



10 Questions to Ask About Your Long-term Planning Process

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Introduction

Your technical services department or external consultants are producing long-term mine plans which are used for project decision making and for guiding operations. How do you know that the plan you are using is the best plan, the one which contributes most to business value?

These ten questions along with your comments and answers may help you see if there is untapped value in your project or operation.

There are several interconnected variables at play in the traditional mine scheduling problem with which the strategic mine planner is faced. In direct terms, the schedule sets forth the spatial and temporal plan to develop resources, allocate assets, handle costs, generate revenue, manage capital investment, meet quality and quantity requirements, and deliver commodities to market in a way that maximizes value for the business. While situations vary widely across commodity and region, in order to achieve this the mine planner is modelling a unique material extraction and processing setting, clearly defining all feasible decisions related to this framework, and leveraging the influence of time and value to deliver a schedule which is most advantageous to the business.

As the strategic mine schedule is such a critical component of the overall business plan, the manner in which this problem is handled (and therefore the merit of the solution itself) have a high degree of influence on real business success. If any aspect of the problem is misrepresented, or if any component is solved in isolation (physically or temporally), then the appropriateness of the resulting schedule (and the business's ability to deliver on expectation) is at stake.

1. How is our scheduling done - manually or automatically?

With manual scheduling, it can be difficult to ensure multiple targets are met. Furthermore, running schedules for multiple scenarios often requires more time than is available.

With automated scheduling, schedules are computed quickly, giving planners more time to analyse different scenarios. However, automated scheduling does not optimize any part of the schedule; it simply delivers schedules more quickly than manual scheduling. If you have automated scheduling without optimization, you could be missing out on extra value.

2. Constraints or Targets?

There is a role for target based scheduling. Targets are similar to goals that you try to achieve or get as close to as possible. However, there are other situations where you want to develop a schedule that satisfies a hard constraint. An example of this is when you need to ship a product of a fixed specification, based on sales contracts. A below-spec product will either be unsaleable or will incur a significant penalty. You want to know if a schedule exists that will satisfy these constraints, not just get close to them. This is where you want to have a constraint based scheduling system used to generate your schedules.

3. Do we use optimization in our scheduling process?

Optimized scheduling can be set up to deliver a schedule that will maximize the value of your project (NPV). Once your model is set up, you can consider how changes to your constraints or equipment will

impact the schedule as you optimize different scenarios. Comparing several optimized schedules can assist you to choose the one that gives the best long-term value to your operation.

Schedule optimization often uses a mathematical model to represent the mine and its production constraints. Optimization algorithms which operate on this model (simplex, branch and bound, dynamic programming and others) are used to automatically compute a schedule which not only satisfies the production constraints, but also optimizes the schedule. Normally it is net present value that is optimized although other parameters can be optimized as well.

4. Do we use single-period or multi-period optimization?

An approach that optimizes individual time periods, one optimization run at a time, can add value to a schedule. However, optimizing multiple periods in a single optimization run can significantly impact the long term value of a project by considering each period in the context of the global schedule. In effect, preparation is done in earlier years to ensure that schedules continue to satisfy constraints and give optimal returns in later years.

5. What about blending constraints?

Does the schedule actually stay within the bounds of your blending constraints, or does it deliver material that is outside the specified blend? If it doesn't meet blending constraints, do you understand the cost impact that has on the business?

Blending can play a critical role in a number of planning scenarios including producing a saleable product to specification and optimizing recovery by providing a consistent feed of material to a mill.

6. Can we use stockpiles to increase the value of our project?

Stockpiling allows you to set aside lower value material in order to process higher value material earlier, giving you an increased NPV for your project. The efficient use of stockpiling and reclaiming can significantly increase your NPV. For projects or operations where blending is important, stockpiles can play a strategic role in economically delivering a product to specification.

7. Can we enforce equipment constraints including trucking?

Long-term plans may often be guided by a total material movement constraint. In effect, this is intended to be used as a proxy for shovels and trucks used to dig and haul the material. If your planning process specifically models equipment productivity and utilization together with the equipment requirements for your mining model, then your long-term plan will more accurately reflect your ability to dig and move the material. Ideally, you will want to have calculated cycle times for each block to alternative destinations together with truck availability driving material movement.

8. Are our destinations pre-determined or decided at the time of scheduling?

If destinations are pre-determined then you could be missing out on extra value your project. Pre-assigning material to a particular destination rather than dynamically evaluating the optimal destination could mean lost value to your organization. Incorporating alternative destinations into your scheduling model allows you to optimize the whole process including destinations, and not just the extraction sequence.

9. Can we consider capital expenditure options?

New capital equipment can accelerate the mining process, but how do you determine the optimal capital decisions? Guesswork and manual calculations can give you some information, but if you have a complex schedule, how do you understand the impact of one, two, or even three new capital expenditure alternatives? Planners rarely have enough time to run scenarios for all possible combinations of capital expenditure options. A planning process that optimizes alternative capex decisions together with a mining and destination schedule will give a truly optimal NPV.

10. Once the schedule has been run, how do we communicate it with other stakeholders?

If the planner runs reports and emails them to others, then how do the other stakeholders know if the information they have is current? In this situation, as soon as the schedule changes, the other stakeholders are using invalid information, which can lead to poor decisions. Schedules that are stored on a centralized database mean that stakeholders in different areas of the organization can easily access up-to-date schedules for analysis, confident that they are working with the latest version.

Have More Questions?

Minemax have been providing Mine Planning and Scheduling solutions and services to the mining industry for over 15 years and has offices in Perth, Australia and Denver, USA. Our solutions cover the whole spectrum of strategic and operational mine planning, and they help mining companies achieve production requirements, maximize resource utilization, and optimize business value. Our software is now used in over 35 countries by companies including Anglo American, Barrick, Freeport, Newmont, Rio Tinto, South32, Vale and Glencore, on their projects and operations. For more information on how we can assist you to find the plan with the best value for your project or operation, please contact us at <http://www.minemax.com/>.