

Use of the Internet and Information Technology in Mining

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ABSTRACT: Rapid advances of information technology and widespread use of the Internet revolutionizes business in general and the mining industry in particular. The paper summarizes the related developments and their impact on the mining industry.

1 THE INTERNET

"The internet is the biggest thing since I've been in business" said Jack Welch, Chairman and CEO of General Electric. As a result of Internet applications his company, GE, plans to cut 15% from its cost base of \$100 billion (one hundred thousand millions) in both 2001 and 2002, five times its typical annual growth in productivity that varies from 3 to 4 % (Anon. 1999).

Jack Welch' view is widely shared by others in the business community in general and in the mining industry in particular. As a result the Internet is driving a global transformation of both businesses and personal lives. It redefines all aspects of how companies work, both internally and externally. The pace of this change has been rapidly accelerating, facilitated by rapid advances in enabling technologies, decreasing cost of computing power, and significant advances in data and knowledge management.

The term Internet is used in this paper to describe the whole cluster of technologies that depend upon and enhance it. Its first widespread application to business was B2C: Business-To-Consumers, by now firmly established business practice. Initially this Internet application appeared to be relatively simple, the activities limited to selection of a vendor, selection of an item to be acquired, processing of the credit and shipment. As a result Internet shopping has become a commonplace in lives of many people worldwide. Only later the intricacies of this business became apparent. These include pricing strategies, security of transactions and data, prevention of disruption and loss of data, and the need to change attitudes of employees in companies involved in B2C.

The next to come was B2B, Business-To-Business applications of the Internet. These are far more complex and difficult than B2C. Purchases are made under long-term contracts, products have to conform with strict specifications, purchasing decisions are made by teams, and there may be a significant time difference between the time of making the decision and completing the related transaction. However, they are believed to offer an opportunity to revolutionize the way in which business gets things done.

Responding to the challenge a number of companies in the process or consider transforming themselves from process-focused, internal organizations into external ones by engaging suppliers, customers and partners through an electronic communications infrastructure. The emerging business model is summarized in Table 1 below.

Table 1 The emerging business model (after The Economist, 2000)

	<u>Industrial Age</u>	<u>Digital Age</u>
Companies	Inwardly focused	Extended enterprises
Customers	Limited access to manufacturer	Direct access to manufacturer
Suppliers	Arms length relationships	Electronic relationships
Intermediaries	Stand-alone entities / separate processes	Extended enterprise links / shared processes
Employees	Hierarchical and functionally managed	Empowered teams, cross-functionally managed

Majority of today's companies, including most of the mining companies are re-evaluating their operations and strategies in order to take full use of the Internet. These evaluations usually include:

1. Identification of these aspects of their operations and strategies that are affected by the Internet, and where it offers an opportunity to develop a competitive advantage

2. Identification of the capabilities needed to take full advantage of the opportunities offered by the Internet, especially in areas of customer and supplier liaison, and

3. Provision of the capabilities defined in 2. above in expeditious and timely manner.

Specific business models used to implement the new strategies and adapt the company to the digital age differ. These are usually site-specific modifications of two principal approaches. The first calls for grouping all e-business activities together and their separation from the mainstream activities of the company. Typical example is the approach used by Western Mining Corporation to create e-WMC business, discussed in some detail below (Western Mining Corporation, 2001). This separate business entity deals with Internet-based parts of WMC cobalt / nickel / copper selling activities.

In a modification of this approach numerous mining companies, including WMC, have formed independently operating joint ventures that are providing a wide range of e-business services. Typical example here is the GlobalCoal (1998-2001), discussed briefly below. By getting involved in e-business these mining companies expect to leverage some of their existing knowledge, expertise and core competencies to generate additional value. On the other hand they look for an opportunity to test various e-commerce models and approaches for their possible introduction into the core operations at a later date (Clarry et al, 2000).

The second approach calls for integration of e-business into mainstream company activities at all stages of its operation. No successful example of this approach to a mining business exists so far. However, several companies are giving it a serious consideration.

2 THE INTERNET AND MINING

The applications of the Internet in mining date back several years. The first successful applications were those for monitoring and control of equipment performance, often involving a variety of dispatch systems, and later extended to equipment condition and performance monitoring. The first full-fledged attempts to use e-business in mining took place less than two years ago, when several miners began offering their products for sale via Internet. At the

same time a variety of third-party e-marketplaces were created to facilitate e-commerce in products, services, equipment and supplies. Some of these were created either by mining company consortia or with active participation of mining and related companies. Most recently use of the Internet for management and control of all aspects of mining operations is proposed.

Several selected, typical examples of various Internet applications in mining follow. The first deals with an early form of mining e-business, e-sales. The second is e-marketplace application. Following that the Internet based outsourcing schemes are discussed (Application Service Providers, or APS). Finally an example of an emerging e-management is given.

2.1 E-sales

One of the first mining-related e-sales ventures was established by WMC, Western Mining Corporation of Melbourne, Australia. It was developed over the last two years, first to sell cobalt produced by this company. Later on nickel sales were added, followed by copper sales. On line supplies tendering was added more recently followed by a full fledged electronic e-marketplace, Quadrem, that provides a procurement solutions to the mining, minerals and metals industry.

The first two activities, cobalt and nickel sales, are relatively simple. E-WMC posts the availability and premiums for defined quantities of its cobalt and nickel on its website, by location, for review and information of potential clients. This makes it easy for WMC to participate in the spot and near-term cobalt and nickel market and expands its client base, as the site in question is freely accessible.

The copper sales business differs, the difference reflecting the fact that most of WMC copper is sold through long-term contracts to well established customers. The prime purpose of the site is to enhance WMC relations with these customers. Thus access to the site is limited, and it is designed to "enable customers direct access to real time data affecting their copper deliveries, 24 hours a day and 7 days a week". The site also lists uncommitted spot copper quantities.

The other two sites represent more recent approach to e-business and are similar to the GlobalCoal business. The latter (GlobalCoal, 2001) is being established by several mining companies with coal interests, namely Rio Tinto, Anglo American, Billiton and Glencore International. This site involves several newer features of e-sales that are: customized trades, tender / RFQ (request-for-proposals) feature and extensive coal-related news section.

Differences between the different parts of the e-WMC business illustrate the development process of mining related e-business. They also illustrate the differences in approach to e-business as determined by various types and quantities of the traded commodity.

It was recently reported that e-WMC business is a successful one. It allowed WMC to lower the cost of sales transactions by over 50%, resulted in better premiums on its products and allowed me company significantly improved access to the customers (Voss, 2000).

2.2 E-marketplaces

More recently a number of mining related e-marketplaces has been established, quite often with active participation of various mining companies. The purpose of e-marketplaces is to facilitate not only sales of products, but also purchases and sales of supplies, services, training and education. Most of e-marketplaces include a variety of features that facilitate price negotiations. The fees charged on transactions conducted through the e-marketplace support its development and maintenance.

One of the most advanced e-marketplaces related to mining is MyPlant (2001). Originally established by Honeywell International, the company that sells its products through extensive network of intermediaries, the site was intended to capitalize on the intermediary expertise. More recently the Honeywell ownership was diluted to encourage wider participation of other, independent companies. Industries served by MyPlant include mining, minerals and metals, petroleum, pulp and paper, chemicals and pharmaceuticals and power generation. Overall MyPlant membership is claimed to be in excess of 14,000 distributed over 95 countries. The main task of MyPlant is to provide plant personnel with "interactive, cost effective solutions that address current process manufacturing challenges". As such MyPlant brings together plant professionals that seek information, answers and resources with solution providers who have the relevant technology and expertise.

In addition to plant expertise and services, MyPlant offer several other services. These are:

- MyExpert, a network of experts who can answer specific plant-related questions
- MyJobs that allow users to reach, recruit and manage jobs and job seekers world-wide
- MySkills, a place for professionals to exchange views, as well as to gain, share and manage knowledge
- MyEquipment that provides on-line access to the equipment that a mine professional needs
- MyCommunities, which offers the ability to share the solutions, views and resources with the peers.

MyPlant benefits members and solution providers through reduced search and transaction costs, and more efficient match of solution providers and plant personnel.

2.3 Vendor managed assets

The mining industry leads the others in wide use of Application Service Providers (APS). The best example here is involvement of vendors in management of mining company assets and in particular of its principal mining equipment.

Any electronic data related to production, equipment performance, equipment and plant condition, and the like, can be easily transmitted over the Internet and made available to off-site vendors in real time. Caterpillar's VIMS Wireless, Vital Information Management System (Caterpillar, 2001), is a typical example of such technology. Competing technologies are available from Komatsu (Modular Mining Systems, 2001), Euclid-Hitachi and others.

Thus an equipment supplier, or a third party, can monitor mining equipment performance and condition, and provide its diagnostics, without the need to be *physically* present at the minesite. With this data at hand the vendor can order a service, a maintenance job or a repair, order the required parts and secure appropriate maintenance expertise. Considering high technical sophistication of today's mining equipment, and frequent lack of advanced expertise at remote minesites, asset management by third parties offers an opportunity to significantly improve asset performance.

As this technology is refined and its reliability is assured, the mining industry will be able to manage its equipment in a manner that is uniform throughout various equipment brands and mine locations. Furthermore it will be feasible to assure that the equipment complies with pre-set production objectives in an optimum way. Thus the mines will be able to concentrate on its core competencies: resource discovery, its exploitation and ore processing, while outsourcing the non-core equipment management to specialized application service providers.

2.4 E-Management

Several non-mining companies, in cooperation with various mining companies, are now developing the mine information management systems, the end-to-end systems, that will allow all engineering, purchasing and sales activities in a mine to be handled by a one • seamless system. The first embryonic system of this type was Caterpillar's

METS system, described in an earlier presentation to this Congress (Golosinski and Ataman, 1999),

During the last three years the Caterpillar offering has significantly expanded and is marketed under the name MineStar (Caterpillar, 2001). In addition to METS system in now includes wireless VIMS (Vital Signs Motoring System), dispatch systems, and other components. Similar system is offered by Komatsu (Modular Mining Systems, 2001), known as Intellimine. Both the systems are being developed by mining equipment manufactures and intended primarily to optimize performance of the mining equipment.

More recently several software companies are involved in development of end-to-end business packages. The most advanced appears to be the offering of SAP Company, known as SAP Mining (SAP, 2001). The package consists of seven "layers" of software, each layer dealing with different aspect of a mining operation. These are:

1. Enterprise Management that deals with strategic planning, accounting, data warehousing, and the like
2. Customer Relationship Management that deals with customer service and liaison, acquisition of resources and sales management
3. Acquire and Develop that deals with exploration and development of the mining prospects
4. Mining and Primary Processing that deals with mining, primary processing and related logistics
5. Secondary Processing that deals with downstream processing of ore
6. Sales and Distribution that deals with product sales, their delivery and invoicing, and
7. Business Support that deals with human resource management, procurement, fixed asset management, environment, safety and other support operation.

As an example of layer content, the mining part of the Mining & Primary Processing includes individual packages that deal with long and short term mine planning, production scheduling, unit operations (drilling & blasting, ground support, load & haul, hoisting and handling), material supply, maintenance of equipment and plant, and product and activity costing.

To author's knowledge no fully implemented, complete system of this type is operational at the time of writing this paper. The main challenge appears to be development of seamless and reliable interfaces between various subcomponents that often were developed by independent, third-party vendors.

In another development, several developers of general mine planning software, most notably Gemcom, have started work on developing interfaces between their software and other business systems used in mines. The latter include interfaces

with dispatch systems, with geotechnical modeling software, and the like.

3 DISCUSSION

In addition to applications described above, a variety of other e-business providers, not named above, are active in the field. Some of these were listed by Annon. (2000), Annon. (2001), Gibbs (2001), Hudson (2000), Ludeman (2001), Voss (2000) and others. Additional providers are entering business each day. This proliferation indicates that a consolidation of the e-business industry is bound to take place at some time. In the future. Few of the current providers are likely to survive in a long term. As indicated by experience with B2C business, the most likely to survive are the providers who enjoy strong financial position, are supported by established mining companies, and who provide the service in the most effective and efficient way.

Many predict rapid spread of business uses of the Internet. E-commerce is expected to reach several trillion US dollars in 2004 (Gibbs, 2001), with the annual growth rates of 125% (Luderman, 2001). These predictions may be somewhat optimistic. The recent survey conducted in the USA by Forester Research and the National Association of Purchasing Management reveals that over 80% of surveyed companies are advanced no more than 20% on the road towards using the Internet for purchasing, and that other business uses of the Internet are even less advanced (*USA Today*, January 23, 2001).

Unlike many other traditional industries, the mining industry is in a unique position to take full advantage of the Internet. Characterized by often remote and desolate mine locations, concentration of expertise and supplies in areas away from mine locations, fragmentation of the industry itself and the multinational character of many companies the mining industry stands to gain most from use of the Internet. The many benefits that can be gained include (Clarry et al, 2000):

- Decoupling availability of skills from the location of workforce. This is facilitated by easy access to expertise and technology providers, by ability to remotely control operations and monitor equipment performance, by ability to communicate performance, condition and diagnostic data, in real time, to service providers, and by ability to manage the knowledge needed for effective and efficient conduct of operations.
- Reducing isolation of remote operations through easy access to expertise, third-party information, and by facilitation of targeted professional development and education of personnel.

- Centralizing and/or outsourcing of infrastructure and non-core activities.
- Improving efficiency of the supply chain by streamlining and simplifying its logistics, by improving efficiency of purchasing transactions, by ability to monitor supplies in real-time, by improving links between similar mines or mines in the same locations, and by pooling resources available to these mines.
- Improved efficiency of product sales through ability to address wider range of potential clients and providing these clients with superior service in terms of product quality, timeliness of supply and competitive pricing.

Not surprisingly the Australian mining industry appears to be most advanced in implementation of business applications of the Internet. This industry is strong and modern, located in a remote area of the world, and able to take advantage of sophisticated communication and computing infrastructure, as well as widespread computer literacy of the mining personnel. It was the first to use e-business and e-marketplaces and by now has developed a body of related expertise.

4 CONCLUSIONS

The effectiveness and efficiency of the mining industry can be significantly improved by incorporation of the Internet in various aspects of mining operations. Internet based sales of mining products, purchasing of supplies and expertise, and remote monitoring of equipment performance and condition, all are proven feasible and beneficial. The relevant business models and solutions are commercially available.

Full realization of the opportunities offered by Internet and related B2B businesses require re-engineering of the traditional mining companies.

The most effective re-engineering patterns and models are emerging from between the wide variety of those used currently. The wide interest shown in use of the Internet by mining companies allows to predict that new, Internet empowered mining business models will be soon adopted by most mining companies. This in turn will lead to more efficient mining operations in the future.

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