



Technology Business Case & Life of Mine Planning

Mine optimization through digital twinning and techno-economic modeling

Faced with negative yearly cash flows and major capital expenditures over the next 5 years, a global diversified miner wanted to use technology to improve the situation. The need was clear: without innovative approaches, the mine would have to close. The owner sought to understand and model the impacts new technologies would have on the operation.

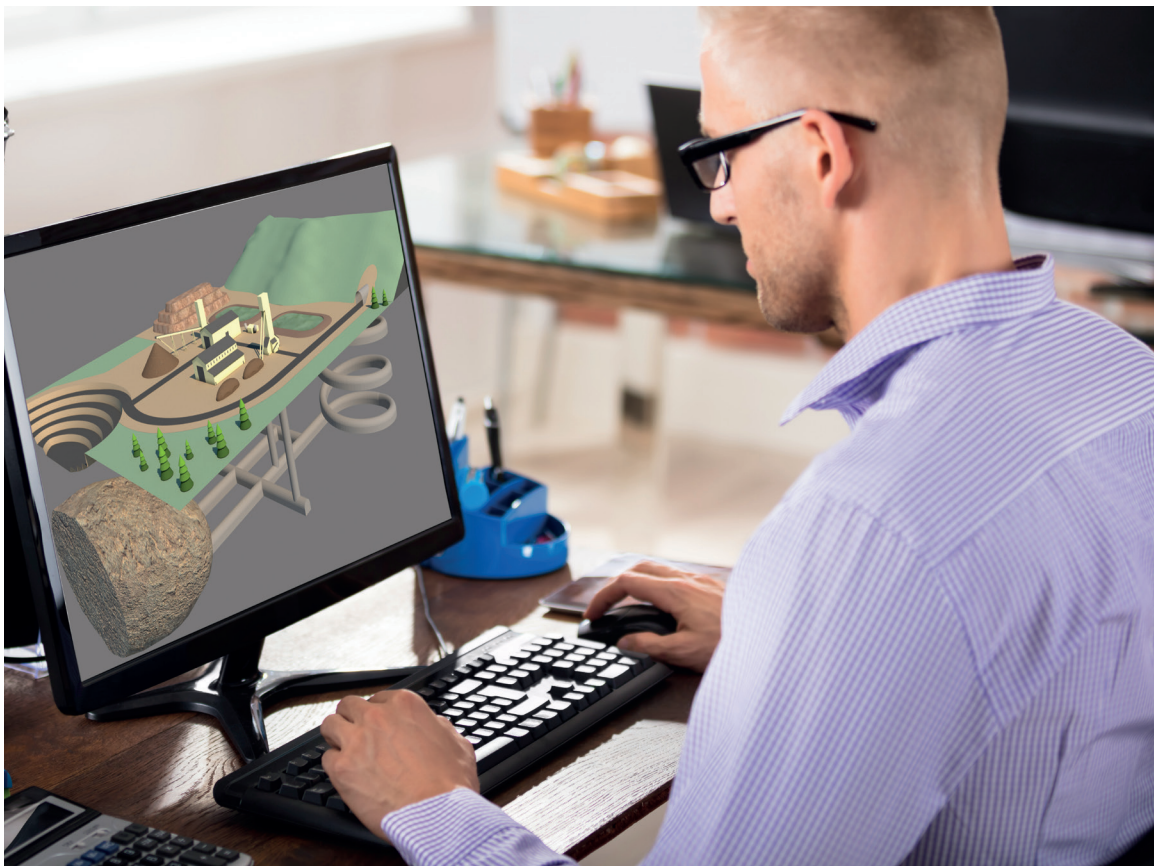
Recognizing that the traditional method of applying technologies in isolation wouldn't lead to accurate

results, buy-in or change, Stantec and Stratalis, developed an innovative form of Techno-Economic Modeling and digital twinning to maximize profitability and eliminate bottlenecks by applying the Theory of Constraints and "Technologies Suites" to the digital twin.

The study started by understanding the operations' and executives' vision for the future, mapping and modeling the constraints and bottlenecks of the current, and future, mine. An industry-wide technology scan helped

understand available technologies and their impacts on CAPEX, OPEX, productivity and time to implementation.

This data, observations of the underground environment, the life of mine plan (LOMP) and exploration plans, allowed design of a techno-economic twin to simulate mine production from all available zones and model the impacts of technology suites on production, cut-off grade and net present value (NPV). The model then identified how the technologies created new bottlenecks



Design of a digital mine twin allowed modelers to simulate mine production and the impacts of technology suites on production, cut-off grade and net present value (NPV).

Diagnose the Present

Understand what reality looks like so that you can virtually map and solve for challenges

Futurecast

Help operations craft a future vision and scan for the technology bring it to life

OUR APPROACH

Create the Twin

Twin process and production digitally and apply technology to discover and solve bottlenecks

Build the Case

Discover technology suites to maximize NPV and build the executive and operations level business case

The outcome of this approach is a technology roadmap, modeled to include the optimal combinations of technologies.

in the quest for maximum NPV-based value (rather than maximum throughput), a shift from the traditional “fill the smelter” or “maximize tons” view. This sort of technological modeling has only recently become possible, as advances in processing power, scenario modeling and agent-based AI engines have allowed modeling of increasingly complex environments.

The modeling showed that focusing on individual technologies was ineffective and did not lead to the highest impact. Technology evolution of impact rarely occurs in isolation; much in the same way that Uber isn’t a single app, but a combination of payment, communication and intelligence. The benefits of grouping technologies into naturally occurring suites and assessing the impact of the suites of technologies to the mine was needed to achieve a “step-change”. This philosophy differs from the typical mining “Top 10 list of best technologies” roadmap.

The techno-economic model demonstrated that when technologies are applied to an operation as “Technology Suites” NPV improved

by 50% over the base case LOMP. While this is impressive, more so is that the dramatic increase in NPV required only a 5% increase in CAPEX over the required sustaining CAPEX from the LOMP. The improvement was achieved due to the impact on mining intensity and face utilization delivered by the technology suites. Individual technology modeling would not have demonstrated such impressive results.

By looking at innovations holistically and by integrating the theory of constraints, the impact of Technology Suites over single machines, and the focus on NPV over production, we established a technology roadmap for an operating mine that led to renewed interest in a challenged operation and a focus on approval for reinvestment, instead of managing potential closure.

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The Stratalis/ Stantec approach to Techno Economic Modeling can be used at any stage of the mining lifecycle.