

Information Management for the Mining Industry



Abstract

Information Technology (IT) can help mining organizations by building in efficiencies to improve productivity, reduce costs and maximize profits. IT does this by providing relevant technologies and applications to equip organizations with the intelligence to improve processes, reap business benefits and remain globally competitive.

Two specific technology areas that can help address some of these challenges are Portals and Enterprise Content Management (ECM). They help in managing unstructured content in an organization. This paper elaborates on the significance of these focus areas and explains how the implementation of Portal, ECM and other segments of Information Management can help in effectively addressing the various challenges faced by the mining business. The paper also describes the reference architecture which can be implemented by mining organizations to drive the benefits provided by Portal and ECM implementations.

Mining is one of the oldest and most important industries. Minerals and products derived from their refinement or processing play an important role in driving growth and steering progress across various facets of the economy. Minerals are essential inputs for the production of metals, ceramics, fertilizers, pharmaceuticals, chemicals, electronic items and a wide variety of other industries and products. Minerals such as coal, lignite, oil and natural gas constitute fuel and vital energy resources.

As is the case with every other sector, the mining industry is also faced with challenges stemming from globalization. Although demand for minerals and allied products is steadily increasing owing to population growth, the dynamic nature of the international economy, volatility of prices, environmental concerns and stringent regulatory frameworks make

it important for mining organizations to make the transition from traditional methods to technology enabled business processes.

Some focus areas:

1. Knowledge Sharing
2. Safety
3. Environment Impact
4. Process Improvement
5. Remote operations
6. Exploration and Production Techniques
7. Asset Management
8. Efficiency
9. Merger & Acquisitions
10. Mine Automation

Knowledge Sharing

Typically, mining operations are spread across diverse locations and employ a large number of temporary workers. There is also a lot of on-the-job learning that happens at various mining sites. High employee turnover can result in a loss of this collective learning if there are no mechanisms to capture, store and share knowledge across the workforce.

Knowledge Management (KM) systems are crucial to create and manage repositories for the storage and distribution of information in a secure and systematic manner. This eliminates multiple information silos, associated redundancies and maintenance overheads. Effective implementation of a KM system ensures that knowledge and best practices are fed constantly into the repository to enable easy access across the organization. This will promote continuous innovation,



help improve processes by learning from past experience, enhance efficiency and increase productivity. This will also have a calming effect on workforce attrition. Since mining organizations generally work in groups of small companies based out of regions where mining operations are located, a KM system will promote collaboration and create a positive work environment across the organization.

Safety

The high risk associated with mining operations makes safety a priority area, more so, against the backdrop of various mishaps in recent years. However, safety is not just about preventing casualties or limiting fiscal loss. From scrutiny by potential investors and the process of awarding contracts, to attracting and retaining talent, the safety track record of a mining company can impact its financial performance on many fronts. Improvement in safety measures also helps save costs arising from litigation, insurance claims, accident damages and production delays. Although targeting zero accident mandates is a given, a well-orchestrated management system helps improve safety performance and can actually drive financial benefits for this industry.

Mining organizations can benefit from the implementation of a **Content Management System (CMS)**, resulting in the effective management of unstructured content and the creation of a single information repository. CMS provides the ability to add, assign appropriate permissions and approvals, and locate safety-related documents and Standard Operating Procedures (SOPs). The CMS also manages title block information or PDF rendition of engineering drawing documents, which in turn enables effective maintenance activities at the mining site. A Web Content Management (WCM) system provides intranet sites where information related to safety can be shared and accessed within the organization in an easy and secure manner.

Environmental Impact

Soil and groundwater contamination, soil erosion, deforestation and displacement of people are some of the common adverse impacts of mining operations. Apart from the onerous task of preventing irreversible damage to the environment, mining organizations also have to deal with carbon management and comply with various regulatory frameworks, including the Australian Emission Trading Scheme, European Union Emission Trading Scheme and Kyoto Protocol.

Portal application provides a gateway to different applications and access to relevant information. Users can get specific information through the personalization feature. To ensure effective energy management, the organization must have access to reports on data pertaining to carbon emission, and energy, water, fuel and waste management. Portal application can easily render these reports and provide a dashboard application to reveal energy consumption patterns. Mining organizations may use various applications such as footprint management, waste management, ecosystem risk management, mine closure and re-habitation, tailings placement management and stewardship management. The Portal application can provide custom views of data developed by these applications and also key tasks to effectively gather operating data and distribute it to decision makers, on time.

Mining operations involve the generation, transmission and analysis of various types of data on a daily basis. This requires massive infrastructure in terms of space, on-premise hardware servers and electricity. **Cloud Computing** has the potential to significantly reduce the carbon footprint of business applications and provide customized resources for the organization. In addition to savings on infrastructure, Cloud Computing cuts down electricity consumption and harmful emissions from air-conditioning equipment. Implementing cloud based solutions can help reduce adverse environmental impact, and also makes good economic sense.

Process Improvement

From mining to material extraction and processing, and from marketing to sales and shipping – mining organizations need to ensure process improvements across all facets, to remain competitive and cost-efficient.

Business Process Management (BPM) helps analyze and optimize organizational processes, promotes better collaboration and coordination between various departments to improve efficiencies and ensure best results. BPM can automate field-reporting systems to improve operations and maintenance by providing managers with up-to-date operational information.



Marketers can automate the sales lead development process and use BPM to track and monitor the contacts made with prospects and customers. BPM can provide a relatively inexpensive solution to ensure relevant and accurate information to sales and marketing personnel on production schedules, output and inventory across a wide variety of product specifications.

Remote Operations

Connectivity is a challenge that is inherent with mining operations as most sites are located in far flung areas. This makes it important to ensure remote controlled operations of the various mining sites through an effective centralized management structure. Remote operations also translate into lesser on-site team deployment, helping reduce costs and improve employee safety and productivity.

At the core of the remote operation is an efficient and reliable communication system – one that ensures seamless channels for interaction between the control hub and various mining sites and enables collaboration between teams at each of these locations. This should also facilitate access to safety and Standard Operating Procedures (SOP) documents stored in the central CMS system, portal sites to log in safety incidents and the KM site to share knowledge.

Since laying network cables at these sites is prohibitive both in terms of cost and feasibility, it is critical for the mining organization to define an appropriate **Infrastructure Architecture** for ECM, Portal or KM applications. The architecture should enable easy access for teams across diverse locations and have optimal response speeds. Products chosen for defining Information Management (IM) applications should support the global architecture. Most CMS products offer **caching features** to enable information storage at locations in the vicinity of the user. This is important since the workforce will need access to large documents such as operation

manuals and drawings. Providing read and write caching prevents frequent content transfers from server to client. Some IM products have **offline capabilities** which can be extended through custom development. While this will enable the workforce to access and create new documents on-site despite lack of network connectivity, these documents will get automatically synchronized to the central repository on connecting to the network. With an increase in the usage of mobile phones and tablets, it's important that the infrastructure architecture supports rendering of content across various mobile devices.

Exploration and Production techniques

Mineral exploration, the search for metal or mineral deposits is the first phase of the mining cycle. However, most exploration projects will not progress to become mines. The success rate for 'grassroots' exploration is extremely low, with less than 1 out of 10,000 mineral discoveries actually going ahead to become a mining site.

Geographic Information System (GIS) helps in managing data related to geographic locations and forms the basis for several location-enabled services that rely on analysis, visualization and dissemination of results for collaborative decision making. Mining organizations can use GIS to target mineral exploration, evaluate mining conditions, model mine construction and display geochemical or hydrological data.

Implementation of GIS applications helps mining professionals perform in-depth analyses, get insights into the data and make well informed high-level decisions. Integration of GIS with CMS provides the ability to blend non-structured documents with maps in heterogeneous and geographically distributed locations, and to analyze surveys and reports while studying maps of potential sites. The facility to view the integrated GIS information through

a portal application helps to improve the decision making process across various aspects related to mining.

Asset Management

Mining organizations rely heavily on a large battery of equipment and vehicles for operations and transportation. With activities spread across diverse locations, organizations have to handle huge tasks related to the operation, maintenance and repair of these assets on a daily basis. An effective asset management will ensure smooth operations, improve productivity and enhance savings.

Records Management (RM) ensures effective asset management across the organization. All assets can be assembled into the database with user-defined metadata to cover information such as tag number, description, model, date of purchase, date of servicing, and so on. This can be implemented through a barcode mechanism that is compatible with leading physical records management products. The records management application can be easily integrated with the document management system to provide a single interface for electronic and physical records management.

Remote Audit through barcoding enables inventory checks to be conducted for any location and the results can be uploaded to the database, significantly saving cost and time. The asset management system automates record keeping for every vehicle and each piece of equipment, keeps track of warranties and planned maintenance schedules. This helps to monitor breakdowns and unplanned repairs and establish best practices. Asset management plays a key role in streamlining operational and maintenance efforts, and ensures maximum uptime of machinery and vehicles used in mining, handling and storage.



Efficiency

Mining and metal companies operate in a very dynamic and challenging environment shaped by cost inflation, sluggish economic growth, heightened geopolitical risks and volatile prices. With a decline in returns, organizations are under pressure to control costs and utilize capital discerningly. To remain competitive and profitable, mining organizations have to improve efficiencies across people, products and processes.

Mining operations place a huge emphasis on data management, and processes such as exploration, extraction, site management and production that involve the creation of various artifacts in the form of documents and IT applications. Given the fact that knowledge workers spend an estimated 38%¹ of their time in information search, a **Search** implementation system can enhance workforce effectiveness. Implementation of a **Collaboration** system will improve

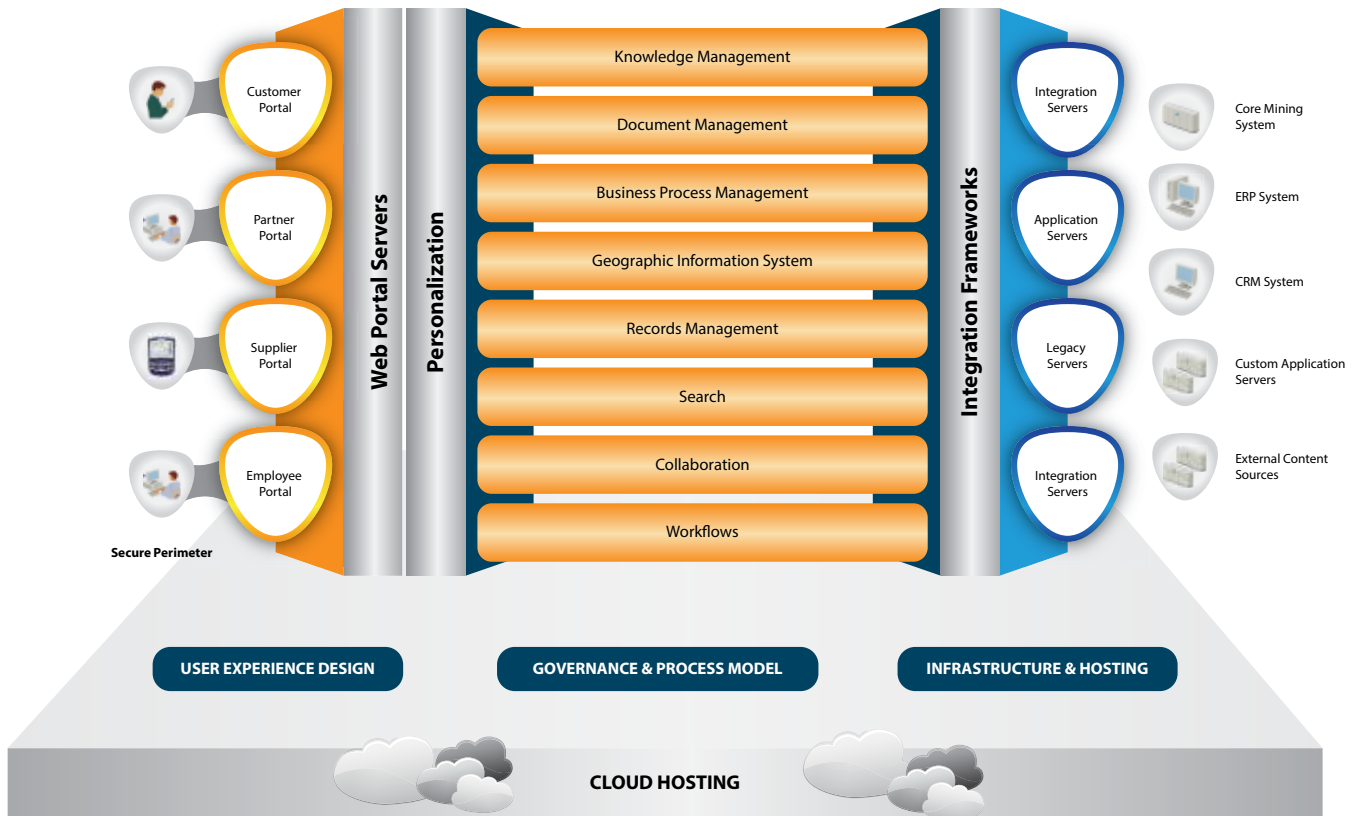
user effectiveness as it promotes co-development. Various technologies such as Wikipedia, blogs, discussion threads, surveys/polls, project workspaces, and RSS feed can enhance work-related communication among employees. Many ECM products offer out-of-the-box features which can help users exchange ideas, participate in discussions and collaborate on specific projects.

Mergers & Acquisitions

Mining is a cost-intensive activity and hence mergers and acquisitions (M&A) are commonplace in this industry primarily to raise capital and share risks, and achieve economies of scale and pricing advantage. The need to address scarcity of large producing assets, collaborative mining operations, sudden spurts in demand for a specific metal, and leverage captive capacities in specific locations are some of the other prominent triggers for M&A.

Streamlining the technology landscape

of different organizations involved in the M&A is a key task, with the objective of providing users with a single information source. Replacing systems is an option to simplify the technical scenario. This involves **Content Migration** from the system to be removed, and should be executed in a planned manner to ensure smooth transition and uninterrupted operations. An additional option is the integration of various systems to provide users with a unified view, without the need to make major changes to the system. This provides users with a seamless experience even as they work on different systems. In cases where the organizations involved in the M&A have CMSs, these systems can be integrated if there are appropriate connectors, or else they will have to be custom built. The key focus for the mining organization is to ensure that these integrations will facilitate the implementation of a common safety or business strategy after the M&A.



Mine Automation

Mining organizations are realizing the benefits of automation in terms of improved productivity, enhanced efficiency and better safety. This translates into greater reliance on technology through remote controlled equipment and management of mining operations across diverse locations from a central hub. Mining organizations typically have various systems to manage different sets of data. For mine automation to be effective, it is crucial to ensure **systems integration** so that all systems work in a synchronous manner to enable seamless data exchange. Since human intervention is minimal, the system should provide automatic alerts and initiate corrective action.

The integration framework should link various systems that reside on different operating systems, using different databases and computer programming

languages. An efficient integration plan will ensure information consistency across multiple systems and provide a common interface for users to interact with various applications. This enables implementation of business rules and policies within a common framework and minimizes vendor dependency for a particular application.

Architecture Component Definition

The key building blocks of the reference architecture are:

i. Portal User Interface

Provides a custom user interface along with appropriate functionalities to different users based on needs specific to their role as customer, partner, supplier or employee.

ii. Portals Servers

Aggregates data from different sources and displays on easy-to-manage websites.

It serves as a window to information available within various applications and also facilitates personalization and customization of the user experience.

iii. Knowledge Management

Enables employees to share information, collaborate and define best practices within the organization. The key building blocks of a successful KM application are technology, process, people and content.

iv. Document Management

Effectively manages various document types being created within the organization and enables users to ingest, manage and archive documents, along with advanced functionalities such as lifecycle and workflow implementation.

v. Web Content Management

Enables the development of web pages to provide relevant information to employees, partners and suppliers with easy access through the intranet/internet.

vi. Business Process Management

Employs various tools and products to analyze current business processes and identify areas of improvement.

vii. Geographic Info System

Helps to capture, store, analyze and manage different types of geographical data to facilitate well-informed decision making and efficient execution of various mining operations. The system provides good integration capabilities with portal or content management applications.

viii. Records Management

Enables management of specific document types which can be treated as records and allows association of parameters such as retention period, file plan and secure permission. Also helps secure storage of

records and adherence to compliance requirements.

ix. Search

Helps to locate and display relevant content to authorized users within the organization. During the search process, a crawler runs through the pages to be searched and creates an index. Queries are executed over these indices and the result is presented in a pre-defined format.

x. Collaboration

Empowers users within the organization to connect, share information, collaborate and innovate while optimizing the way they work, and improve efficiency.

xi. Integration Servers

Helps integrate applications developed on

diverse operating systems and different programming languages. This allows easy exchange of information among various systems deployed within the organization. An enterprise integration server may include pre-packaged applications, customized applications and legacy applications.

xii. Cloud Hosting

Refers to the use of computing resources that are delivered as a service over a network, providing the benefit of remote accessibility and freedom from location dependency for the business. In addition to enabling easy expansion by quickly adding resources, it also offers enhanced security through real-time backup capability, preventing loss of data.

Conclusion

The mining industry is straddling an unprecedented surge in demand fueled by population growth as well as a host of challenges in running day-to-day operations. Leading mining organizations are keen on exploring new practices that will sustain and grow the business.

The implementation of Information Management (IM) will help mining organizations achieve business goals and adhere to demanding compliance requirements. Deep insights into priority areas for the mining industry will ensure that IM initiatives are not implemented as mere technology projects, but drive business benefits for the organization.

About the Author



A Senior Technology Architect with the Digital Transformation Practice of the Manufacturing unit at Infosys, Vineet Saxena has around 13 years of Information Technology experience including 8 years in the Content Management domain. Vineet has worked as an Information Management consultant for Mining and Oil & Gas firms for more than 5 years and has implemented and architected content management solutions for various customers around the world. He has a BE degree and an MS in Software Systems.

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