Using GIS effectively in mining and exploration

by Charl Retief, Esri South Africa

The challenge being faced by GIS professionals in the mining sector is not so much a technological one but rather one of value. In an economic environment where budgets are being slashed, how do GIS professionals working in the mining environment ensure that their departments survive and provide value to the overall operation.

GIS is a transformational technology, when implemented effectively, so how can we ensure that it is used to its maximum potential in the mining and exploration environment.

Making GIS indispensable to the mining value chain

As GIS people it is our responsibility to be bridge builders. We need to be able to articulate and demonstrate the value of GIS to our colleagues and managers in a way that makes them realise the business value of GIS. In order to successfully weave GIS into our companies’ organisational fabric, we need to focus on two areas. First we need to clearly understand the mining sector as well as the strategic goals and business objectives of our companies and second we need to constantly work at finding ways to apply GIS to those business goals. Put simply: we need to understand the business and then apply GIS to the business.

Our goal should be to get the use of GIS as close to the core business of mining and exploration as possible. Ask yourself why your company is conducting exploration activities. Why is it mining. When distilled down the answers will look something like this: “We are doing exploration because we aim to discover an ore deposit of economic value. We are mining because we aim to extract ore of economic value out of the ground.”

Then ask yourself what your GIS is doing to facilitate, enhance and enable exploration or mining efforts at your company? Is your GIS critical in making a new discovery? Is your GIS indispensable when it comes to increasing mine production while maintaining or improving safety standards?

These are tough questions but if you cannot provide answers to them, you need to question the relevance of your GIS to your company.

Understand the business

The business of mining and exploration is a complex, highly dynamic environment. It requires massive capital investment from companies that are at the mercy of global commodity price fluctuations. Few other industries experience the impact of global economic downturns as acutely as the mining industry. This is largely due to the fact that the mining industry is at the first step of the value chain of products used in everyday life.

Mining requires specialised skills from a large range of disciplines. An effective mining and/or exploration company requires knowledge and expertise from the fields of logistics, mechanical engineering, mining engineering, civil engineering, electrical engineering, metallurgical engineering, geology, geotechnical engineering, geophysics, geochemistry, environmental management, health and safety management and, of course, survey. This list covers just some of the experts required in the industry and it also illustrates the technical complexity involved in mining and exploration operations.

When studying Fig. 1 it becomes apparent that very few exploration projects become operational mines. The other interesting fact to note is that money has to be spent in order to progress a project, with limited knowledge about whether the project will eventually deliver any positive financial outcome, a catch-22 situation. Some companies have well defined

Fig. 1: Time and investment towards a producing mine.
decision gates before they proceed, but it remains a very risky business. Critically though investment into exploration can never completely stop. If companies do not actively explore for new deposits or for the expansion of existing deposits, the mining pipeline will eventually run dry.

Two main elements are at play here: time and money. Given some inherent facts such as political risk and commodity price fluctuations, ask yourself this question. How can GIS make the odds more favourable for mining and exploration? Or to phrase it differently, how can GIS be used to reduce the turnaround time for projects while simultaneously reducing costs?

We need to dig a bit deeper to be able address this issue successfully. Take a look at what exploration and mining companies effectively spend their money on. Bear in mind though, that the costs for a producing mine are to a large extent related to the cost involved in extracting the ore, whereas the costs involved during exploration phases are more capital expenditure in nature.

More than anything mining and exploration is about risk - managing and mitigating risk. Some risks are inherent to the specific operation such as the metallurgical properties of the ore body, the lack of infrastructure in the project country or the geotechnical risk such as the occurrence of seismic events at an operating mine. And of course the risks attached to a specific commodity.

Fig. 2 illustrates clearly the fact that risk reduces with the acquisition of information, and as time goes by, the accumulated cost of information grows exponentially. The formula being “more information = less uncertainty = less risk”. It’s quite safe to deduce then that information is the critical asset here. And not just any information, information that represents the work a company has done in the field, drilling programs, sampling programs, assays, geophysical surveys, and lidar surveys.

The same principle and the same formula is applicable to an operating mine. In Fig. 3 it is apparent that mining is a repeated process of exploration, development, mining, and reclamation. As this process is repeated and the mine grows in size, more information is accumulated resulting in a better understanding of the mineral resource and its environment. Essentially mineral resource management then relies on information, not just any information, but information about how the mine has been developed – how much economic value has already been extracted, how much economic value remains and where the risks for fall of ground are, and so on.

We also see that the process at an operating mine is a mini-cycle of the bigger value chain. Therefore we can safely assume that at an operating mine the formula of “more information = less uncertainty = less risk” also applies.

Clearly information is critical to both mining and exploration activities. This makes it imperative that serious attention is given to the management of this information – how it is gathered, how it is analysed, how it is presented, how accessible it is internally, and how this information is communicated to key management personnel.

**Conclusion**

The case has been made for the value of information to mining and exploration activities, but where does GIS fit in? All information in mining and exploration has one common underlying theme that holds everything together – location. Using spatial location (actual location on the earth) as a primary approach to manage information, integrate information, analyse information, gather information, present and distribute information is what we at Esri have termed the “geographic approach”. When applying the “geographic approach” with a sound methodology it is possible to make and demonstrate the undeniable value of GIS to mining and exploration.

Contact Charl Retief, Esri South Africa, Tel 011 238-6346, cretief@esri-southerafrica.com