

White Paper:

Planning in the Mining Industry



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Fictitious case study - every mining company has a Marvin

Marvin the Mining Engineer has a talent for modelling and an attention to detail bordering on the obsessive. His pride and joy is a 43-sheet, VBA-drenched Excel model simulation of the mechanics of the Company's processing plant. Simply input all the key parameters (552 of them, spread over 16 sheets), and the spreadsheet calculates a full production forecast of processing plant physicals, from a feed-rate and blend optimised by using goal-seek, right through to the grams of contained metals (by element) in the finished products. It even pops up a warning message if radioactivity levels are projected to exceed safety standards!

The model becomes globally referred to as 'the Marvin model'. It is such a success that it is integrated into the Company's overall planning model, with automated links to the other components such as the Mining Model, Sales Model, etc.

(Fast-forward 2 years)

Marvin has gone!

The Company has changed, new ore sources have been brought online and old ones have been closed.

New technologies and methodologies have been introduced in the processing plant. The dynamics of the operation have changed.

Workarounds have crept in to try to accommodate the changing conditions into the planning model, but nobody really understands how 'Marvin's model' works, or the potential knock-on effects of making changes.

Increasingly, calculated cells in the spreadsheet are overwritten with hard-coded numbers to 'fix' the results. Links to the other models (Mine, Sales, etc) begin to fail as those models evolve. Results begin to look odd, breeding a lack of confidence in the model.

A rework of the processing model is required. The task is assigned to a new hot-shot engineer called Marvin....

Although this is not a true story it is a pretty accurate reflection of what we see when we visit mining organisations to discuss their planning and reporting processes. There are a lot of very talented Marvin's working in mining organisations across the world and more often than not their Excel based solutions are critical to the management of the organisation. Unfortunately many mining organisations end up caught in a forecast and budget modelling cycle like the one detailed in Figure 1. which erodes confidence and leaves the company exposed:

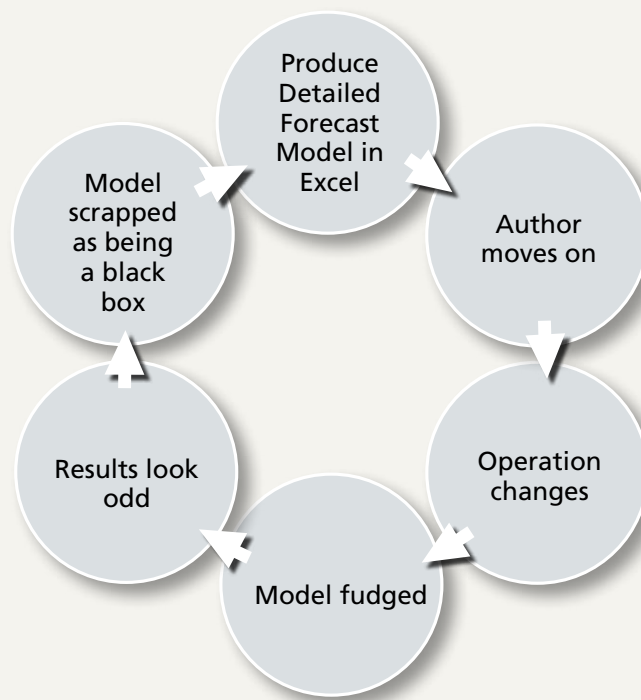


Figure 1: Typical budget model lifecycle

This outcome is at least in part, due to the complicated nature of mining operations and the level of detail required to produce a forecast that reflects the real-world conditions. The outcomes illustrated are obviously not welcome and represent challenges that most mining companies are looking to overcome.

Before we look at how some organisations have resolved these challenges, let's look in more detail into the reasons why these processes are so difficult.

Why are mining operations so complicated to model?

1. Segregation of duties = isolation of planning models

Most modern mines are large-scale enterprises, with the operations and staff necessarily divided into manageable structures generally dictated by the geographical location of the sites – e.g. separate staff for each mine, processing plant, refinery, smelter, etc.

The staff responsible for planning/forecasting production activity will naturally focus on the processes for their own particular area of expertise, with an inclination to plan in more detail than would perhaps be necessarily required at Corporate level. Although there is generally some form of central control over the basic requirements of the planning models, it is rare to find a standard template imposed across all operations. The result is a mish-mash of different planning models built in isolation of each other and then loosely linked together at a later stage.

2. Real-world mining is technical

The mining process is not simple, as the salary levels of mining engineers attests! At least some of the actual methodologies used must be incorporated in the planning model for it to stand any chance of being an accurate reflection of the real-world operation.

We can simplistically define the main production activities of a mining operation as follows;



Figure 2: Typical Mining Process

Although the fundamental processes are similar for most mining organisations, each company faces unique circumstances which often translate into very different requirements for Physicals planning;

- Are production volumes dictated by available ore feed, mill capacity, sales demand for finished products, or some other constraint?
- There may be multiple ore sources feeding a single processing plant. Each source will have different attributes in terms of metal grades, rock hardness, shape, agglomeration, etc, which will affect their relative ability to be processed. Should the feed sources be blended to achieve maximum plant throughput, maximum finished product tonnes, maximum contained metal tonnes, maximum revenue, minimum plant maintenance or a combination of these things?
- How complex is the process for extracting metals? A mineral sands processing plant will contain many more circuits and produce many more finished products than, say, a copper plant. What level of detail of these processes needs to be captured to enable accurate planning..?

And that's just planning the basic physical mining processes. A full planning solution needs to consider all other aspects of mine operations, including;

- **Operational Costs**
 - A driver-based approach will allow operational costs to flex automatically to reflect changes in the underlying physical activities
 - Allocations of overheads, etc.
- **Workforce**
 - Planning for the current workforce, estimated new hires and retrenchments, FIFO and Camp logistics (often incorporating multiple shift patterns)
 - Translating the above to plan the associated costs of employment.
- **Stock Management**
 - Managing the volumes in each stockpile in terms of total weight and weight of contained metal (method = LIFO, FIFO, weighted average, other?)
 - Valuation of stocks based on associated cost of production
- **Capex/Projects**
 - Tracking projects from conception to completion
 - Calculating associated depreciation/amortisation
- **Maintenance**
 - Projection of scheduled downtime of mobile fleets and processing plants, linked to the production plan (e.g. through Operating Hours)
 - Plan for costs of both scheduled and unscheduled maintenance activity
- **Sales/Revenue**
 - Plan logistics around future sales – available product (tonnes and grade), demand, prices, etc.
- **Financials**
 - Forecast P&L, Balance Sheet and Cashflow
- **Analytics**
 - Product profitability, Cash planning, etc.

These activities are all interdependent. For example, say the Maintenance Superintendent wants to change the maintenance interval for relining the sag mill from 100,000 operating hours to 110,000 operating hours. Below is listed just a few of the potential following knock-on effects, depending on the operational circumstances of the Company;

- The dates on which the Sag Mill will have maintenance downtime
- The dates on which key maintenance staff are required on site, possibly affecting FIFO and camp schedules
- The feedstock available and blend options available when the mill comes back online (assuming mine production is not throttled to accommodate the change)
- The processing plant throughput and finished product volumes
- The tonnes and grade available for sale at key dates, possibly affecting price obtained
- Product shipping schedules
- Projected revenue, operational costs, maintenance costs and therefore cash planning

When all of this is considered together, a morass of loosely linked Excel models starts to look a bit cumbersome and ineffective.

3. The Devil is in the detail

By default, the people who design and maintain the forecast models need to understand the operations. For the modelling of physicals, it is generally the mining engineers who are the best fit for this task. One of the character traits which help define a good engineer is attention to detail.

Attention to detail is highly desirable in real life production situations (e.g. when working out optimum feed rates). However, this same character trait can be inefficient when applied to Planning out the next 5 years – we should always remember that a Budget or Forecast is no more than an educated guess as to what might happen.

Is there a solution?

Yes there is. Software solutions have been available for a long time that can automate, control and manage your planning, budgeting and reporting processes. But the challenge comes in translating what is generic software content for standard organisations into specific, tailored content for a mining company. Too often we hear the mining organisations can't use standard software solutions because their needs are unique. Examples include:

1. Our processes are complex, but we can follow the logic ourselves in Excel to keep track of what is happening. Replacing Excel with other software will remove that easy audit trail, leaving us with a planning system that is a black box where nobody will trust the outputs.
2. Off the shelf planning solutions are too generic. We need a bespoke solution because our Company's operations are unique.
3. System developers don't speak our language. How will they be able to build what we need if they do not understand the requirements?
4. Our processes have to adapt quickly to changing conditions (e.g. a new mine) and as mining methodologies and technologies advance. The system will either quickly become obsolete, or we will have to spend a fortune on consulting fees to keep it up to date.
5. Staff turnover in the mining industry is relatively high. We will be forever training new people on a completely new system.

But with a bit of help the generic software solutions that are fit for purpose for a standard organisation can be developed to deliver excellent results for mining organisations. Examples include Rio Tinto, Anglo American, Xstrata, Newmont, Alcoa, Barrick Gold and Newcrest.

What makes our solutions different?

M-Power is completely focused on delivering planning, budgeting and reporting services into the mining sector. Our consultancy team has delivered solutions to over 40 mine sites across Australia, South America, Africa, USA, Papua New Guinea and Canada over the last 10 years. Our knowledge and experience has helped us to become the number one implementer of mining specific Planning and Reporting solutions in Asia Pacific.

During this time we have encountered most of the challenges that a mining company faces in this space and worked through different ways of delivering successful outcomes for them. That knowledge and experience has been encapsulated in a pre-built Planning, Budgeting and Reporting solution for the Mining Sector.

Our pre-built solution is based on the number one planning and budgeting software in the world, Oracle Hyperion Planning. M-Power's Accelerator Templates provide a pre-built solution covering all of the major aspects mining organisations focus on. Installed at your site or available as a hosted or managed service M-Power's Mining Accelerator Templates include the following modules:

Physicals - Used to capture and report actual and plan information covering the end-to-end mining process from exploration through mining, processing, shipment and sales.

Opex - Provides a driver based planning solution, for example diesel costs are typically driven by truck hours. Actuals are loaded from the General Ledger allowing variance analysis at cost centre / account code detail by site.

Workforce - Typically a position based planning capability. Users review current workforce and manage new hires / retrenchments; the model references various assumptions to derive total cost of employment including FIFO and camp costs. Tight integration with your HR system to source actual data facilitates variance analysis.

Capex/Projects - From when a project is first conceived during the long term budget cycle, through the various approval and execution phases, our Capex module provides a single reference point for planning and reporting actuals versus plan.

Financials - P&L, Balance Sheet and Cash Flow solutions linked to the other modules above. The Cash Flow component is used to derive actual as well as plan. Also includes stockpile valuation for both actual and plan.

Daily Physicals - Standalone component designed to answer what happened yesterday, where are we at this month, how is our grade trending etc.

Maintenance - Integrates with your maintenance system and the mine plan. It projects forward maintenance schedules and cost.

Many of our clients leverage the templates capability across life of mine (LOM), with the option to run numerous "what if" analyses assessing different operational strategies and seeing their impact through to financials. Joint Venture ownership rules are built into the templates, giving you the flexibility to look at an operation both in a 100% sense as well as the Joint Venture share.

The Accelerator Templates cover a broad range of a mining company's requirements but we understand that every company is different and a "one size fits all" approach is not practical. Typically we find that 80% of your Planning and Reporting needs will be covered by our templates. For the remainder we work with you and your team through a set of pre-defined gap analysis techniques to define the perfect solution for your organisation.

The benefits of deploying M-Power's Mining Accelerator Templates include:

- Mining industry best practice developed with the world's leading mining companies is included from day one.
- Reduced implementation timeframes, lowers costs and gets your team up a running quicker – with the hosted solution this can be even quicker.
- Reduced project risks. Every project carries risks. Our templates, industry knowledge and track record reduces implementation risks substantially.
- Strong User Acceptance – Enabled by early visualisation of a pre-built solution and ease of use for operational staff built in.
- Simplified Administration – We've preloaded the smarts that minimise administration and support costs.
- Standardised, low risk, industry specific deployment of Hyperion Planning.

For more information about M-Power, Oracle and the Mining Accelerator Templates please visit www.mpowersolutions.com.au or contact us on +61 8 9481 0013 or info@mpowersolutions.com.au

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