Putting Knowledge Into Place

// Strategic Location Intelligence in the Mining Industry
// An ESRI Australia White Paper

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1 Introduction

Mining, by its very nature, is based on location. Spatial (location-related) data used in the industry includes information typically seen on a map, such as contours, roads and rivers plus the location of infrastructure and plants (both planned and as-built), mine plans and the location of equipment – both fixed and mobile.

The knowledge of where resources and infrastructure lie is critical to the successful operation of all mining companies. Many of the operational systems used in the resources industry rely on location-related data. Unfortunately, many of these operational systems produce silos of spatial data – data that is often difficult to access and extract despite the very critical role some of the data might play in other systems in the mine lifecycle.

Despite the key role that location plays, most mining companies do not exploit their spatial data to anywhere near its complete potential. While Geographic Information Systems (GIS) are used by most mining companies as one of many tools to meet exploration or environmental and heritage requirements, the use of GIS in the resources industry often does not extend much further than this.

However this situation is changing. More mining companies are increasingly looking to exploit the capabilities of location intelligence to capitalise on the ever increasing amount of location-related data generated, held and purchased by mining companies. This White Paper will discuss how GIS can be implemented successfully and strategically to improve data access and business integration, delivering improved efficiencies, risk mitigation, and maximum return on investment.

2 GIS and Location Intelligence

Geographic Information Systems (GIS) enable the capturing, managing, analysing and displaying of all forms of geographically referenced information.

A GIS is an information system, and unlike many of the operational systems, it is designed not only for the management and storage of spatial information but, most importantly, the delivery and analysis of this location based information. The intelligence derived from this location based information adds a whole new dimension to the decision making process.

While its role as an operational system should not be underrated, the key role of GIS in the resources industry is its capacity as a critical information management platform to serve corporate-wide business requirements and systems. In the resources sector, GIS is increasingly being seen as an environment for the delivery and analysis of information integrated from different operational systems – returning improved efficiencies in workflow and risk mitigation.

In the various phases of the life of a mine from exploration to closure (see below), considerable spatial data is generated and used for a variety of different purposes. This data is developed in a number of different systems. These range from CAD systems that are used in the design of plant and infrastructure, to mine planning systems used for designing and detailing how the ore body is to be mined.

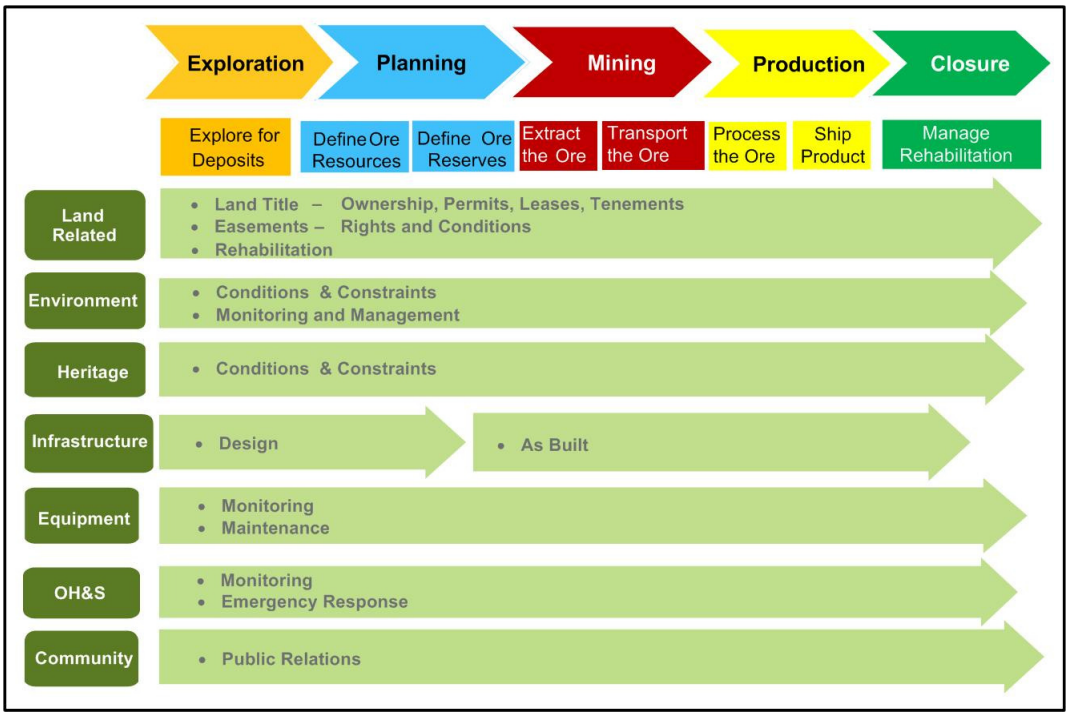

Figure 1 – Spatial data in the business of mining

What is particularly important in the mining business is the distinction between:

- // The software designed to meet a particular purpose (technical system) such as a Mine Planning System or a Plant Design System which generates, manages and uses spatial data; and
- // GIS software

A GIS is designed as an information system that delivers information and data as required. A GIS is designed to not only capture, manage, analyse and portray spatial data in the form of a map view, but has the capacity and capability to manage considerable amounts of attribute data that may be pertinent to the location of the features represented by the spatial data. These include the identification of the feature such as the road name or tenement number, and extends to related documents, drawings, and photographs that may be important to the business.

Despite spatial data being a valuable asset in both investment and potential business advantage, it is generally extremely hard to get at because it resides in different business and system silos.

The role of GIS lies in extending the use of spatial data beyond purely the technical systems (such as Mine Planning) to providing a platform of spatial information that supports the wider mining business throughout the mine life. This business includes the management of land, tenements and leases, environment, heritage, and asset maintenance planning and extends to supporting emergency response measures (see above figure).

The challenge for the mining industry is to provide ready access to this spatial data such that it can be used more widely across the enterprise to provide greater efficiencies and the corresponding returns to the business as a whole.

3 Business Drivers

The key driver for resources companies in extending their GIS capabilities across the enterprise is the aim to have a common and consistent view of where and what activities are planned or current across a company's operations. By extending GIS to the enterprise, the benefits of location intelligence can be seamlessly integrated throughout an organisation's business workflows. By making the implementation of GIS seamless and integrated across corporate business systems, the resultant location intelligence will deliver multiple flow-on benefits for all parts of the business.

3.1 Opportunities

The opportunities are boundless for resources companies looking to extend GIS capability across the enterprise and gain the location intelligence advantage.

3.1.1 Situational Awareness

With access to GIS, staff can interact with corporate information in a map view, switching on and off themes of information and interactively querying the data.

Typically, staff would be able to:

- // Drill down to documents and drawings that relate to a specific feature of interest
- // Access a range of integrated information from different systems including:
  - / A basemap comprising topography – contours, rivers, roads etc.
  - / Infrastructure and Plant
  - / Mine Planning Designs
  - / Environmental Constraints
  - / Environmental Monitoring
  - / Heritage Constraints
  - / Sub-surface Infrastructure
  - / Areas approved for activity such as mining, exploration or land clearing
  - / Locations of equipment and hazardous material

Enterprise GIS access delivers efficiencies primarily through time savings and mitigating the risk of decisions being made on different versions (copies) of data.

3.1.1.1 Time savings

Staff will be able to readily answer:

- // What is going on where – the location of an incident (e.g. safety, fire);
- // What are the constraints to development in a particular area- can we put an access road through here?
- // Where is the equipment that is to be serviced over the next month, and how do we get to it?
- // Where have all the safety incidents occurred over the last month?
- // What is the status of the approvals for ground disturbance over this area?

Without access to this information using GIS, information would need to be collated from a number of sources. This would involve:

- // Operating different information systems, including a system that could produce maps
- // Locating and extracting data from different systems to produce a map
- // Dependence on an expert technician (e.g. in a mapping system), consequently relying on their availability and time

3.1.1.2 Risk mitigation

Ensuring that all decisions are made using the same version of spatial data guarantees that decisions are based on the most current and accurate corporate information.

3.1.2 Field Force Enablement

There are significant time savings and corresponding efficiency gains in enabling staff to access maps in the field as and when they require it. By accessing GIS capability in the field, staff will be using only the most current and authorised information.

Examples include:

- // As part of orientation in the field (safety)
- // Emergency services when responding to an accident or environmental threat such as bush fires
- // Assisting environmental officers monitoring sites
- // Community relations activities when required to brief or consult the public

3.1.3 Data & Asset Management

The amounts of spatial data grow significantly over the mine life – particularly in the early days when the mine and the associated facilities are being planned. For operators involved in the development of spatial digital data representing plans, infrastructure, tenements, heritage and environmental constraints, significant time and money can be wasted in either finding spatial data – or indeed purchasing data - that the organisation may already have. Practices, procedures and systems can be put in place that will mitigate this occurring. The earlier this is done the better in terms of the business efficiencies that can be gained at later stages in the mine life.

3.1.4 Planning and Analysis

Much of the planning and analysis requirements for a resources company rely on compiling data from many different databases, systems and other sources. With most of this data containing a location component, analysing this data from a location perspective adds a new dimension to a company's decision making capabilities.

Location intelligence can add a new dimension to:

- // Compliance management
- // Approvals
- // Safety incident reporting
- // Chemical safety
- // Asset management and maintenance
- // Environmental management
- // Heritage management
- // Tenement management
- // Document management
- // Equipment, vehicle and people tracking
- // Near-real time environmental monitoring

3.2 Major Influences

The key issue in implementing an enterprise GIS platform is ensuring maximum business value from the investment in this capability. To gain maximum value, it is important that any influences that could affect return on investment are considered.

3.2.1 Staffing with appropriate skills

For the mining industry there are two interlinked issues with staffing – availability and mobility.

Availability - As the commodity prices rise and fall, the availability of staff with appropriate skills fall and rise. This has a significant impact on the implementation and deployment of location intelligence capabilities to the organisation as a whole. Lack of staff with the correct skills can also have an impact on the integrity of systems, particularly the data.

Mobility – The nature of the staff involved in GIS generally sees individuals remaining within an organisation for an average of four years. In well established mining companies, there is evidence that many of those dealing with spatial data have been there for a long time and carry an immense amount of knowledge that is not documented. Mobility also comes in buoyant economic times in the mining industry and is a risk to GIS projects and implementations in that very specific knowledge walks out of the door.

3.2.2 Regulatory Authorities

Mining companies exist within a highly regulated environment – failure to comply brings heavy penalties. Regulations governing the mining industry are continually exposed to the whims of the political environment. Changes to interest over land for example may impact the regulations either directly or indirectly and need changes to compliance reporting.

Part of the regulatory framework within which the mining world operates requires reporting to ensure the company is meeting its obligations. These reports frequently involve gathering information from a variety of different sources – a time consuming task which can be alleviated by using the intelligence provided through location data.

3.2.3 Commodity Prices

The rise and fall of commodity prices affect the capability of organisations to implement or extend location intelligence capability.

High commodity prices bring a hectic environment whereby resources - in terms of both people and time - are not considered available, although financial resources are available.

Low commodity prices generally bring lean times when financial resources (and possibly personnel) are not available despite there being the time for the development of the initiative.

The net result is that over the years, despite there being the stated drive and business value in extending location intelligence capability, many resources companies still face the issues caused by business silos of spatial data that “just work” and meet the minimal business needs. The efficiencies and corresponding competitiveness in the market are not realised - the mining company remains “one of the mill” without any differentiator.

3.3 Potential Challenges

While extending location intelligence across the enterprise can deliver wide-reaching business opportunities, there are a number of challenges that need to be addressed before implementation.

3.3.1 Accessing Spatial Data

The value of extending location intelligence capability across the enterprise relies on accessibility to the most current spatial data that is generated in a number of different systems. Companies need to ascertain how best to make the corporately relevant spatial data in the different formats and systems readily available for consumption by applications and business systems. This issue can be addressed through providing delivering direct access to the spatial data in each system, or introducing a spatial data warehouse. The best approach will depend on individual business requirements.

3.3.2 Sensitive Data

Some spatial data is highly sensitive for any number of reasons and should not be made readily available to all staff or contractors. However, knowledge of its presence in a place can be critical to the operations. To address this issue, access to sensitive data can be either restricted or made available in a generalised format.

3.3.3 Governance

If access to location related data is made available across different business units and from potentially different business systems, there is the issue of governance and assigning responsibility and appropriate procedures to ensure the success of the initiative. The success of the project relies on executive backing of the importance and potential of spatial data, the willingness by all business units to share access to their section's data, and a project based approach to data and information management.

3.3.4 Staffing and Spatial Data Stewards

As with any information systems required to deliver data and information across the whole enterprise, personnel with appropriate skills are required as part of the supporting infrastructure. For enterprise GIS this includes those with skills to maintain the hardware and database environments as well as GIS Professionals that can ensure the delivery of the spatial information that is fundamental to the business. This spatial data must be correct from both a technical and a business perspective before it is released for corporate use i.e. the data must be authorised for release. This fundamental and critical role should be filled by spatial data stewards.

3.3.5 Discovery of Spatial Data

A potential issue for operational staff is being able to easily discover what spatial data is available for a particular area for a particular business task. This issue does become more pronounced with time and as spatial data sets become more prevalent. To resolve this issue, a standard logical mechanism for discovery of spatial data would be required.

3.3.6 Integration and Collation of Business Data

With a significant onus placed on resources companies on reporting, whether it be compliance, regulatory or otherwise, a large amount of time is spent collating and integrating information and data that reside in different systems. The mining industry suffers from this issue in all phases of the mining life cycle.

Key efficiencies and significant business value can be gleaned from providing an environment in which data can be readily collated – an “integration environment” in which data residing in different systems can be collated for specific business purposes. A GIS provides an excellent environment for integration, collation and reporting. The key GIS brings to integration is location and mining data has location.

4 Conclusion

With so much location-related data held by mining companies, exploiting this information to its full potential provides significantly greater efficiencies and the corresponding returns to the business as a whole. However, despite this spatial data being a valuable asset in both investment and potential business advantage, it is generally extremely hard to get due to the data residing in different business and system silos.

A successful enterprise GIS requires cooperation across the entire business to overcome the challenges identified. These include a willingness to share services and information across departments, to balance the need for a sustainable and long-term solution against the desire to quickly show results, and gain agreement on a common set of standards and governance processes.

By strategically implementing GIS across the enterprise, the results will also inherently extend across the enterprise. By seamlessly integrating the benefits of location intelligence throughout an organisation's workflows, all parts of the business will benefit from streamlined data management, enhanced planning and analysis capabilities, field force enablement and an increased level of situational awareness.