

Is it Time for Capability Maturity Measurement in Mining?

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Opinion

Sustainable mining operations depends on external and internal factors. Externally, the most notable factors include a socio-economic and political environment, availability and support of technology, the physical environment, and legislation. Internally, a system is not only designed to meet these external requirements, but also to meet organizational goals and objectives in an efficacious manner. The ability to define a performability framework for sustainable, cost-effective mining operations depends on the availability of benchmarked measures of effectiveness. Such a framework may be defined using Capability Maturity (CM) to address external and internal business requirements in an integrated way. A good CM framework utilizes the holistic advantages of a systems approach to characterize operations inside a unique environment. At its core lies a set of grounded (so to speak) business and operations processes that align with the wider business strategy. Apart from core business processes, a good CM framework additionally provides practice areas as one will find in the CMMI™ V2.0 maturity model. Such a framework may be adapted to meet the characteristics found in mining, which will allow business to assess its own maturity in a quantitative manner. This, in turn, allows improvement and comparison with peers in industry and ultimately provides visibility and elimination of blind spots. One important, and critical, advantage of utilizing a good maturity model is that it provides overall governance and oversight.

While consulting to South African deep mines and comparing local (mostly manually operated) mining operations with more technologically advanced operations, it became evident that optimal efficacy is constrained when finding the balance between organizational structure and environmental forces. Clearly, business processes used in a first world do not apply in a developing country, and incorrect application of technology in mining operations may lead to a reduction in productivity and sustainability. This, however, does not prevent the use of advanced business intelligence methods and fundamentally sound business management principles in a conservative culture. A generalized capability maturity model will take unique factors in business culture and philosophy into account, where it is evident that a mature model in a developing world will consider all constraints imposed by human factors because of labour unions and related legislation. An interesting challenge in maturity measurement involves the Fourth (and Fifth) Industrial Revolution's reliance on technology and data, and the interaction between technology and humans in mining. A capability maturity model will consider this interaction as part of integrated work management when running production activities and providing technical solutions, where the production and technical solutions include all mining operations except for engineering activities (to which we will refer below). Here, it is necessary to consider interfaces as part of system analysis and to ensure organizational training and skills levels meet the ever-changing requirements of technologically advancing mining operations and business management. Technology

management (as part of engineering management), that forms a significant part of a maturity model framework, must be measured. When considering a systems perspective, with reference to life cycles, resource allocation and optimization, configuration/change management, and all quality functions, the lack of integration is often highlighted. Locally, cultural differences between engineering, production, and occupational health and safety came to the fore when production goals were chased at the expense of safety. Law enforcement played a significant role in reducing incidents, but the ingenuity of the labour force could not be underestimated in the process. In order to meet production goals, engineering may be forced to implement solutions without the opportunity to conduct a full life cycle cost-effectiveness analysis, which requires a systems perspective. Cause-effect analyses, scenario planning, and risk management all rely on a sound operating model and analysis to ensure both capability and maturity. This is also true for all planning, implementation, measurement, and control of operational effort—a grounded operational analysis and model provide excellent tools that integrate resources to optimize and balance work effort. A good maturity model will provide a framework for measurement of operational effectiveness based on a systems approach.

Sustainability relies on several factors, but most notably includes business continuity, governance, risk management, and strategy operationalization while doing business performance management. Given a strong operations framework and a solid management foundation, it becomes possible to perform business optimization, which is the highest level of maturity. The ability to quantify, measure, analyse, and optimize must be measured and compared with peers and industry standards in a normalized manner, which must be provided by a realistic maturity model. CMMI™ V2.0 considers 25 practice areas that cover the considerations above. Adaptation is required to adapt the CMMI

model to a mining environment, but it may be worth-while to measure mining business on a generalized, normalized scale. Ten capability areas may be characterized in CMMI™, including: Service delivery and management; Engineering and development; Quality assurance; Supplier management; Business resilience; Workforce/resource management; Work management; Support functions; Performance improvement; and Sustainability and persistence. These are scaled on a level from 1 to 5 in an evolutionary manner, ranging from: 1–Tasks being executed; 2–Work being managed and reactive; 3– Processes defined and proactive; 4–Processes being quantitatively managed; and 5–Processes being optimized. The differences between environments are well known, taking into consideration political, natural, social, legislative, and economic environments. How effective is my business in my environment, and how does my business perform relative to peers in different environments? How much risk do I introduce when considering new technology or mining methods? How effective is my workforce given all environmental constraints? These challenges, and more, may be answered using a capability maturity model customized for mining business. Making performance visible on a dashboard is critical to strategic planning and sustainability—this can be effectively done using a measurement tool provided by a capability maturity model.

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