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Portfolio modelling to enhance group level decision-making

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Mining is typically capital-intensive with a long-term investment horizon. Therefore multi-asset mining companies have to make long-term strategic decisions around capital project selection, timing and current asset configuration based on different market views. This may involve multiple production areas, ore sources, processing facilities and capital projects at different stages of investment study.

The ability to configure a portfolio model of the complete business, generating what-if scenarios relating to asset configuration, capital project selection and scheduling is the ideal platform for strategic decision-making. The different scenarios need to be stress-tested against changes in external market parameters (price, inflation, exchange rates, etc.) and by rapidly generating different scenarios, guide strategic decision-making based on different market views.

A portfolio modelling application was developed for a large platinum mining company where multiple scenarios were generated for different 'mine ownership models', capital project selections, global assumptions and capacity constraints. The NPV, cash flow, capital efficiency, and other key metrics for each of the generated scenarios were then compared to demonstrate the key drivers of value between scenarios and the main reasons for variance between scenario outcomes.

This case study proposes a portfolio planning methodology to define and test multiple scenarios to guide strategic decision-making.

At this particular client, the Cyest Portfolio Modelling Solution is currently being implemented to support the methodology described in this case study, and therefore no actual quantifiable results from the portfolio are available for this paper.

Introduction

Executives in the South African mining industry face increasing operational challenges and investment decisions stemming from rising costs, volatile commodity prices, socio-economic issues and unique labour challenges. Without a thorough understanding of the impact of different strategic choices on the business, it is difficult to have confidence in decision-making. Mining companies also need to maximize value from a finite, non-renewable asset, while operating in a market environment characterized by variable metal prices (Smith *et al*., 2005).

Strategic planning is certainly not a new field. The world's leading management consultancies have been providing executives with strategy from as early as 1926 (McDonald, 2013). However, while these firms provide sound advice during the engagement, management generally do not have the ability to generate their own scenarios and continuously test different strategies throughout the year. This suggests the need for a strategic planning tool to assist management to decipher and respond to continually changing circumstances and make optimal long-term strategic decisions at group level.

Technically, a portfolio model is a mathematical representation of the complete business that integrates production and financial metrics into a holistic representation of the group (Lane *et al*., 2009). It then enables different scenarios to be stress-tested against changes in internal and external market parameters (price, inflation, exchange rates, etc.), guiding companies to make informed decisions based on different market views.

A strategic decision may be correct in one macroeconomic environment, but be deemed inappropriate in another. The current environment of volatile prices and increasing costs means strategic planning is more important than ever. As an example, due to short-term cash generation requirements, it may be more beneficial for a particular operation to reduce production and capital investment in order to maximize short-term cash flow in a trade-off against long-term value. It may also be more beneficial to dispose of or purchase an asset that would negatively impact the particular operation, but positively enhance group value. These kinds of decisions are generally counter-intuitive, but can be highlighted with the assistance of portfolio modelling.

Additionally, the hierarchical management structures within large companies may inhibit the process of challenging the current strategy and status quo. Portfolio modelling could foster a better environment where alternate future strategies are backed up by rigorous quantitative modelling, enabling management to propose and support alternate or counter-intuitive scenarios to support decision-making.

The portfolio planning process

Figure 1 illustrates how the business can, at a high level, utilize the portfolio model within the entire portfolio planning process. The process is cyclical in nature and should be iterative, allowing management to continuously manage the portfolio and enhance group-level decision-making. The seven items illustrated in Figure 1 are explored in further detail in subsequent sections.

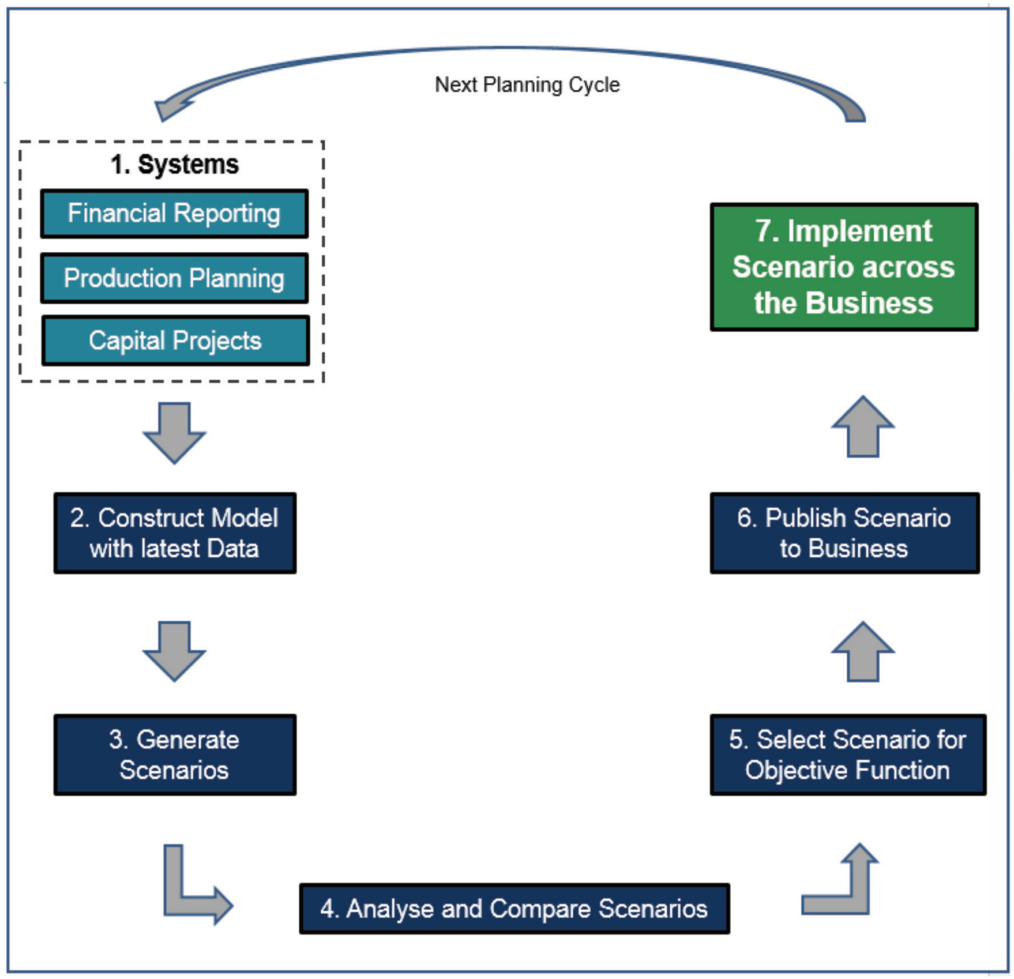

Figure 1. Portfolio modelling within a mining organization

Systems

A portfolio model requires data from different systems to construct an accurate view of the business. Since a portfolio model is a long-term planning tool, the information should cover a minimum of 25 years.

- **Financial reporting:** the financial reporting systems within the organization are vital to ensure a successful planning exercise. The expected capital expenditure, operational expenditure, stay-in-business capital, fixed/variable cost splits, cost allocation methodologies and macroeconomic assumptions are imperative for a portfolio model.
- **Production planning:** production plans for each mine, shaft, level, or investment centre within an organization are required for the portfolio model. Typical information would include tons milled, refined metals produced, platinum group metals (PGM) splits, grade, recoveries, etc.
- **Capital projects:** capital project planning is imperative for long-term externally focused strategic decisions (Lane *et al*., 2009). This includes planned purchases of a mining asset, expansion of a processing plant, acquisition of another company or planned extensions of the mine to increase production.

Additionally, the integrity of input data is paramount when portfolio planning. Despite its obvious importance, data quality remains a challenge in almost every large organization. Incorrect or inconsistent data can significantly distort the results of analyses, often negating the potentially large benefits of information-driven approaches to scenario planning (Hellerstein, 2008). Typically, a data cleansing exercise is required before starting the portfolio planning process.

Construct portfolio model

Mining companies often operate individually with each mine and the processing division managed as a separate entity. Operational key performance indicators (KPIs) are aligned with these objectives without a full understanding of the impact up or down the full value chain. A particular operation may be maximizing production of a certain ore type as this impacts the unit cost KPI, but this may be at the expense of processing efficiency, thereby reducing overall group value. Maximizing the value of each individual component of the business may not yield the maximum value for the group (Lane *et al*, 2007). The complexity around alternative ore sources, routings, processing options and different products becomes even more complex to optimize without a portfolio model that encompasses the complete business value chain.

Utilizing the systems data described in the previous section, the portfolio model consolidates all underlying operations, mines and future capital projects to allow users to make trade-offs around project selection and scheduling, closing of mines or operations and/or changes in commodity prices.

Like any system, a portfolio model is mathematically built based on relationships between variables. In essence, thousands of individual relationships with inputs and outputs construct a complete portfolio model (Lane *et al*., 2009). This concept is illustrated in Figure 2.

Scenario generation

Once a base model of the complete business value chain is built from validated system data, the foundations are firmly in place to begin the scenario planning process. Figure 3 illustrates the entire process for building and utilizing a portfolio model, and will be referred to in this section as well as subsequent sections of this study.

When generating scenarios, the strategic objective (and objective function) must always be kept in mind. Figure 4 illustrates a few very feasible strategies, each requiring a strategic trade-off yielding differing results.

A portfolio model enables the user to generate scenarios that answer different questions.

- **Capital projects:**
  - o 'Should we invest in Project X or buy an existing mining company? If so, how much incremental value will the investment add to the group?'
  - o 'Will this value be enhanced if we delay the project or bring it forward?'
  - o 'Will the capital investment benefit my existing current operations?'
  - o 'Which project should we invest in within a capital constrained environment?'
- **Current operations:**
  - o 'Taking into consideration processing constraints, how should the production levels from each existing operation be adjusted to maximize group value?'
- **Ownership model:**
  - o 'How much value will be added if we buy out our joint venture partner to fully own Mine X?'
  - o 'Would it be beneficial to group value if we sold the mining operations of Mine Y, and instead buy concentrate from an external company and only process the concentrate?'
- **Macroeconomic assumptions:**
  - o 'What would our margin be if the platinum price drops by 10%? Would it be beneficial to the group to modify (or initiate) the hedge book and reduce our NPV sensitivity to price?'
  - o 'Will I still be profitable if my costs escalate by 15% instead of at the rate of inflation?'
  - o 'How will my cash flow change if the rand strengthens by 20% against the US dollar over the next 2 years?'

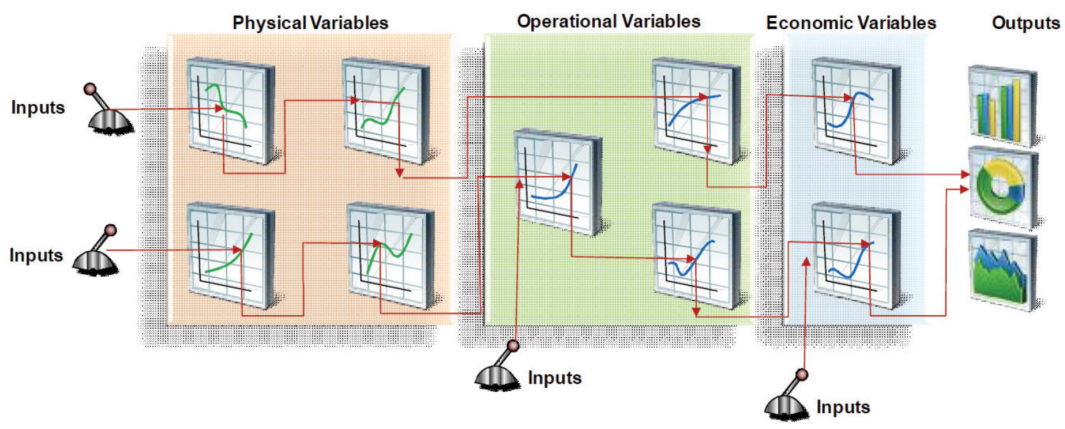

Figure 2. A portfolio model integrates all aspects of the business (Lane *et al*., 2009)

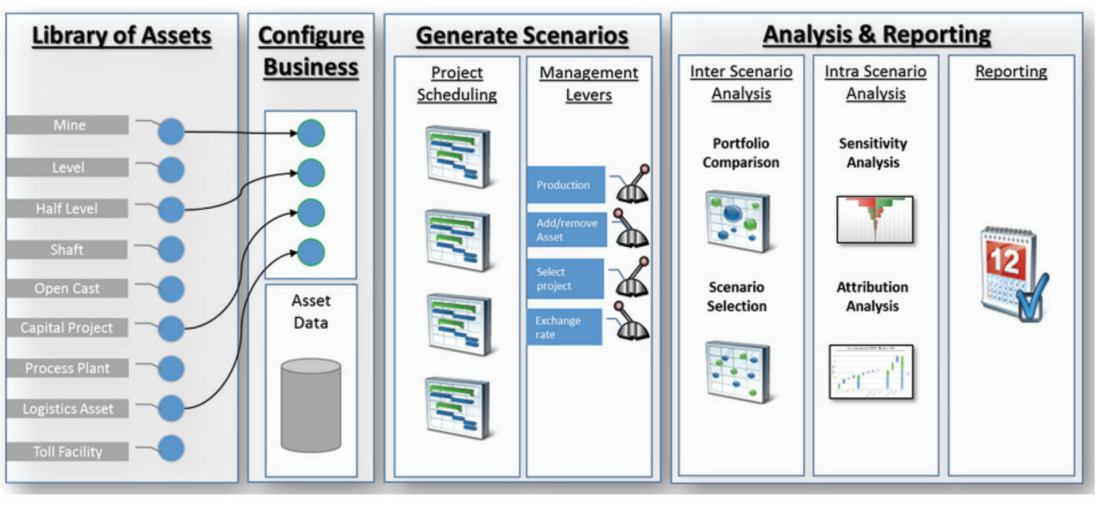

Figure 3. Building and utilizing a portfolio model

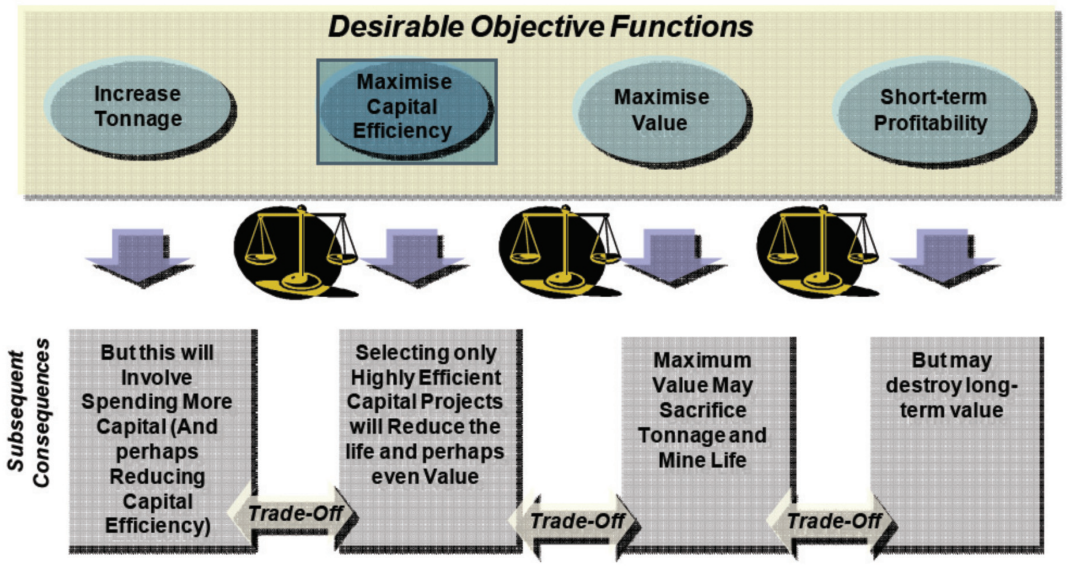

Figure 4. Objective functions and trade-offs

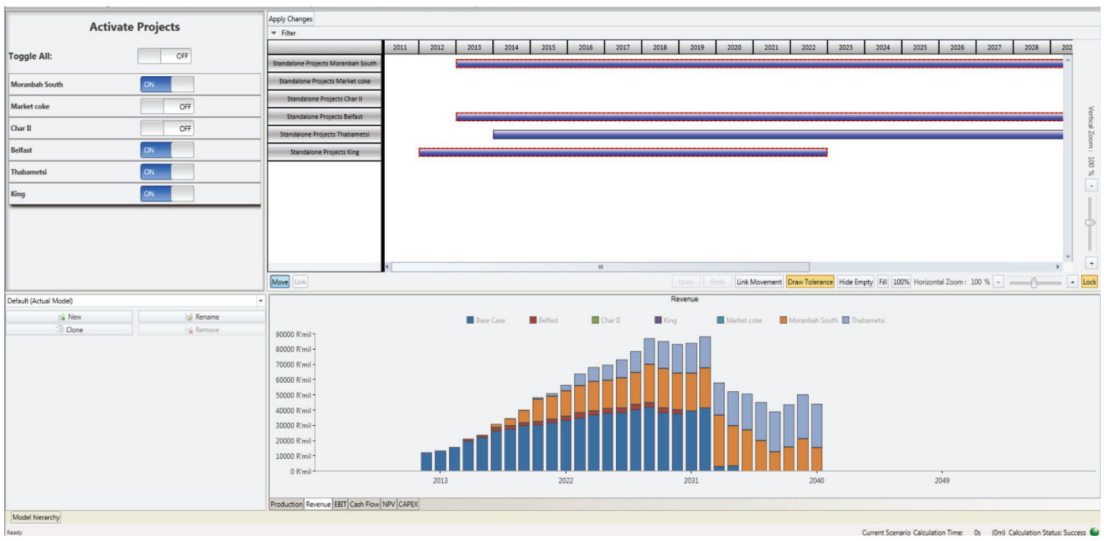

Figure 5. Capital project selection and scheduling screen

Figure 6. Analysis using a value driver tree to understand 'reason for variance' between scenarios

Analyse and compare scenarios

A specific scenario is a consolidation of the many possible changes mentioned in the previous section. For example, executives may want to know the ideal scenario for a high-inflation, low-price environment. This may include selling an operation, delaying a project, acquiring a new company and changing the ownership type of an operation. All these changes are grouped together and finally presented as a scenario.

Once defined, executives should compare different scenarios with the assistance of advanced analysis techniques. Figure 5 and 6 shows examples of typical user interfaces and analysis from a portfolio model.

Select scenario for objective function

Once the different scenarios are compared, the executive team must make the required trade-offs and select a final scenario based on the objective function. As described earlier, the objective function may be different depending on the particular situation a mining company faces. The executive team may need to maximize:

- Long-term value (NPV)
- Short-term cash flow
- Capital efficiency
- Life of mine
- Market demand.

Once the executive team have carefully selected the optimal scenario for their objective function, the use of the portfolio model is complete for that planning cycle. The strategy must then be communicated and implemented within the business.

Publish scenario to business

It is critically important that all business units (operational and strategic) understand the overall strategy and why a specific scenario was chosen by the executive team. Business units that understand the overall strategy, will be able to make better day-to-day decisions that support the overall vision (Bradford, 2013).

While most companies understand this concept, they often have difficulty effectively communicating the strategy to people outside the strategic planning team.

Implement the chosen scenario across the business

While the analytical capability of a portfolio model is important in strategic planning, the softer aspects of change management and good communication of strategy is equally critical. Companies must master the softer side of strategy – leadership, culture and teamwork – to make the real changes that a new portfolio strategy demands (Norton, 2012).

Conclusion

Mining companies have to make long-term strategic decisions around capital project selection, timing and current asset configuration. The ability to configure a portfolio model of the complete business and quickly generate what-if scenarios provides the ideal platform for rigorous strategic decision-making.

A portfolio planning process was outlined in this study, which if followed, could add significant value to planning departments across the industry. It is an iterative process that should occur at least once every planning cycle. The softer side of strategy communication and change management should work in conjunction with the portfolio model to ensure a successful implementation of the selected scenario.

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Dirk Kok has a BCom (Hons) in Computer Science and a MCom from the Nelson Mandela Metropolitan University, South Africa. Prior to joining Cyest, Dirk contracted for 10 years as a software architect to various companies. During that period he acquired experience in several industries including, retail banking, capital markets, engineering and IT security. Dirk has been involved in several engagements where he specialised in the design and development of large, complex, multi-user software applications. In 2012 Dirk became an associate director of Cyest Technology and is currently overseeing the product development division.

Dirk played an important role in the vision and overall leadership of the Syndicated Driven Development Program (SDDP) with Bentley Systems for the New Mining Planning Solution that is jointly being development by Cyest and Bentley and which brings a new paradigm to effective mine planning.