audit and due diligence, technical advice on water and waste issues, and environmental reporting.

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The importance of understanding corporate structures

The merger of a Public Company and a Private Company is not as simple as it may first seem. The Public Company is required to conform to statutory regulations for reporting, whilst the Private Company has less stringent reporting protocols. In this situation there are many factors to consider through the process of independent technical review before finalising the viability of the merger.

SRK recently completed an Independent Technical Review (ITR) of two companies to support a potential loan to the Acquirer. SRK reviewed the assets of the Acquirer and the Vendor: underground mines, processing plants, new projects and associated infrastructure assets (dams, dumps and stockpiles).

SRK's assessment covered the initial 5 years of the Mineral Resources/Ore Reserves (to be in accordance with JORC Code 2012 guidelines), exploration upside, mine planning and mineral processing; and for the valuation model inputs, the Acquirer's and Vendor's combined acquisition model, the MergeCo model.

A high-level 'red flag' approach was undertaken to highlight fatal flaw issues; during the site visit, discussions with management were held and supplied documentation was reviewed. Upon identification of potentially material issues, further investigation and benchmarking to confirm the veracity of the information, estimates and forecasts were completed.

The merger of a public company and a private company is not as simple as it may first seem

Critical company differences
The Acquirer, an Australian Securities Exchange listed company, required to conform to numerous regulations, including the JORC Code. No material issues with respect to JORC Code compliance were identified, and SRK was able to sign off.

In contrast, the Vendor, a private company with less-stringent reporting regulations, was non-compliant in terms of JORC Code reporting. Reporting has been done under a combination of 2004 and 2012 JORC Codes, and the Ore Reserves incorporated Inferred Mineral Resources (70% of the Vendor's main ore source) within the first 5 years of the MergeCo plan.

The Vendor's Mineral Resource estimation methodology was also fundamentally flawed due to misclassification of Mineral Resources (also impacting the validity of the Ore Reserves). The Mineral Resources were not considered compliant with the JORC Code and SRK was unable to sign off on these.

Did it work? Greater comfort for the Acquirer and Lender
Resolving and reporting to the 2012 JORC Code provided greater comfort to both the Acquirer and its lenders that the ore tonnages and grades were available and mineable.

A key lesson from this assignment was the importance to understand the corporate structures of Acquirer and Vendor companies, public versus private, early in the ITR process to prepare for likely issues that may be encountered, and identify the areas that require greater interrogation and understanding. It also provides both parties the benefit of early identification of areas where additional work may be required to meet the standards of public reporting. Early understanding results in a more timeous process and potentially fewer surprises and delays in any potential transaction.

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Alexander (Alex) is a Principal Consultant with 35 years' operational (underground and open pit), consulting and corporate experience in metalliferous start-ups, corporates and multinationals; listed and unlisted resource sector, across Africa and Australasia (Australia, Papua New Guinea, Solomon Islands and Fiji). Alex has managed the technical and management input for numerous mining due diligences, independent project reviews, Ore Reserve reviews and audits, as well as independent technical reporting for public disclosure.

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Mark has over 30 years of experience and provides advice in all aspects of orebody knowledge for developing projects and operating mines. As a leading consultant in geosciences and the mining industry, Mark provides advice, training, and mentoring in exploration reporting, data assessment, resource definition and reporting, mine geology and grade control through to inputs to reserving. Mark's clients include the technical leads, management and boards of resource project owners, as well as the investors, lenders and legal advisors to these projects.

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GARY POXLEITNER

Gary is a Principal Consultant and Practice Leader with over 30 years of operational, engineering, management, and consulting experience in the mining industry. He is an underground mining specialist with expertise in the areas of technical support, mergers and acquisitions, cut-off grade determination, due diligence, audits, mine cost estimation, and operational improvement. Gary has worked at near-surface and ultra-deep mines worldwide, including gold mining in the Northwest Territories, copper and zinc mines on Vancouver Island, diamond mines in South Africa, and base polymetallic mines within Canada's Sudbury Basin. Gary has been consulting globally with SRK for the past 10 years.

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Technical study public disclosure quality

Ongoing effort is required to improve the quality of technical public disclosures

The current mineral asset disclosure framework is based on the CRIRSCO template and encapsulates various sources of guidance such as the Australasian JORC Code, the Canadian CIM Definition Standards (and instrument NI 43-101), and the US SEC S-K 1300. The application of this framework has provided improved public disclosure consistency across international markets and between local reporting codes, guidance and disclosure regulations. One key area in which the framework provides guidance relates to the public reporting of technical study information, in particular for pre-feasibility and feasibility levels of study.

Key improvements have been achieved largely through common definitions. These include technical study level types, as well as ensuring the Competent/Qualified Persons and company management prepare disclosures based on the key principles of competency, transparency, and materiality, such that they are clear, complete and unambiguous. In this regard there remain inconsistencies between how Competent/Qualified Persons actually interpret the level of detail and explanation appropriate for disclosure.

An important improvement in disclosure quality has been the implementation of the accounting principle, which is to report material matters on an 'if not, why not?' basis. This requires reporting on all material matters of importance to the reader, namely the investor. And so, if a particular matter is not disclosed, why is it not reported on, and when reported on, is the meaning and relevance clear? It should be clear to an investor which key items have been considered, which have been deemed of low consequence or remain to be addressed or resolved. Getting this right, namely providing sufficient information as well as a professional opinion on relevance, requires ongoing effort to improve the quality of technical public disclosures.

It is not uncommon for companies at different stages of maturity to interpret and apply the disclosure guidance differently. Companies, especially junior companies with early-stage exploration and assessment projects wish to inform the market about the technical details of their project, but at the same time seek to promote the project to investors. Given these competing requirements a reasonable question to ask is whether a technical study was completed to support construction of the operation or as a public disclosure/marketing exercise. Given this, project proponents must ensure that any public disclosures relating to either a pre-feasibility or feasibility level of study have a reasonable basis and are supported by reasonable grounds for any such forward-looking statements. At the same time, those relying on such information need to understand the basis is clearly and reliably supported.

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This article is based on an interview by Northern Miner with Mark Noppé and John Pfahl in November 2020.

Applying a value optimisation methodology to meet your mine's corporate objectives

When assessing the economics of your mine, we begin by determining the breakeven cut-off value.

In simple terms, cut-off value (CoV) is the value of combined metal in one tonne of rock at which revenue earned is enough to cover the cost of producing that tonne (and it is expected earn a certain amount of profit). Setting the right CoV is key to achieving an optimal balance between competing priorities like annual production rate, mine life and net present value.

Let's assume we can produce one gram of gold for each tonne of ore mined. Applying a gold price of $1,650/oz (at one tonne, this is equivalent to $58/t of ore), a 1% discount for payables (treatment, penalties, insurance, transport) and a further 5% discount for mill recovery, we end up with an NSR (net smelter return) after processing of just under $55/t.

If the cost to run our mine is $55/t, then our base-case cut-off grade of 1 g/t would be enough to break even. If the cost is three times higher, or $165/t (as we will assume for the sake of this hypothetical scenario), then our cut-off grade would also need to be three times higher, or 3 g/t, in order to break even.

In some cases, a mine may wish to add a certain profit factor, over and above the breakeven cut-off value. The profit margin involves adding a percentage or dollar value above the breakeven NSR. If our profit margin is zero, then the cut-off grade remains at 3 g/t. But in order to achieve a profit margin of $10/t, we would need a cut-off grade of 3.67 g/t.

Profit margin: $55/t - $10/t = $45/t
Breakeven CoV: $165/t ÷ $45/t = 3.67 g/t

Determining an optimal CoV can be completed by flexing modifying factors such as metal price, profit margin, costs, or production rates to determine the preferred economics, life of mine or ounces of metal.

Although many companies prioritise high production rates, some have other goals. For example, when Dundee Precious Metals conducted a review of its Chelopech gold mine in 2020, its priority was to extend mine life and maintain a viable NPV while maintaining a consistent agreed annual production rate. (At this time, the mine applied a metal price of $1,250/oz with a profit margin of $10/t as a CoV). In order to achieve these goals, it was understood that it would need to bring in lower grade (profitable) material and move higher grades early in the mine plan.

SRK generated nine scenarios from a combination of three gold prices ($1,250/oz, $1,400/oz and $1,600/oz) and three profit margins ($0/t, $10/t and $20/t), calculating mine life, production and a cashflow model for each scenario. Mine schedules were imported into a Schedule Optimisation Tool (SOT) to produce an NPV-optimised production schedule that considered the value of each zone. To select the preferred CoV, all scenarios were summarised into a Pugh Matrix ranking for each scenario weighted to favour Dundee Precious Metals' objectives.

The exercise demonstrated that a gold price of $1,400 and profit margin of $10/t would fulfill Dundee Precious Metals' objectives by providing both robust economics and a preferred extended optimised mine plan.

No matter your mine's priorities, generating multiple mine plans at different CoVs – and importing these into an SOT – is a great approach for selecting the best CoV for your mineral resource, mineral reserves and mine plan.

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Technical review of dimension stone projects

SRK China was commissioned to review several dimension stone projects, including marble and granite projects. Compared to metal mining projects, dimension stone projects have the following unique features:

Special resource estimation method
Normally, grade interpolation is not required for dimension stone projects, and the geological models are mostly based on lithology, structure, and slice pattern. The geological model is used to define the volume and structural influence. Detailed structure logging for fractures is an important reference for the geological model and provides the quality continuity required to assert dimensional stone resources.

Different data validation approach
As quantitative assay results are not used in the resource estimate or assessment of the stone quality, standard samples, blank samples, and assay samples are not suitable for data validation. The emphasis is on features such as compressive strength, flexural strength, abrasion resistance, water absorption, hardness, glossiness, radioactive properties, and density. Independent sampling for these features is used for data validation.

Waste rock dump
The block yield for dimension stone projects is usually less than 20%, meaning that to obtain 20 m³ of quality quarry stones, at least 80 m³ of waste rock will be produced. Although such waste rock can be used as construction or other raw materials, it still requires quantitative assessment. Sufficient temporary stockpiles and a waste dump with corresponding capacity are required.

Market sensitivity
Unlike metal commodities, dimension stone projects are extremely market sensitive and the value is dominated by transport costs. For early-stage projects, market analysis is required to make sure the products can be sold as planned, and it is highly recommended to acquire sale contracts and sound sales records before the project enters the capital market.

With technical capabilities and market experiences, we support our clients with their projects from early stage to capital market, and finally to successful operation.

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Frank is a Senior Consultant (Geology). He joined SRK in 2010 and has been involved in more than 40 projects located in China, Mongolia, Southeast Asia, Africa and South America, including gold, silver, lead, zinc, iron, nickel, vanadium, magnesium, marble, granite, and bauxite. He has a deep understanding of analysis and mineral resource reporting conversions between of Chinese and JORC Code standards and has abundant experience in project management and mineral resource estimation.

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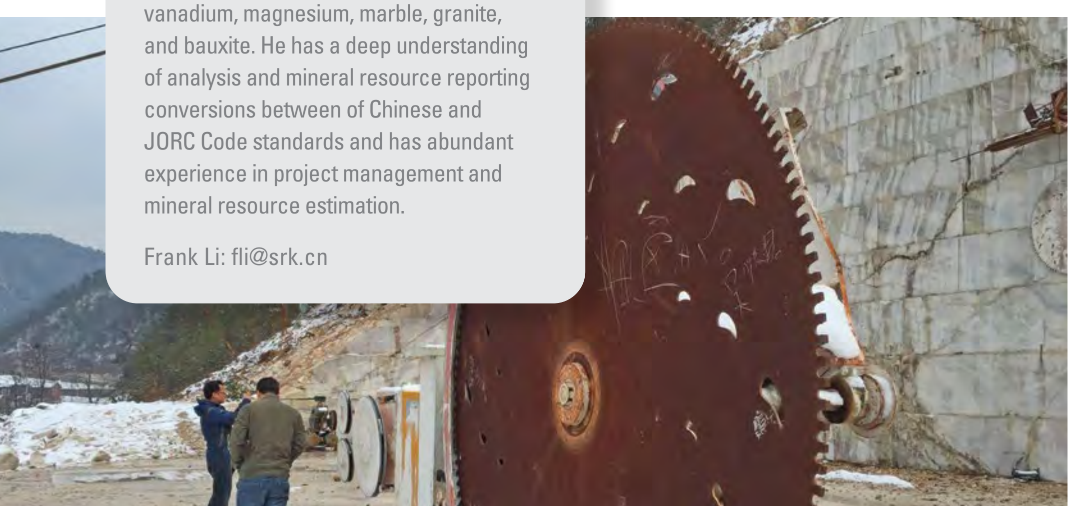
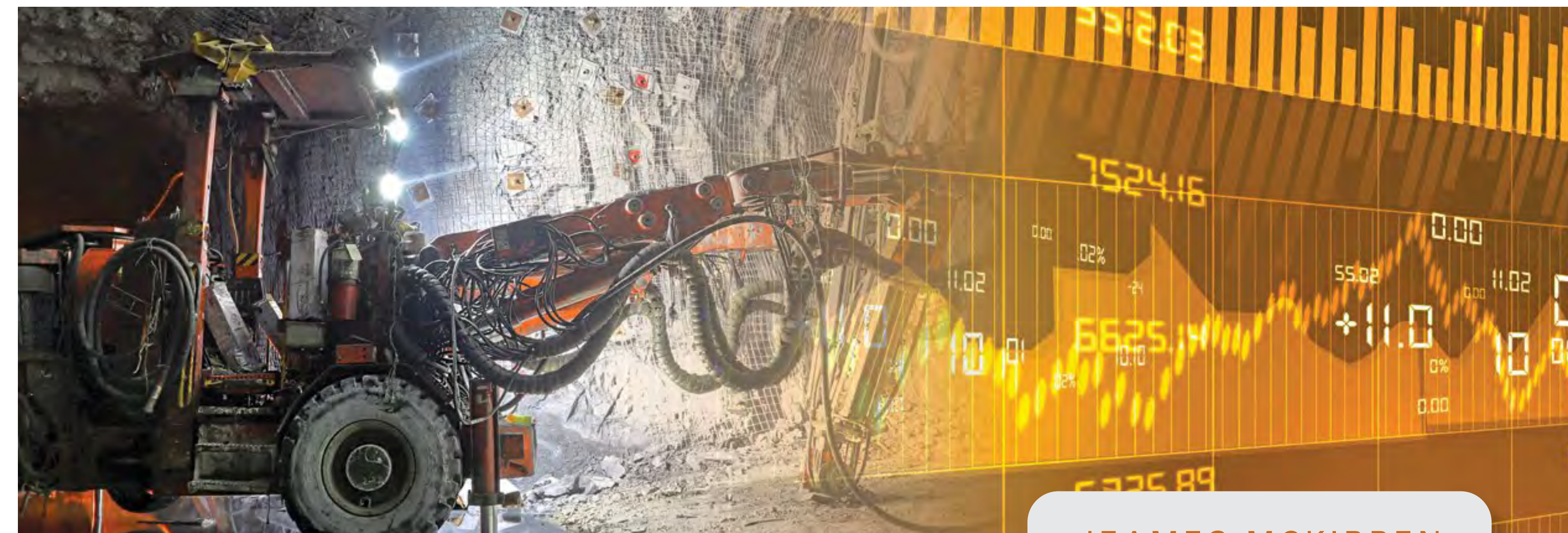


A marble quarry in Shaanxi, China

Is there value beyond the publicly reported mineral reserve?



Estimating the exclusive mineral resource is not a straightforward subtraction approach

With the introduction of CRIRSCO (Committee for Mineral Reserves International Reporting Standards) template based mineral asset disclosure S-K 1300 (Regulation S-K part 1300, 2019 (S-K 1300) by the United States (US) Securities and Exchange Commission (SEC)), Mineral Resources are now required to be reported exclusive of Mineral Reserves for companies listed on the New York Stock Exchange. These 'Exclusive Mineral Resources', also referred to as 'Mineral Resources additional to Mineral Reserves', have been permitted in jurisdictions outside the US for many years.

The reporting of an Exclusive Mineral Resource is considered by many to be more transparent for investors as the portion of Mineral Resources not converted to Mineral Reserves is clear. However, estimating the Exclusive Mineral Resource is not a straightforward subtraction approach since the spatial conditions, modifying factors and reasonable prospects for eventual economic extraction all need to be considered. The term 'eventual economic extraction' is used in respect to Mineral Resources in the CRIRSCO template, the JORC Code 2012 edition and SAMREC Code 2016 edition, whereas S-K 1300 does not use the term 'eventual'. These differences need careful consideration, not only when companies are reporting in multiple regulatory jurisdictions, but for the purposes of valuation of these remaining Mineral Resources.

The Exclusive Mineral Resources include 'remnant material' such as mineralised fill, mining remnants, pillars, or low-grade mineralisation which are recognised and discussed within the JORC and SAMREC Codes, but which are not defined in the Canadian and US disclosure requirements.

From a valuation perspective, Practitioners must carefully consider the prospects for, and likely timing of, material to ultimately become mineable thereby producing a cashflow. Mineral Reserves typically inform the majority of material within the production schedule (albeit some Mineral Resources may be included for practical mining purposes) which are valued using a discounted cashflow approach, whereas Exclusive Mineral Resources and/or remnant materials are likely to be valued using other market-based methods. This distinction in valuation methods in part reflects the Practitioners' view regarding:

- Location of remnant material and its likely future recoverability (i.e. extension at depth or along strike, isolated, sterilised?)
- Likely timeframes to development or production
- Ability to satisfy 'reasonable prospects' criteria now and in future, by considering:
  - Whether material that is currently sub-economic, but for which there is a reasonable expectation that it will become economic in future, may potentially be classified as a Mineral Resource and still has value
  - Whether remnants have merely been 'carried forward' by depletion and hence may ultimately prove unrecoverable
  - Whether remnants represent 'marginal grade material' intended for treatment towards the end of the mine life.

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Jeames has over 27 years' experience and specialises in mineral asset valuations, equity listings and mining related transaction support. He has a strong record in valuation, project due diligence, independent technical review and deposit evaluation and has been actively involved in arbitration and litigation proceedings. Jeames has assisted numerous exploration and mining companies, as well as their investors, financial, accounting and legal advisors. Jeames has experience in the geological evaluation and valuation of mineral projects worldwide.

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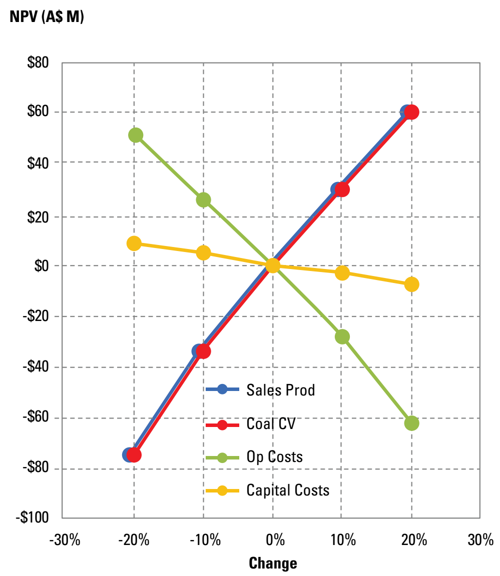
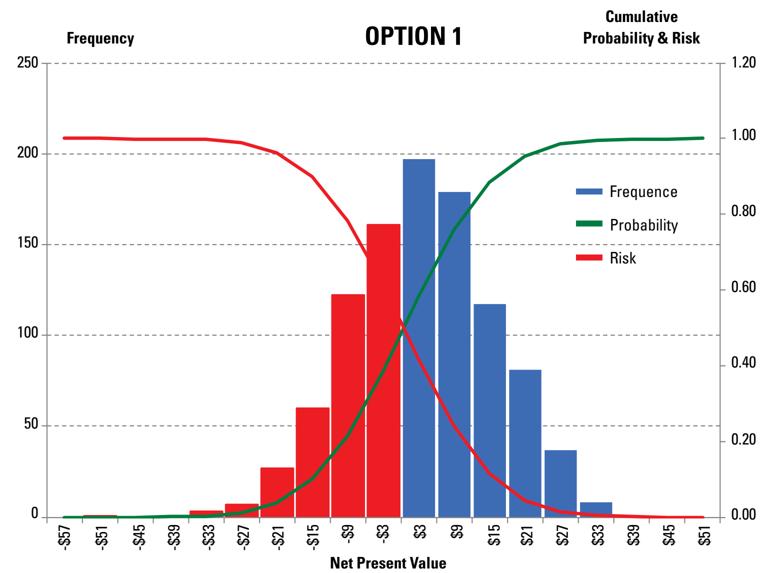
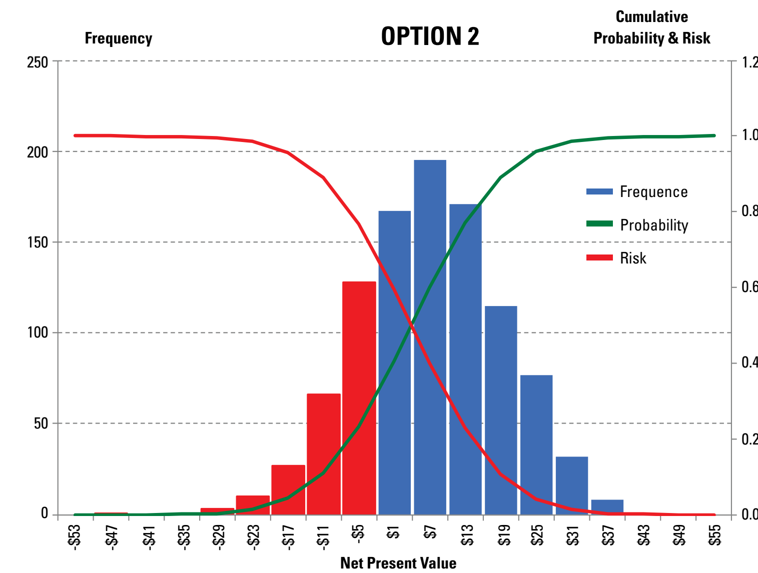
Sensitivity analysis in project evaluation







SHAUN BARRY

Shaun has a commercial and geological background with more than 30 years of experience in mining, exploration and quarry valuations, mineral economics, minerals marketing and geology. In corporate advisory and business development roles, Shaun has provided independent expert reviews, valuations, due diligence and optimisation mine studies. In his role of marketing, Shaun contracted sales of alumina, bauxite, copper, cobalt, chrome ore and other commodities. Shaun worked as a mining equity analyst on the Johannesburg Securities Exchange, and as a mineral economist and mine geologist in South Africa.

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Sensitivity analysis is an important part of project evaluation, but in many cases it is given insufficient time and effort. In such cases, the overall analysis of a project's financial metrics suffers.

Under a deterministic approach, the impact of changes in key valuation assumptions can be assessed by changing one assumption independently of all other assumptions, which remain constant. In this example, four parameters in a cashflow are analysed: coal calorific value (CV), total operating costs, capital expenditure, and sales production tonnages. Each assumption is either increased or decreased by 10% and 20% to determine the impact on the project's value in the graphs above.

This analysis shows that the project is most sensitive to changes in coal CV and sales production tonnage. Operating costs and capital expenditure have less impact on project net present value (NPV).

Sensitivity analysis often stops at this point. However, this approach does not tell us anything more than the input parameter the NPV is most sensitive to.

In a stochastic approach, all parameters may be simultaneously varied to assess the impact on the project's cashflow value. In this example, a uniform distribution was adopted to simulate changes in operating and capital costs, but truncated to prevent unreasonable values. A normal distribution was used to model changes in coal CV and sales production tonnage.

Monte Carlo simulation can generate and assess many scenarios, producing a distribution of NPVs, as illustrated in the bar charts above. This distribution can then be used to quantify the probability of an unsatisfactory NPV outcome (that may be negative) with a specific set of coal CV, costs and sales production assumptions. This NPV outcome represents the 'value-at-risk' (VAR).

Monte Carlo simulation statistics

STATISTIC	UNIT	OPTION 1	OPTION 2
Mean	A$ M	1.0	3.7
Standard Deviation	A$ M	12.1	12.2
Min	A$ M	-50.5	-47.3
Max	A$ M	31.2	34.3
5% confidence limit	A$ M	-18.4	-15.8
95% confidence limit	A$ M	21.0	23.9
Value-at-risk	%	45	35

In this example, the simulation suggests that there is a 45% probability of returning a negative NPV in the case of Option 1. However, in the case of Option 2 when certain upfront capital expenditure is provided by a contractor miner, the VAR is only a 35%.

This example shows how a reallocation of capital costs from owner to contractor may have limited impact on NPV distribution, but a major impact on VAR and the expected value of NPV (mean) as shown in the table below.

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Understanding public reports: Do they say what they mean and mean what they say – a technical perspective

The technical content (geology, exploration, resources, reserves, inputs/outputs of technical studies) of resource-sector public reports contains factual statements but often with limited explanation or professional opinion of what these statements actually mean, and why they are important in the context of the deposit or project development stage being reported.

Given that public reports should inform investors and their advisors, it is important these reports do exactly that – namely provide not only a technical description of the matters of importance but ensure transparency and clearly address why and how the information is material for the given project. SRK has prepared a short course for PDAC2022 presenting examples of common technical descriptions found in public reports (company releases, annual reporting, statements and technical summary reports) where further elaboration, opinion or context would greatly enhance the reader's understanding of the relevance of these descriptions.

The problem identified and therefore the opportunity for improvement is that mining company disclosures (public technical reports) contain factual statements often with limited explanation or professional opinion of what these statements actually mean, and why they are important in the context of the deposit or project development stage being reported.

In identifying the opportunity to improve the quality of public reporting, it is important to remember that reporting should provide investors with a comprehensive understanding of a mineral property, which should help them make more informed investment decisions. These public technical reports are required to fulfil exactly that purpose, namely to provide relevant information through not only a technical description of the matters of importance (materiality), but also to ensure transparency that clearly addresses why and how the information is material for the given project.

In working to improve the quality and content of public reporting of mining projects it is useful to:

- Appreciate the purpose of public reports for resource-sector projects, namely to inform investors
- Understand the key topics important for reporting need to address and consider the status or stages of project development
- Review the report content to ensure the 'true' meaning for key matters typically described in public reports for each stage of a project's development are clear and relevant
- Provide report content that provides transparent and meaningful technical descriptions and discussion in public reports to benefit the understanding of the project status and opportunity.

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Before bidding on a project, dig deep into the geotechnical data

Weighing up a potential project acquisition? During the due diligence phase, a thorough review of geotechnics and rock mechanics is critical to discovering opportunities… or fatal flaws.

Digging into source data from mapping, drilling and geologic modelling will uncover any geotechnical risks. When we look at source data, we ask:

- Has the data been collected in sufficient quantities to help us understand potential rock mass behaviour?
- How has the data been used when formulating the project design?
- How does the resulting design impact mineability, and does it introduce a lot of downside risk (or, on the flipside, potential upsides)?

Often, we run a mine design of our own to see how it compares to the design under review. Next, we assign a risk level to each design flaw, so as to understand if it could cause the entire mine to fail or merely impact mineability without compromising the entire project. From there, we make suggestions as to how to improve the design. In this phase we may require additional data collection and analysis; the more data at hand and the better its quality, the better the odds of helping the client reach a decision on whether to bid for the project or run away.

If the client decides to enter the bidding process, then the next stage is to use the geotechnical data to help them estimate the value of the project. Key aspects to look at are:

- Slope design, which impacts strip ratio, among other things. If strip ratios get higher, this can lead to higher extraction costs and having to leave more resource behind.
- Design of benches and haul roads, because if these are constantly failing, it will have a substantial impact on operational costs.
- How much development is needed to commence production or upgrade the mine, as this will greatly impact capital costs.

Unfortunately, it is an all too common occurrence that a company will try to sell off a mine without providing sufficient geotechnical data. It would be easy to put this down to incompetence, but often when juniors are tight on money, the first thing they will cut back on is collecting proper data on rock mechanics and geotechnics. Whatever the reasons, inability to provide adequate geotechnical data should be a deal breaker – because without it, you can not properly understand the inherent risks in a project.

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Material ESG promises must feature in project evaluation

ESG promises are being made in communications with stakeholders - there is now more pressure to keep these promises

Miners make many ESG promises to their stakeholders when securing mineral rights and obtaining approvals to proceed with mining. Further ESG promises are now being made in sustainability reports, annual reports, climate action reports and other communications with investors. These commitments are relevant to project evaluation as they are often material and failure to meet promises can become liabilities. In addition, risks of legal action for ESG misstatements are on the rise.

Numerous material ESG promises are captured in agreements with governments, as well as in conditions of mining and environmental permits. There is now more pressure to meet these, driven by disclosure and transparency initiatives and the corresponding new opportunities for public scrutiny.

The trend for public disclosure of conditions of mineral rights agreements and mining licences is reflected in the commitment made by ICMM members to disclose their contracts with governments. Variously named 'mining conventions', 'minerals agreement' or 'state-investor agreements', these contracts will reveal substantial ESG obligations, particularly related to value addition in the host country.

Increased ESG disclosure requirements are also emerging under the Extractive Industry Transparency Initiative (EITI). Some EITI member countries have expanded the scope of information disclosed under this initiative beyond taxes and royalties to include various contributions to socio-economic development and provisions for closure. This is in addition to the relatively new requirement for all 55 countries implementing the EITI Standard to publish new and amended contracts, licences and agreements concluded with extractive companies from 1 January 2021. Countries are also encouraged to publish contracts concluded before that date.

Published net-zero targets and climate strategies are clear examples of sustainability commitments made to a wider stakeholder audience that need attention in project evaluation. Decarbonisation of mines can require substantial capital allocation, as can addressing physical risks from climate change.

Standards aiming to strengthen the financially material element of sustainability reporting include the SASB standards and the recommendations of its Task Force on Climate-related Financial Disclosures (TCFD). New IFRS sustainability disclosure standards are to be developed in 2022 by an International Sustainability Standards Board (ISSB). These will be compatible with the IFRS Accounting Standards and are expected to have global reach; the IFRS standards already have a direct effect on securities regulations in over 140 countries.

Stock exchanges are already promoting improved ESG disclosures. According to the Sustainable Stock Exchange (SSE) Initiative, 27 stock exchanges have ESG listing requirements and 63 have written ESG guidance. Guidance published by the UK Financial Conduct Authority (FCA) in December 2020 reminds issuers to take care that there is no omission of material ESG information in disclosures to investors or presentation of misleading ESG information. Existing consumer, contract, competition and/or market-abuse laws generally provide for legal action to address false promises.

1) https://www.icmm.com/en-gb/news/2021/new-commitment-contract-transparency

2) https://eiti.org/news/contract-transparency-requirement-to-take-effect-in-january

3) https://www.ifrs.org/news-and-events/news/2021/11/ifrs-foundation-announces-issb-consolidation-with-cdsb-vrf-publication-of-prototypes/

4) https://www.ceres.org/sites/default/files/6-10-21%20Ceres%20Letter%20to%20SEC%20-%20Final.pdf

5) https://sseinitiative.org/

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Due diligence exercises – what can be learned from these?

Value assessment measures from a due diligence

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A due diligence process is typically required to support project financing, either during a project development phase or for a merger and acquisition process.

Due diligence exercises can be commissioned by either the project owner or the potential lenders. A typical scope is to examine all of the technical aspects of a project and opine on the completeness of work and importantly, whether capital and operating cost estimates are suitable for use in financial modelling, or whether any adjustments or sensitivities are required. If a project owner commissions a due diligence, they should take care to allow a truly independent review for potential lenders to take place.

Key aspects that are highlighted during project development financing due diligences are discussed below.

A typical shortcoming for junior mining companies is to produce studies that are not based on any formal study guideline. This often results in a so-called definitive feasibility study, in reality being a compilation of work done along the spectrum of a pre-feasibility study to a feasibility study. Companies should consider two international guidelines (AusIMM Cost Estimation Handbook, Monograph 27 and AACE International Recommended Practice No 47R-11) that provide valuable guidance to the required contents for study phases.

Defining an achievable contract strategy is critical, particularly for mineral processing facilities. It is noted that more complex flowsheets are required now to treat more complex mineralogies. A key aspect that should inform a contract strategy (and who should be assigned what risk) is the level of engineering definition immediately prior to project execution. Projects that are approved with lower levels of engineering definition can have increased levels of execution risk for both owners and contractors, when poorly defined elements only become visible partway through execution.

The assignment of contingency is a critical aspect for project financing. Contingency is required in all capital estimates and can also be needed for operating cost estimates. Study guidelines recommend a range of contingency, depending on the study level. Dependent on the quality of execution readiness, a realistic level of contingency should be selected and referenced to benchmarking for similar projects. More use is being made of probabilistic contingency assessments. It is noted that while the outcomes portray a high level of apparent precision, in reality this method routinely fails to identify the real cause of capital overruns when they eventuate. Hence a good degree of human intellect is required when assessing contingency to ensure a realistic outcome.

Merger and acquisition due diligence reviews need to consider the above points for development projects; however, reviews may also include operating assets, where key consideration needs to be given to historical performance and how that relates to potentially adventurous future estimates.

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Determining damages

Mining companies face the risk of having their projects interrupted by host governments. SRK recently assisted on an arbitration case involving a company that had an operating gold mine and exploration properties in Central America but was unable to continue operating because the government suspended their licence to operate.

SRK's role involved developing a Life of Mine Plan to show how the operating mine would have progressed, assessing the potential of the known exploration targets, and evaluating the amount of gold that could have been discovered in extensions to the known exploration targets (lost exploration opportunity).

For the Lost Exploration Opportunity, SRK conducted a detailed desktop evaluation of each known exploration target, and further analysed those with exploration potential. SRK relied on several sources, including existing exploration data (comprising soil and rock surface sampling), drilling, and past geological field studies.

SRK then compared the exploration targets against six deposits worldwide that were similar in deposit style (orogenic gold) and age (Mesozoic). SRK evaluated the potential gold ounces each target could have contained. This used an estimation of the potential average contained ounces per vertical metre and per strike metre for each benchmark deposit to provide a range of potential gold ounces per exploration target.

SRK then applied a modified Geological Probabilistic Approach to evaluate what the probability of discovering gold would be, depending on the stage of exploration each target may have reached since the company lost their right to operate. This provided the lost exploration opportunity in the form of a range of gold ounces that could be subsequently used in valuation analysis.

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James is a Principal Consultant (Structural Geology) with over 24 years of experience in the structural analysis of mineral deposits. He is an expert in deciphering deposit-scale controls on ore plunge in precious and base metal deposits, the structural inputs to geotechnical/hydrogeological studies and mine seismicity and applied 3D geological modelling. James also assists clients with strategy and technical reviews for exploration and mining projects worldwide, and has undertaken projects in Europe; North, South and Central America; Asia and Africa. He has taught more than 50 Applied Structural Geology courses to over 2000 exploration and mining geologists and engineers.

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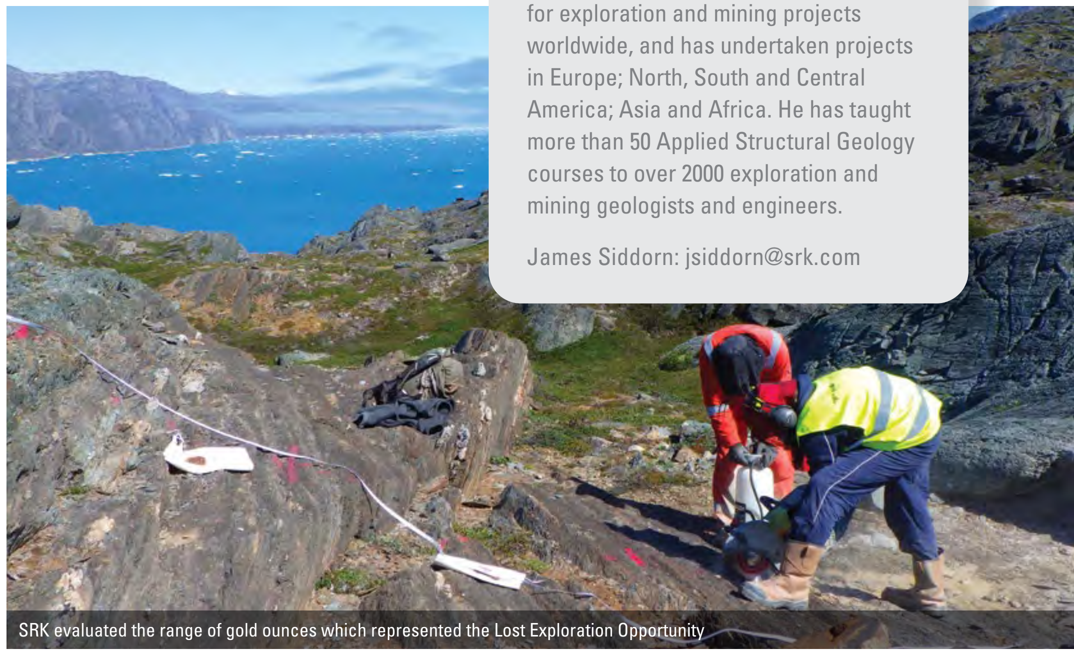

SRK evaluated the range of gold ounces which represented the Lost Exploration Opportunity

Mining historical data

Is there still value in a historical mine or exploration project? This is asked in the industry as new discoveries are harder to find and looking back may be the future to looking forward. Unlocking the potential of a project can be accomplished through mining historical data that often has been neglected and is likely not in a digital format. The process can be slow and arduous but yields significant results once completed.

The author has firsthand experience with initiating the 'mining' process that resulted in exploration success and resource expansion.

Historical data is often forgotten about, and stored in dark, stale rooms collecting dust. What companies forget about is the value of the information remains as relevant and significant as the time that was spent recording detailed field notes, generating hand-drawn cross-sections and maps. In some cases, generations of geologists and engineers could have been trying to make a new discovery or resurrect a previously mined property, but were making uninformed decisions. In today's technology-driven industry, companies often forgo quality due to shorter time pressures, which can introduce unnecessary risk.

There is now the capability to convert these records into functional digital formats and potentially breathe life back into an operation. The process of digitising, georeferencing and compiling data into a useable format can cost hundreds to thousands of dollars, but the potential added value can be millions of dollars. Using historical data can aid in evaluating the exploration potential, increasing geologic confidence and potentially saving capital through reduced drilling and exploration activities. Taking the time and making the investment in understanding and using all the available data, historical and modern, to make sound decisions can create additional shareholder value.

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Scott is a geologist with over 15 years of experience in resource development, ranging from greenfields to advanced exploration to open pit and underground production. Scott's expertise includes executive-level mining and exploration, project management, generative exploration, geologic model development, resource estimates, and implementing data collection and database management systems. Scott has worked on a variety of mineralised systems, including bulk tonnage sediment-hosted gold, epithermal precious metals, carbonate replacement base metals, sedimentary exhalative zinc, and more.

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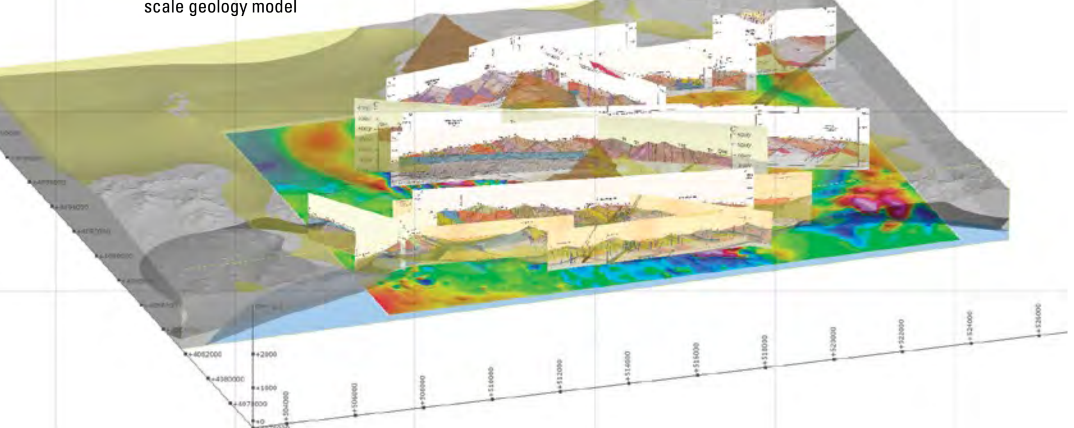

Compilation of publicly available data used to generate a regional scale geology model

Due diligence on lithium brine projects

Lithium brine projects are in hyper-arid environments, thus facing several technical challenges

Lithium brine exploration, resource/reserve estimation and mining focuses on hydrogeological techniques adapted for hyper-saline solutions. The high variability in basin size/geometry, aquifer properties and brine chemistry, along with the fact that projects are in hyper-arid environments, cause technical challenges and undertaking independent reviews and due diligence requires a multi-disciplinary approach. Due diligences are focused on the following critical aspects.

Resource: brine volume and chemistry
Critical exploration data for resource definition include surface geophysics, geological core logging, specific yield, hydraulic conductivity and brine chemistry. The resulting geological model is composed of hydrostratigraphic units. Data quality and QA/QC procedures should be reviewed for brine chemistry, specific yield and hydraulic conductivity. Brine chemistry data should include not only lithium but also other key parameters that may negatively affect brine chemistry, such as magnesium, boron, sulphate and calcium. The robustness of the geological model and resource estimation relies on the 3D distribution of specific yield and brine chemistry throughout the hydrostratigraphic units.

Reserve: brine extractability
Critical parameters to assess brine extractability come from short-term and long-term hydraulic tests, both in the brine reservoir and surrounding freshwater aquifers. Additionally, long-term pumping tests (at least 30 days) with brine sampling should be performed to assess suitability of pumping rates for annual production at the expected commercial scale, assure freshwater availability according to process plant demand and evaluate risk of brine dilution in the long term.

Processing: process design suitability for brine chemistry
Brine chemistry should be carefully reviewed either by pre-evaporation or direct lithium extraction methodologies to assess the client's decision. Afterwards, assessment of process design, flow diagrams, CAPEX and OPEX, among others, must be in line with freshwater demand/availability and long-term brine chemistry evolution from the reserve review.

Infrastructure: $Li^{2}CO^{3}$ production plan suitability
The designed and built infrastructure is reviewed for capacity and adequacy in relation to the project and its potential expansions. The facilities are analysed from the capacity of mining camps and potential for energy generation, to supply of raw materials and export logistics proposed for lithium carbonate.

Environmental and Social: feasibility assessment
Environmental and social input to due diligences on lithium brine projects is in line with international standards. Any inappropriate handling of environmental and social features can render a project unfeasible, regardless of the technical aspects. Critical features of these projects are scarce water availability for brine process demand, fragile ecosystems surrounding the salars and lack of proper social management plans.

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Diego is a mining engineer with experience in all stages of a mining project, from pre-feasibility to mine closure, through operational planning, supervision and management of mines and quarries in production stages, planning and implementation of closure of disturbed areas. Diego has worked on waste characterisation, geoenvironmental design of dumps and other environmental aspects such as remediation of areas affected by tailings dams.

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Mining project evaluation for supply-chain clients

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Terry has over 28 years of professional experience dealing with environmental compliance activities that require engineered solutions at mining operations. His projects often require negotiations with regulatory agencies and other stakeholders to achieve client objectives. Terry's multi-disciplinary project teams address unique technical issues associated with mining, including permitting, design, construction and long-term monitoring of large-scale mine closure projects.

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More emphasis is being placed on sustainable development and the technical risks related to production

Responsible sourcing motivates buyers and producers to consider a life-cycle approach to raw material production, refining and conversion into end-use products. Responsible sourcing examines sustainable development goals, defines performance criteria, reports on compliance with criteria and offers independent, third-party audits of compliance reporting. This approach is applicable across the extractive industries with adaptation to specific commodities and within a range of frameworks. The perspective of the supply-chain buyer will vary based on the commodity and the framework endorsed by the buyer's organisation. When the client is a procurement team from a manufacturing organisation, the approach to mine project evaluation moves from a traditional focus on economic viability, technical risks and social and environmental impacts to a new emphasis on sustainable development and technical risks related to production (i.e. quality, quantity and reliability).

Most frameworks rely on the United Nations Sustainable Development Goals. Established responsible sourcing frameworks applicable to the mining industry include, but are not limited to, governance of materials produced in Conflict-Affected and High-Risk Areas as defined by the Organization for Economic Co-operation and Development, the Conflict Mineral Due Diligence requirement for publicly listed US companies, and standards produced by the London Metals Exchange. Examples of industry-sponsored responsible sourcing frameworks include the Copper Mark for copper, lead, nickel and zinc production; ICMM Performance Expectations; and the Aluminium Stewardship Initiative.

For a given supply-chain buyer seeking to secure raw material for its manufacturing operations, the applicable responsible sourcing framework(s) will be defined at the start of the engagement. The mining consultant must understand how their technical inputs will be used by other stakeholders engaged by the client to complete the responsible sourcing assessment. Depending on the project, these technical inputs may include energy efficiency, water consumption, re-use and discharge metrics, labour requirements, and equipment fleet specifications.

The technical assessment for a supply-chain client focuses less on mineral resource uncertainty, alternative or optimal mining plans, or the potential for lower-cost production. Rather, this client seeks a qualified opinion regarding confidence that the commodity can be responsibly produced at the quality and quantity required by the client and on the timeline expected by the client. This opinion requires the same fundamental principles of mining proj-ect evaluation, but framed in a manner that aligns with the responsible sourcing expectations of the client.

If the property is a development project, the evaluation will require benchmarking and technical review of technology risk, ability to achieve production targets and efficacy of social and environmental mitigation. If the property is an established producer, the evaluation relies on operational data, performance to plan, and a track record of reporting on sustainable development performance.

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Geotechnical audit: a tool for mining project evaluation

Economics and safety of large open pits rely primarily on the stability of the pit slopes. However, many historical operations do not adequately consider geotechnical aspects for pit slope design or for its operational management. As a result, geotechnical risks and opportunities associated with the operations remains unidentified.

SRK India was retained to undertake a geotechnical audit of open pit operations owned by a metal mining entity. The aim of the audit was to review performance of the pit slopes and to use the audit as a benchmarking tool to compare with international best practices.

SRK considered 25 parameters to evaluate the geotechnical condition of the pit slopes. These included the mine-scale geology, structure, and geotechnical setting; geotechnical reports that supported pit slope design; Ground Control Management Plan (GCMP); reviews of pit inspection and slope monitoring practices and associated documentation; performance of surface excavation in hard rock, weak rock, and soil faces; and ramp performance and the role played by an in-house geotechnical team. The audit scope excluded review of waste dump and tailings facilities and also excluded any slope stability analysis.

The parameters were divided into four categories (red, orange, yellow and white) based on the risk associated with each parameter. Action points were derived for the parameters and were ranked. A timeframe for the actions was also recommended.

The table below shows an example of an audit summary. The mine design was not based on an appropriate geotechnical study; however, the pit slope parameters were conservative and therefore the pit walls were found to be reasonably stable.

Implementation of the prioritised action points may help pit slope steepening (with adherence to the safety standards) and may thereby improve the economics and safety of the mine.

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Sujit is an Engineering Geologist currently based at SRK Consulting, India. With more than 17 years of academic and mining consulting experience, Sujit has a broad background, including design and management of mine site investigation projects, geological modelling, structural geological mapping, oriented core assessment and structural modelling, rock mass characterisation, geotechnical assessment of ground conditions, geotechnical mapping, mine hydrogeology, open pit stability analysis, design and optimisation.

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AUDIT CATEGORIES	RED FINDINGS	ORANGE FINDINGS	YELLOW FINDINGS	WHITE FINDINGS
Description	Serious or systemic issue	Significant Impact	Moderate - low occurrence or impact	Suggested improvements to current practices, or recognised good practice
Maximum remedial timeframe	As soon as reasonably possible	Within 6-12 months	Within 12-18 months	As required
OP slope designs (5 parameters considered)	1	0	4	0
Slope performance (8 considered)	0	0	1	7
Ground strata management (6 considered)	0	1	4	1
Waste dumps and stockpiles (2 considered)	0	2	0	0
Slope monitoring (1 considered)	0	1	0	0
Mine hydrology and hydrogeology (3 considered)	1	0	2	0

Evaluating reasonable prospects

When is a resource not a resource? To answer this, we must look at a poorly defined aspect in the industry: the QP's consideration for reasonable prospects for eventual economic extraction.

Under JORC Code definitions, "A 'Mineral Resource' is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction." While these terms are defined under CRIRSCO, the basis for the definition of what is 'reasonable' and what is 'eventual' remains relatively subjective and at the discretion of the QP.

BEN PARSONS

Ben has over 19 years of broad geological experience, including precious metals, base metals, and more recently niobium and phosphate mining. Ben's expertise includes the production of independent mineral resource estimates, geological modelling, due diligence and auditing of exploration/ mining projects, review of operation performance, technical reviews, and assistance in project evaluation as part of Competent Person's/ Mineral Expert Reports and stock exchange listings. Ben has project management experience in technical studies such as exploration programs, mineral resource and ore reserve studies, scoping/conceptual studies, pre/definitive feasibility study projects, working with junior exploration companies at grassroots exploration level through to the listing of large multi-national operating companies with multiple assets.

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Examples of these differences include the requirements and reporting for remnants, pillars, or low-grade mineralisation under JORC and SAMREC, which are not defined under CIM or S-K 1300. As another example, CIM guidelines include the requirement for 'reasonable' to be via demonstration of the spatial continuity of the mineralisation. At a minimum, these constraints should be addressed by creating constraining volumes, using costs and assumptions for operating mines or conceptual scenarios for new projects. In all cases, input parameters and methods should be documented.

The second consideration is the time scale. A notable change in the reporting codes under S-K 1300 is that the terminology excludes the term 'eventual'. The SEC requires the assessment of the Mineral Resources to be demonstrated at the time of reporting. This could impact many assumptions being used to define key assumptions such as potential markets, price, or recovery technologies. The assumption of the time period should be disclosed within any technical report summary.

These issues were raised in a due diligence SRK completed in 2021. The client company had significant portions of polymetallic resources which on paper demonstrated a long future to the life of mine. Upon review, the 'Mineral Resource' was an inventory of all material remaining, and did not consider the impact of previous mining or the requirements to achieve the required minimum stope size. This reduced the available material by over 50%. This highlights that the one consistency across all the reporting codes is that the Mineral Resource is not simply an inventory of all mineralisation.

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Considering mining method optionality in asset pricing

OPTION	OPEN PIT MINE	SELECTIVE UNDERGROUND MINE	BLOCK CAVE UNDERGROUND MINE
Ultimate Size of Mine Plan	Continuous Option	Step-wise Option	Limited Options
Mining and Milling Rates	Few Constraints	Significant Constraints	Significant Constraints
Cut-off Policy	Dynamic (truck-by-truck or bucket-by-bucket)	Dynamic (stope-by-stope)	Shut-off Only
Stockpiling	Strategic	Surge/blend	Surge
Ore Type Selection	Easy	Possible	Impossible
Stop-start Mining	Easy	Possible	Hard

In any transaction, determining the true value of the asset is critical. Mining assets are typically valued on the basis of a central deterministic set of assumptions that provide a guide with respect to the fair value of the asset. However, the only thing we know for certain at the time of the valuation is that all of our assumptions about the future are wrong. Understanding the effects of this uncertainty is key to high-quality asset pricing practices. Simple sensitivity analysis across the ranges of uncertainty informs us of the risks, but is limited and ignores both non-linearity in project economic outcomes and the embedded option value in the asset. A simple example is that flexing a cashflow model with upside price varies the revenue and cashflow, but ignores the opportunity to alter cut-off policy and/or expand the mine plan into previously sub-economic areas.

The mining method that is either in place or being proposed has a major effect on the value of the optionality and its effect on the asset pricing. Long-life, open pit mines have high optionality that allows for production optimisation decisions on an extremely granular scale. Best practice using real-time assay technology now promises to allow optimisation on a truck-by-truck, or even shovel-by-shovel basis. At the other end of the spectrum is block caving, where the major economic determination of waste and ore is made in the design phase, and where changes are essentially limited to drawpoint shut-off decisions. In large multi-panel and multi-lift caving mines additional strategic decision points exist, but these are still on a scale that is far short of the granularity offered by open pit mining. The other types of more selective underground mining sit between these two extremes.

Scenario analysis offers a way of exploring the embedded optionality and the value it may create. Basically, alternative future worlds are imagined. These can vary across a range of assumptions including commodity price, resource base, capital costs, operating costs, productivity, and metallurgical recovery. Optimal strategies can be developed for each of these worlds and compared. Various aspects of valuation can be explored. The degree to which the current strategy remains optimal under a range of future assumptions is initially a useful outcome. The value that could be created by making decisions in response to future variations is also informative. Finally, the set of possible project outcomes can be combined on a probabilistic basis to estimate an 'expected value' of the asset. This understanding can bring value to assessing and negotiating potential mining asset transactions.

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Neil has over 30 years of experience in the minerals industry. He has held senior management positions in operations, technical services, and business analysis. At SRK, Neil focuses on economic evaluation of mineral industry operations and projects. He has expertise in economic modelling, specifically in the creation of flexible models for scenario-based risk characterisation and strategic project evaluation and optimisation. Neil specialises in semi-stochastic analysis such as expected-value analysis, and full Monte Carlo simulations.

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