

**T**he work of engineering, procurement, construction and management, or EPCM, firms in the mining industry is shifting as mines take on more capabilities and require greater detail in their design phases. There are significant advantages to operations retaining an EPCM contractor, including having a single cohesive team that joins a project and remains over its full life cycle to commissioning.

For EPCM firms, the task is to perform various aspects of a complex project on budget and on schedule efficiently, and keep the customised tasks of the work streamlined for the client.

This stage of a mine's development is an enormous task, and it is

important the EPCM provider and operator work well together and have a clear shared understanding of end goals. Aggressive completion schedules and tight capital budgets are just the tip of the iceberg of the EPCM-operator relationship. The EPCM companies' capabilities, and





preventing cost overruns and other major issues, and that starts with accurately defining all project parameters: site data, quantities, realistic schedules, equipment and bulk costs from both local and global sources, and local construction capabilities and productivity.

"It's also very important to have team continuity between the feasibility study and EPCM phase – that deep knowledge and understanding of the project plan and basis for decisions helps make execution more seamless and means the execution team is vested in the original basis," he notes. "The larger, more complex and logistically challenged a project is, the more difficult it is to control costs, especially in the construction phase."

What does Fluor think are the keys to success? Having the right execution strategy and controlling both project quantities and construction costs, Morgan stresses. The firm's technique to tackle this includes advanced modular designs, using pre-cast, pre-assembly, modularisation and advanced work packaging for improving productivity.

"We are starting to implement modularisation on projects where it was previously not possible, such as remote, mountainous regions of South America. We have also established portable fabrication yards that enable work ... in a controlled environment and at grade, improving safety and productivity."

Fluor says many of the firm's client conversations are now focused around data use and innovation as operators push for improved safety, project productivity and future-proof plants.

"These are exciting conversations ... leading to improvements in mine sustainability and cost competitiveness," Morgan says.

"Mining operations are looking to big data to enhance business outcomes. Whether you call it big data, digitalisation, deep learning or artificial intelligence (AI), the trend is to take a step change increase in the level of data gathered from ongoing operations, analyse this data using sophisticated software tools and use the outputs to drive significant improvements."

The firm's innovation focus at current is its Do it Right Now on Projects initiative, and it was advancing a client's digital twin project at press time.

"Ideas are not enough. To add value, ideas need to be implemented on projects; that is our focus for 2019," he says.

### STANTEC ON RISK

Mining operations, regardless of location or circumstance, and especially self-financed projects, are focusing on predictability and risk management, says Stantec mining vice president Steve Rusk. Why? Predictable outcomes are what inspire confidence in a project, and well-managed projects have clear mandates well understood by all contributors.

Other elements important to both parties in an EPCM-operator relationship: a solid tracking system to measure and illustrate progress, giving a solid basis for good reporting.

However, sometimes project circumstances necessitate a change in direction, and it is the response from both parties that shapes the next steps. Rusk says: "If the team goes through a rigorous process of redefinition, including identification of all anticipated project risks, the new direction can be executed with the kind of predictability required for ultimate project success."

Regarding larger issues leading to cost overruns, Stantec believes some partners discover project plan errors, while others have an adequate plan but execution falls short. What brings it back together, or prevents that altogether, is active project management from every angle.

"Aside from unknowns and uncontrollable circumstances, major project issues come from a misalign-

ment between the project plan and project execution," he notes. "In some cases the plan was wrong; there are [numerous] ways to end up with a plan that does not fit the execution model or circumstances. Robust planning ... is not just about identifying risks in the area they immediately impact, it's about understanding implications of those risks across the entire project and then planning/acting accordingly.

"In other cases the plan can be fine, but there are execution problems," he says, adding that some of the more significant snags include project timing, procurement/contracting strategies and other risks.

"For example, many projects go through optimisation processes ... to ensure time/money is well spent," Rusk notes, adding that one unintended consequence of optimisation is an increased sensitivity of project to execution variability.

"While active management of projects is an important component of current best practice, it is particularly important, even necessary, for success in modern projects with optimised scope, budget and schedule."

When asked how regulatory and environmental requirements are playing into projects of the future, Rusk stresses that those issues are not

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“The industry still has not fully reconciled the impact of these changes that range from time and money invested, to metal (and mineral) deliveries in the future,” Rusk adds.

Moving ahead, Stantec does not think mining will remain insulated from information technology and

data management advances. Opportunities abound for the industry, and it is beginning to take advantage of some of them.

“The current view is these applications will be applied to specific operations needs like autonomous equipment operation. However, once there is a more fundamental understanding of what goes into making AI systems function effectively, we will be in a position to apply this knowledge much more broadly,” he notes.

## PÖYRY DELIVERS AT KITTILÄ

There are three key priorities for mining companies and EPCM providers in their modern relationship, says Pöyry head of mining and metals Jouni Honkala: budget, timeliness and safety. These are non-negotiable whether the project is large or small. Pöyry points out that not only the major investments, but also many relatively small investment and maintenance projects are retaining EPCM contractors to handle work and management more efficiently.

“The way it works [for smaller projects] is the same as larger projects,” he notes. “Often, small investments are made without the important project development phases, which may then lead the project into unpleasant surprises. Using EPCM implementation, these unexpected circumstances are more manageable and ... dealing with them is more cost-effective.”

Regardless of mine size, overruns and other issues can arise, but they are preventable – or at least can be mitigated by accurate, detailed project development phases so decisions can be made prior to implementation and execution.



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"In fact, this is arguably the only way to prevent major cost overruns," he adds.

"Using the EPCM model for mining operators offers a more risk-free experience versus many other implementation models, making it attractive for all sizes, and as a whole is a less expensive option as well. In addition to greater flexibility for all, it is a more 'open' implementation method as the owner has full visibility of costs and progress," Honkala notes.

"Decisions can be made and sub-contracts agreed as the project progresses, making it easier to select the best, most cost-effective technology solutions. EPCM is also a very flexible implementation model; while key guidelines ... are already being decided in the project's development phase, in practice, refinements, changes and unexpected situations are always met during the project."

Pöyry also feels that, when the project owner is not legally tied into one EPCM agreement, the agility is kept and the investor can always

make appropriate changes/decisions during the process.

With changes in regulatory and environmental guidelines, it's important for all involved to analyse environmental and social risks associated with a facility's planned operations. Many measure these by assessing the risks' likelihood and potential severity; while unlikely to occur, each needs consideration because even the most 'normal' operations can have a level of environmental or social impact.

"Good environmental and social impact assessments will plan for all these eventualities, however likely or unlikely, and [implement] mitigation plans. This can only be achieved if the risk management of a mining project is systematic," he says.

Currently, Pöyry is delivering an EPCM project for an expansion investment of Agnico Eagle's Kittilä gold mine in Finland, operated by subsidiary Agnico Eagle Finland.

Kittilä's current life cycle is estimated through 2035, but according to Agnico Eagle's exploration

programme, site exploration will continue beyond that time.

Pöyry's assignment includes services for the gold mine expansion to be carried out between 2018 and 2021.

"The shaft will make it possible to utilise the deeper parts of the deposit in an economically sensible way, and it will improve our energy efficiency, as well as decrease our emissions," Agnico Eagle Finland managing director Jani Lösönen says. "The efficiency advantage of the shaft combined with the raised production rate will improve [its] competitiveness."

Lösönen confirms Pöyry and the mine have worked together on projects that date back to 2014.

"Pöyry's role in the project was the entire EPCM delivery, which covered all aspects of design, safety services, procurement, site supervision and start-up support," Honkala says. "Close cooperation with the client in project management and decision-making enabled the project to remain on schedule and on budget." ▼

MM asked each company: How can an EPCM firm and a mine operator get the most from their relationship? While many responses had some overlap, each company's perspective was unique.

For example, for Wood, the crucial elements are clear communication, a clear division of authority and strong alignment on what defines a successful project.

"All parties must seek to find a balance where EPCM contractors are responsible for the risks they can control, while other risks continue to rest squarely with the mining companies that have many years (decades) to mitigate impact. While mining companies have decades to secure their future, EPCM contractors have two to four years," according to the firm.

However, alignment is key to a successful project, it adds, because risk and reward must be correctly aligned to ensure both parties are incentivised to deliver a successful project as measured against the aligned vision.

For Fluor, getting the most from partnerships means bringing in an EPCM firm to perform a project's feasibility study. That ensures benefit for both sides, as it is the phase that provides the most opportunities for