

Mining companies, regardless of location or circumstance, are focusing on predictability and risk management at today's mines

Making the most of the EPCM partnership

Donna Schmidt talks to EPCM firms about their evolving roles in mining projects and where mine operators' opportunities and challenges lie

The 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 thus evolving roles, are growing in sophistication, complexity, technology and expectation.

MM asked firms from across the globe what the essential elements are to success for both the EPCM firm and mine operator; after all, remaining on budget isn't the only factor at play. We also asked what issues can hold operators back and what they visualise for the future.

WOOD ADAPTS TO CHANGES

From the viewpoint of Wood mining and minerals president Dave Lawson, part of the evolution in the EPCM-operator relationship has been driven by changing conditions at developing mines.

"Mining projects are large endeavours – both for the EPCM and mine owners," he says.

"Lower ore grades mean plants must be larger to be economically viable. Bigger plants take longer to design and build and cost more. The time between project commencement and start of production is considerable and runs into years. Herein lie the two key common interests between EPCMs and miners: schedule and cost."

He points out, though, there is room for differences of opinion between the parties regarding individual risk and reward. Additionally, the idea of a 'lump sum contract' may appear to be attractive for a mining company seeking secure costs and schedules.

That scenario may not always work for an EPCM company, since no two mines are identical. Diverse spans of mineral compositions, locations, geographies and other factors leave firms not as willing to commit to a fixed-cost contract with perceived uncertainty without adequate risk coverage and/or upside potential.

"Attaining cost and schedule alignment between both parties is underpinned by the ability to define the scope," he says.

Many projects suffer some level of cost overrun, with Lawson looking again to the EPCM-operator relationship and their respective abilities to align, when changes arise, for solutions.

"Change should be managed, and contingency must be included to cover the unexpected; it does not include scope changes." He adds that project proponents can at times be optimistic when preparing cost estimates, execution plans and schedules being submitted for approval.

One area of concern for projects is the changing landscape of regulatory and environmental requirements. This is due to changing public perceptions of mining, Lawson believes, with every issue encountered becoming open for discussion in the court of public opinion.

Another keyword of today's industry as a whole is sustainability.

Because of these changes, projects of the future have to adapt. Lawson uses Chile as an example.

"We have seen a significant step change in complexity in Chile ... with approvals now requiring years," he explains. "Beyond regulatory compliance – sustainability is becoming critical to this sector and future projects, presenting both risks and opportunities stemming from environmental and social pressures."

Simple stakeholder engagement is no longer enough, Lawson notes, as mine operators are also being judged in greater detail on their overall societal impact.

"Doing the right thing means more than simply investing in schools

and infrastructure near a mine; companies must create sustaining community value that lives on long after the project has been completed and the mine closed."

As a global EPCM service provider, Wood's view of tomorrow's mines spotlights sustainability as a central focus, alongside growing technological trends like digitisation.

"By putting machines into harm's way instead of humans, far fewer will be hurt," Lawson says. "Mines will ▶



Sustainability is a keyword in today's industry, which is expanding with each working day, says the team at Wood

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Fluor is the EPCM contractor at Anglo American's Quellaveco copper project in Peru



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"Our journey to that future has begun, but is still in its infancy. The goal of widespread integrated digital solutions wrapping the complete mining value chain is still far from reaching fruition."

While the technology of digital twins is expanding and remote operations are becoming more common, there's still a long road ahead.

"Put another way, mining has a lot of ground to make up in comparison with Silicon Valley – so much so that almost all initiatives will show positive results," Lawson says.

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

FLUOR'S BASELINE

Fluor mining and metals president Tony Morgan says many elements are balanced by both parties in the EPCM-operator tie. One commonality binding these partnerships is a commitment to and concern over the social licence to operate.

"We want to develop operating mines that are built and operated safely, with no environmental issues and have a positive impact on the local community," he says. The aforementioned balance comes into greater scope when this desire is matched with the need for efficiency and scheduling balance to get the

project to full production as rapidly as possible.

"There are many things to balance, including tension between capital efficiency with overall cost certainty, versus high reliability and low operating costs, and conflict between using proven technology and new innovations," he notes.

"It is our job as the EPCM provider to help the client navigate through these issues. Today there is a greater focus on tailings, as a result of the recent Brazilian dam failures, and the use of water and energy consumption – all so the overall environmental impact of the plant is minimised."

Fluor acknowledges one thing a client does not want to do: have to return to the board to ask for more money or more project time. An accurate project baseline from day one is crucial. Once established, the focus will be on executing the baseline with quality, speed and safety, as well as within cost.

"I believe setting this baseline up is best started early in the project life cycle, certainly well before the project gets close to the full execution phase. At this early stage it is possible to develop the capital-efficient designs needed to meet the ... objectives," Morgan states. Fluor's approach, Zero Base Execution, helps ensure capital costs parallel the client's business drivers.

Establishing and cementing that baseline is absolutely vital to



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 something to worry about later – they are impacting projects of the present.

"Many owners are taking a multi-year hiatus away from intensive project planning and design in order to complete the permitting process," he explains. "We have been actively working with regulators to help streamline these processes while maintaining rigour." ▶

Part of the evolution in the EPCM-operator relationship has been driven by changing conditions at the mines being developed, says Wood's Dave Lawson

Stantec believes minimum and average time to take a mineral deposit from confirmation to production has increased by at least 50% since the start of the new millennium



► He also estimates the minimum and average time to take a mineral deposit from confirmation to production has increased by at least 50% since the start of the new millennium.

“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.”

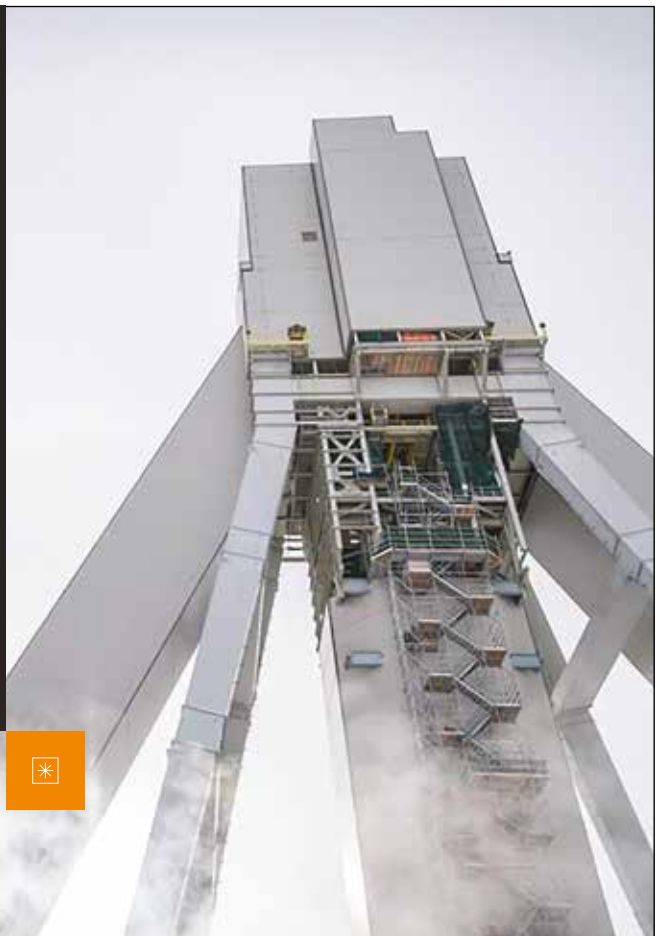
Regardless of mine size, overruns and other issues can arise, but they are preventable – or at least can be mitigated by accurate, detailed project development phases so decisions can be made prior to implementation and execution.



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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." ▼

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The EPCM-operator relationship

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 design, technology and execution planning, and the greatest cost and schedule advantages.

"And then ... the continuity of the team through the phases is also important," the company stresses. "This early engagement has been used very successfully on projects like Quellaveco in Peru for Anglo American and the Spence project in Chile for BHP."

The alignment of all goals, especially when combined over multiple projects, builds a trust between the parties that can in turn compound the success of future

projects. This trust helps facilitate project teams with complementary skill sets.

"Fluor's ... reputation for project delivery is very important to us, and on the basis of our project successes we have built many long-term alliances with mining companies. These alliances are sometimes formal, sometimes informal, but always to the benefit of both organisations," the company explains.

"You also get great benefits when you align and improve the transfer of information between the project team and the ultimate users, the operations team. We're doing a good bit of this through our digitalisation initiative so that we can provide clients with a digital twin."

Alignment is a central idea for Stantec, and a high level of it must come from both partners.

"[It] starts with a comprehensive understanding of each other's businesses and desire to build a win/win project approach" and is followed by a clear project mandate.

"All contributors to a project can do their best work when they know what the goal is. Third, clear and transparent project expectations and accurate reporting. If where we think we are going is where we are actually going, the outcomes tend to be positive."

Finally, Pöyry calls collaboration its key word for a successful teaming.

"The EPCM model allows the project owner, suppliers and contractors to work collaboratively and openly, rather than feeling locked in to a particular course of action," the company states. "Principally, this means the owner and EPCM consultant are always on the same side of the table in all negotiations, ensuring they will get optimal results."