Digital Twin: Technology Transformation in Mining
Workshop Outcomes

Identify potential use cases:	**What challenges need to be addressed?**	**What can GMG do?**
→ Entire mine including distribution → Predictions for process deviations and equipment failures → Optimize process online and process design in engineering phase → Stochastic development of mine block models from the field observations to predict real data → Process intensification and use of natural resources → Monitoring of sustainability indicators → Dynamic replanning of autonomous vehicles and systems → Standard models for different processes and equipment with ability to import to client's system → Geotechnical considerations → Mine planning and expansion → IIoT enabled edge sensors feeding into the digital twin → Remote plant inspection → Water use simulations → Communition efficiency and optimization → Material tracking across entire value chain → Identification of bottlenecks → Use in remote locations and hostile environments → Prescriptive maintenance	→ Engineering model's lack of meta data → The possibility of losing information due to issues with data formats → Data quality and acquisition → Incompatible file formats from different sources make it hard to bring data together → Low quality images → Delayed return on investment → Difficult to set up → Unclear ownership, governance, and integrity of data → Proving validity of insights → Lack of internal resources to implement, manage, and maintain the technology → Real time geolocation of all assets → Lack of definition between benefits of commercial product vs. in-house development → Sensor calibration → Change management required for a technology conservative industry → Data not open or interoperable → Managing changes can be difficult without a closed loop → Speed of reality scan integration	→ Develop a framework for digital twins to allow for common language → Prepare guidance for standardized processes, data collection standards, equipment models, data marketplace → Library of case studies, success stories, use cases, lessons learned, published references, industry standards and guidelines → Create a digital twin working group/project group → Consolidate data exchange formats and a master data dictionary → Continue to hold events on the topic of the digital twin with presentations of working examples

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→ Training and safety → Improving planning and scheduling outcomes → Support route cause analysis → Optimization of different mining operations → Implementation of artificial intelligence → Auto-dispatch system → Wall and slope failure and general hazard prediction → Mill reagent addition optimization → Processes with low maturity → Fixed and mobile asset maintenance training → Scenario simulations for "what-if" decision making and predictions → Fleet management system → Training and on-boarding	→ Lack of business models for sharing data in a digital twin → Unclear IP rights for digital twins → Lack of awareness of potential advantages → Need for strong sponsorship from management → Lack of connectivity through the value chain → Need for standard architecture recommendations for data streaming → Ability for organic growth → Lack of maturity of models to describe basic unit operations → Supporting and maintaining model quality	→ Facilitate a forum for developers to meet with end users → Develop understanding of business needs as well as technical needs → Organize upskilling and training → Assist in change management and sharing benefits of digital twins → Benchmark to compare data input of multiple operations