



Optimising overburden removal

Since 2004, Synergies Economic Consulting has provided quality advice and delivered innovative, client-focussed solutions to the private and public sector throughout Australia. Synergies has built its reputation for timely and high quality professional advice through the expertise, skills and flexibility of a dedicated and experienced team.

What sets us apart from our competitors is the ongoing hands-on involvement of our senior professionals in all our projects. We take great pride in the quality of our work, our people, the way we work together and our ability to deliver practical solutions using sophisticated commercial and economic techniques.

We are known for our thorough approach, innovative thinking and clear communication. This has been reflected in the diverse range of specialised economic and financial modelling projects we have undertaken, including for clients in the mining, health and telecommunications sectors. An example of such a project is summarised below.

The model

Overburden is the rock and soil that has to be removed to expose ore deposits and coal seams in open cut mining operations. It is one of the largest mine operating costs and the level of overburden has a profound impact on the operating performance of the mine. Inadequate removal may result in operational interruption, while excess removal raises costs, through the opportunity cost of the capital expended in its removal.

Many factors affect the optimal level of advanced overburden removal and the optimal deployment of resources to achieve it. They include, amongst other things: the costs, availability and operational performance of equipment; the type of equipment in use (e.g. drag line or truck and shovel); the scope to move equipment between adjacent mines; self-provision or contract provision of overburden removal; the distance that overburden needs to be carried, which varies with age of the mine; strip ratios which vary with the depth of the deposit and mine age; and the nature of the overburden itself.

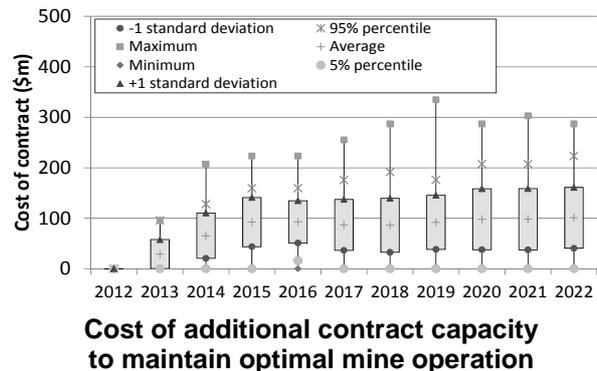
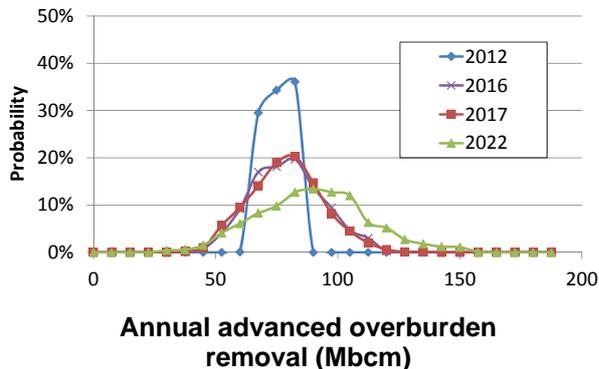
The mine operator is faced with a complex optimisation task, balancing all these factors in the face of variable performance and volatile ore prices. The commercial consequences of inadequate overburden removal will be exacerbated if it results in supply interruptions when ore prices unexpectedly rise, but not when ore prices are low.

Synergies developed a sophisticated model to address this challenging task recognising that there

is no 'right' level of overburden removal. Rather, different target levels of overburden removal give rise to different revenue risk exposure for the mine operator. The model helps the mine operator assess the preferred level of overburden removal by showing the expected revenue and the value at risk at different target levels. The model was constructed using:

- twin Weibull distributions to represent equipment failure and less frequent but more severe failure events such as wall collapses;
- separation of the impacts of normal operating variance and large scale stochastic events (LISE) on target overburden removal;
- volatility in market prices for coal or ore, based on observed patterns of price volatility;
- Monte Carlo simulation to gauge the trade-off between the expected value of the mine and its variability;
- indivisibilities in overburden removal capacity including minimum sub-contracted quantities, minimum contract tenor, contract renewal options, and lead times on equipment purchases or contracts (which can be volatile); and
- optimisation to derive the decision rule for adding sub-contracted or self-provided overburden removal capacity at any time, as a function of the state of and remaining life of the mine at the time.

Some typical results



Some of our other modelling experience

- Modelling the commercial value of additional under-sea trans-Pacific telecommunications cable capacity having regard to the expected level of growth in demand for broadband transmission, technological change, the likely behaviour of existing trans-Pacific carriers, and the impact of new capacity on prices.
- Using real options modelling approaches to determine the value of increased flexibility in the supply chain of a major mining operation, and hence the value of securing additional supply chain capacity.
- Using Monte Carlo modelling to assess how the risk of viral contamination of blood products is affected by blood donation regulations, the characteristics of tests for viral contamination, and testing and manufacturing processes.
- Real-options modelling to determine the optimal timing and size of investment in bulk potable water supply in the face of highly variable annual rainfall and various demand rationing measures.
- IO modelling to assess the economic contribution of a major pharmaceutical and R&D company to the Australian economy.
- A combination of game-theoretic and Monte Carlo simulation modelling to forecast the likely pattern of vaccine prices in the face of significant future demand and supply uncertainty.
- Empirical models of the causes and consequences of industrial accidents, including modelling the impact on the rate of accidents of improved workplace health and safety legislation.
- Pricing models for transport supply chains used to determine appropriate end-user tariffs.

Our people



Sam Lovick, a Principal at Synergies, has developed a large number of practical models in his 25 years of international economic consulting, using a broad spectrum of modelling techniques. His modelling encompasses: electricity markets; real options modelling of water investment, pharmaceutical R&D, supply chain infrastructure; the cost of capital for new investments at airports; game-theoretic models of vaccine markets, pharmaceuticals and broadband transmission; and simulation models of a variety of commercial activities ranging from blood collection to mine overburden removal.



Euan Morton is a Principal at Synergies with renowned expertise in minerals, rail haulage, transport, and utilities. His detailed and comprehensive knowledge of the mining sector is essential in ensuring that the factual and economic description of the assets represented by these models strikes an appropriate balance between detail and abstraction. As with all modelling exercises, finding that balance is essential if the model is to successfully address the client's needs.

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