'Mining conjunctive-itis'

Daniel Kahneman should be cited in every investment pitch by mining industry executives to show they understand their project risks.

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Executives should look up Daniel Kahneman if they want to give a fair representation of risk to investors

Kahneman, a psychologist, received a Nobel Prize in economics in 2002 "for having integrated insights from psychological research into economic science, especially concerning human judgement and decision-making under uncertainty", according to the award committee.

Much of Kahneman's research was conducted with Amos Tversky, another cognitive psychologist, whose collaboration could not be recognised by the Nobel awards committee because he had died of cancer prematurely in 1996.

In the early 1970s, Kahneman and Tversky began to highlight what appeared as sometimes irrational decision making and inexplicably erroneous thought processes by individuals confronted with uncertainty in markets.

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Their experiments showed that people were prone to take some decisions even when results ran counter to their own best interests and in defiance of what may have been known about likely outcomes. The decision-making errors arose from a systematic bias in the way in which human minds process risk.

In a paper entitled 'Judgment Under Uncertainty: Heuristics and Biases' in Science (Vol 185, pp 1124-1131,1974), the two psychologists described how "people rely on a limited number of heuristic principles, which reduces the complex tasks of assessing probabilities and predicting values to simpler judgmental operations".

Kahneman and Tversky described these heuristics or rules used to simplify complex decision-making problems as "quite useful, but sometimes they lead to severe and systematic errors". The 1974 paper is a catalogue of explanations for apparently irrational decision-making outcomes.

While neither Kahneman nor Tversky appear to have thought explicitly about investment decision-making within the mining industry, their discussion of "biases in the evaluation of conjunctive and disjunctive events" has a direct bearing on industry decisions and, potentially, on why sector returns so often disappoint investors.

"Investors are constantly being asked to back situations in which failure is the overwhelmingly most likely result"

In the terminology of Kahneman and Tversky, any mining development can be viewed as a series of conjunctive events.

Once a mining company has demonstrated a mineral resource, it usually begins a trip down a well-trodden path toward production. Analytical studies of increasing sophistication, government and community approvals, funding, recruitment of qualified project managers, identification of customers, construction and operational commissioning are all necessary for success.

The omission of any single step in the sequence renders the whole incapable of completion. For a conjunctive business undertaking to succeed, each of a series of events must occur.

Kahneman and Tversky described how "people tend to overestimate the probability of conjunctive events and to underestimate the probability of disjunctive events". A disjunctive event is where only one of a series of possibilities is needed for success.

Kahneman and Tversky observed that "even when each of these [conjunctive] events is very likely, the overall probability of success can be quite low if the number of events is large".

Moreover, they concluded, "the general tendency to overestimate the probability of conjunctive events leads to unwarranted optimism in the evaluation of the likelihood that a plan will succeed or that a project will be completed on time".

Timing is an important added dimension in the mining investment market context. Delays can jeopardise the willingness of investors to provide ongoing support.

Not only must each step along the development path be completed; it must be completed within a time-frame acceptable to investment markets to fully benefit those behind the funding.

In the context of a mining development, let's assume there are seven necessary steps each of which has an 80% chance of success. Statistically, this is equivalent to drawing seven successive red balls from a bag containing eight red and two white balls, with replacement of the balls after each drawing.

The probability of the overall development being completed will be 21%.

The probability that just one step in the required mining project development sequence is not realised – the chance of drawing a white ball on any one of the seven draws – is 79%.

This example typifies the standard mining industry investment model. Investors are constantly being asked to back situations in which failure is the overwhelmingly most likely result.

Companies, when pitching for investors, will typically speak of each link in the development chain as having a high chance of success. In practice, this claim usually arises from other biased judgements.

The tendency to use historically favourable outcomes or those with which directors are most familiar to infer their own chances of success, while ignoring large numbers of failures, is another common decision-making bias.

Mining investment promoters are also inclined to apply the average chance of success attributed to each of the individual components to the overall outcome. On this reasoning, if each component of the plan has an 80% chance of success, the overall chance of completion is said to be 80%, despite the sloppy statistical analysis.

A disproportionate amount of mining industry investment is based on the "unwarranted optimism" arising from such decision-making biases.

Notwithstanding the strong empirical and theoretical evidence for the persistence of these errors, no attempt is made to control how companies present their investment propositions.

Most times, company executives will be entirely free to assert erroneously that the chance of success exceeds the chance of failure when the reverse will be true.

If executives had to attribute a probability explicitly to each event in the sequence they identify as being necessary to fulfil their production ambitions, they would gain a more realistic view about their projects' worth.

Mining executives often lament publicly (and even more frequently privately) that markets do not share their expectations of success.

The reason for the disparity in views might be straightforward enough: executives are ignoring what Kahneman pointed out 40 years ago and what should be compulsory reading for any mining project promoter today.

**John Robertson is the chief investment strategist for PortfolioDirect, an Australia-based equity research and resource stock rating group. He has worked as a policy economist, business strategist and investment professional for nearly 30 years, after starting his career as a federal treasury economist in Canberra, Australia*