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## PROSPECTS OF INFORMATION INNOVATIONS IN FUEL-POWER AND MINERAL COMPLEXES

**Summary.** The mining enterprises are characterized by specific risks: mining risk, risk of share market loss because of biased evaluation of mineral resources, productivity and capital access, cyber safety risks.

In this regard the mining enterprises require promoting innovations. In the conditions of financial resources deficiency information innovations are especially actual, in particular: data-mining, information architecture, knowledge management, professional social networking sites and also national cadastre of raw materials and Internet platform of databases.

**Keywords:** information innovations, data-mining, information architecture, knowledge management, national cadastre of raw materials, Internet platforms of databases.

## PERSPEKTYWY WDRAŻANIA INNOWACJI INFORMACYJNYCH W KLASTRACH PALIWOWYCH I SUROWCOWYCH

**Streszczenie.** Przedsiębiorstwa górnicze charakteryzują się specyficznymi źródłami zagrożeń, do których można zaliczyć: ryzyko górnicze, ryzyko utraty udziału w rynku z powodu nieobiektywnego oszacowania surowców mineralnych, ryzyko związane z produktywnością i dostępem do kapitału, ryzyko cybernetyczne. Z tego powodu od przedsiębiorstw górniczych wymaga się promowania innowacji. W warunkach deficytu środków finansowych, innowacje informacyjne są szczególnie przydatne. Należą do nich między innymi: eksploracja danych, architektura informacyjna, zarządzanie wiedzą, profesjonalne strony społecznościowe oraz krajowe katastry surowców i platformy internetowe z bazami danych.

**Słowa kluczowe:** innowacje informacyjne, eksploracja danych, architektura informacyjna, zarządzanie wiedzą, krajowe katastry surowców, platformy internetowe z bazami danych.

## 1. Introduction

In recent years as a result of raw materials depletion of developed deposits mining business owners have to get a mineral license of fields and sites which are at the earliest stages of geological studying. Thus to work in the conditions of high uncertainty of undertaken decisions. At the same time according to the accepted classification mining enterprises are considered as potentially dangerous objects. Meanwhile economic activity of mineral deposits development has such specific features as mineral resources base of mining company and the environment of economic activity (risk object), and risk factor<sup>1</sup>.

In this article we will discuss the main risks inherent to the mining industry, and prospects of the information innovation as ways to increase the performance of mining industry in conditions of deficiency of investments.

## 2. A review of the risks inherent in the mining industry

Minerals developer does not have full knowledge of subsoil structure where he carries out the activity. It leads to additional risk factor which is usually called "mining risk". Influence of mining risk on economic activity of mining enterprises is very considerable<sup>2</sup>.

While mining activities there are also other risks connected with mineral resources, in particular risk of share market loss because of biased evaluation of mineral resources from market point of view.

Due to features of the Russian economy and the continuing process of legislative base reforming in the Russian Federation essential value gets political risk. In the other words it is a risk of legislation and standard legal requirements change. Change of the legislation and state political policy can lead to increasing taxation, access reduction of financial, labor and raw markets and other restrictions.

Boyarko G.Yu. offers to distinguish in the mining industry the following strategic branch risks<sup>3</sup>: group of the external measured risks (price and tax risks), group of the internal measured risks (geological, technological and mining risks), external nonparametric risks (legal risks), group internally - external nonparametric risks (environmental and information risks). According to the quantitative assessment of local risks individual and integrated risks can be calculated for projects of particular fields development divided into mining branches. Their

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<sup>1</sup> Shaklein S.V., Rogova T.B.: Estimation of risk of using bowels. GU KuzGTU, Kemerovo 2009; [http://www.sibgeoresurs.ru/downloads/Ocenka\\_riska\\_polzovaniq\\_nedrami-uh.posobie.pdf](http://www.sibgeoresurs.ru/downloads/Ocenka_riska_polzovaniq_nedrami-uh.posobie.pdf).

<sup>2</sup> Fomitchyov E.S.: Risks in sphere of primary activity of the mining enterprises. "Gornaya promyshlennost", No. 6, 2003.

<sup>3</sup> Bojarko G.Ju.: Strategic branch risks of the mining industry: The author's abstract on competition of degree of the Doctor of Economics. Tomsk polytechnical university, Tomsk 2002.

integrated external and external risks for the mining industry of Russia can be also calculated in general.

The experts of "Ernst & Young" publish annual researches in the field of strategic business risks of mining and metallurgical companies. According to the data in 2008 shortage of qualified personnel and limited opportunities of infrastructure took the first place in the list of ten main strategic business risks<sup>4,5</sup>. In 2010 financing and cash flow issues were the main problems. In 2012 nationalization of resources was on the top in the rating of risks<sup>6</sup>: in many countries of the world government is not limited only by taxation tools in their wish to get more profit from these branches. They also introduce such requirements as obligatory mineral dressing, export taxes and a share restriction of foreign property.

New research of the company EY "Business Risks in Mining and Metallurgical Industries in 2015-2016"<sup>7</sup> has shown that investment shortage from party of mining enterprises leads to development projects reduction and decrease of stability outputs limiting opportunities for future growth. Among 10 main business risks included in the rating in 2008 only three of them were chosen as the most significant risks for this year (resource nationalism, obtaining "the social license" for production, energy resources access)<sup>8</sup>.

According to the forecasts in the next several years the majority of raw materials will go up in price within a business cycle. This tendency is caused by supply reduction in the market because of geological exploration decline as well as fields development in recent years. It can be also caused by market failure of high product cost and increasing expected demand.

Productivity and capital access are the most significant business risks among top three risks occupying the second and third position respectively. New risks in the rating of the year are connected with cyber safety and innovation introduction. The risks of the mining enterprises connected with hacker attacks and insufficient innovation introduction increased so significantly that were included in the list of top ten business risks for the first time<sup>7</sup>.

The issue of almost total absence of industry innovations was brought to the fore by restoration efforts of the lost performance level. As a result this risk was included in ten the main business risks of this year. Many experts consider that in comparison with the majority of other branches the mining branch has undergone the minimum changes connected with introduction of innovations. As percentage of revenue mining and metallurgical industries spend on technologies and innovations 90% less than oil industry<sup>7,8</sup>.

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<sup>4</sup> Research in the field of strategic business risks – 2009. Mining and metallurgical branches. Ernst & Young; [http://www.ey.com/Publication/vwLUAssets/MM-GSBRR-2010-RU/\\$FILE/MM-GSBRR-2010-RU.pdf](http://www.ey.com/Publication/vwLUAssets/MM-GSBRR-2010-RU/$FILE/MM-GSBRR-2010-RU.pdf).

<sup>5</sup> Ten risks for the companies of metallurgical and mining branches. August 26, 2009; <http://finance.tltnews.ru/news/article20C38/default.asp>.

<sup>6</sup> Business risks in mining and metals industries. Study for 2012-2013/; <http://www.ey.com/RU/ru/Industries/Mining---Metals/Business-risks-in-Mining---Metals>.

<sup>7</sup> The EY study "Business risks in mining and metals 2015-2016". August 28, 2015; <http://metalmininginfo.kz/бизнес-риски-в-отрасли/>.

<sup>8</sup> Press release. The main risks for companies in the steel industry are related to declining productivity of the activities. July 29, 2014; <http://www.ey.com/RU/ru/Newsroom/News-releases/News-Productivity-tops-mining-and-metals-business-risks-list>.

According to the report "Deloitte Touche Tomatsu Limited" (the international company as well as "Ernst & Young" included into "Big Four" of the auditor companies) published in January 2014 mining companies have to carry out the retrospective analysis of the activity and define accurately the values and plans for a long-term development<sup>9</sup>. And the company specialists suppose that widespread introduction of innovations can be extremely helpful.

### 3. The potential of information innovation in the mining industry

Innovations are closely connected with the scientific and technical progress (STP) being its result. Innovations are divided by stages of STP in the following way: technical ones usually come out of products production with new or improved properties; technological take place at application of the improved, more perfect ways of product production; organizational and administrative are firstly connected with processes of the optimum organization of production, transport, sale and supply; social are directed to improvement of working conditions, the solution of health care problems, education, culture; information innovations solve problems of rational information streams organization in the sphere of scientific and technical and innovative activity, increasing reliability and efficiency of obtaining information.

Information innovations are often regarded only with IT taking into account only pure technologies – computers, telecommunications and tools providing business with the necessary opportunities<sup>10</sup>. But in real life "new information technologies" have been existing for a long time aimed at simplification of work with a daily data flow. This level is over technologies. In general it focuses more on working basis than what people do and how much they work<sup>11</sup>.

That is why such programs as enterprise resource planning (ERP) and customer relationship management (CRM) have become so popular. They are aimed to reduce load of managers and CEOs. But "big systems" (for example, scales of SAP) and big consultants have some restrictions. They considerably change all business processes structure and the long term period of its introduction often has negative influence on company activity. Especially if the incorrect strategy is chosen or industry or market changes strongly during its introduction.

But there are some decisions allowing new approaches for business information streams and solving information problems quickly, flexibly and step by step. Currently there are four most perspective directions:

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<sup>9</sup> Trends in the development of the mining industry in 2015. According to estimates from Deloitte; [http://www.tadviser.ru/index.php/Статья:Горнодобывающая\\_промышленность](http://www.tadviser.ru/index.php/Статья:Горнодобывающая_промышленность).

<sup>10</sup> The Oslo manual: guidelines for collecting and analysing data on innovation. 3rd ed., Moscow 2010; <http://innovation.gov.ru/sites/default/files/documents/2014/25340/3937.pdf>.

<sup>11</sup> Volkov A.: Information innovations; <http://www.moscowuniversityclub.ru/home.asp?artId=1981.15.06.2005>.

- the data-mining (DM),
- the information architecture (IA),
- knowledge management
- and also social networks having the greatest effect almost in all spheres of work involving knowledge<sup>12</sup>.

Such kinds of information innovations are of special interest for enterprises of fuel and energy and mineral complexes.

Each of the directions is based on well-known facts. Thus information architecture is based on centenary experience of librarians, archivists and classifiers, social networks develop people wish to form groups of interests. But data-mining is based on ability to distinguish unusual situations and exceptions in order to study them and, perhaps, to derive a benefit.

*Date-mining software packages* allow to isolate regularities from huge streams of numbers and indicators and become thus a powerful tool of the statistical analysis as statistical regularities are not usually published in public sources. Sometimes these trends are described in industry reviews and reports but it also does not guarantee analyst's or journalist's data are reliable. Therefore ordering such researches for company requirement or providing such research by company specialists are more efficient ways<sup>12</sup>.

Tableau package can be given as an example (<http://tableausoftware.com/>). The program offers to use any of tens types for making visual and difficult schedules. It would take several hours to make the same with Excel. But even packages focused on more professional audience can be always adjusted for the most popular and demanded selections allowing to trace quickly business indicators and reduce time for decision-making. Data-mining allows to carry out commercial investigation and optimize internal organization processes.

One more kind of information innovations is *information architecture* (IA). It can be defined as organization art and information presentation in the convenient way for target audience. Now system integrators are based more on technical aspect of systems. As a result, currently companies need information architects. They are people who combine knowledge of technologies with ability to apply them in the context of the company business purposes<sup>12</sup>. Having good design of information architecture of the website the next moments are surely considered:

- users requirements are traced almost in real time. Thousands of potential clients visiting company website from search engines are the most considerable source of visitors today. If website is organized and constructed competently almost always people coming through search services are target audience. For them it is necessary to arrange and improve the website, first of all for the solution of their tasks;
- image formation, influence on openness and perception by company partners and clients. In this case IA is also a tool of marketing specialist or PR-manager. When har-

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<sup>12</sup> Volkov A.: Information innovations; <http://www.moscowuniversityclub.ru/home.asp?artId=1981.15.06.2005>.

monious and transparent structure of the website or annual report make additional impression on reader;

- information collection in one place. Very often information describing company production extends according to target editions in the form of reviews and press releases. Later these editions die and company history dies with them if there is no copy left. The website always allows to have this information at fingertips especially for those users or journalists who will begin to study the historical background. It is a common practice when "historical materials" involve journalists preparing industry reports and they find required material only on company website. Thus it adds more authority to company image<sup>13</sup>.

One more direction of information innovations is *company knowledge management*. Information is divided into two parts: knowledge and operational data. Operational data is data which are necessary for decision-making here and now. The victory over competitors depends on the speed of decision-making. New technologies, lower or higher prices of competitors, new niches, changes in stock market, new bills have to be studied. For this purpose systems of the complex analysis are created. Up-to-date information becomes outdated very quickly. So it has to be applied as soon as possible in advance.

Knowledge denotes projects history and all company work, information of some difficulties and ways of their decision. Formalized business processes are based on this knowledge very often. When company passes from "partner" level to a stabilization stage, when employees number grows and all of them should be trained how company business management is constructed. In such cases the corporate "library of projects" is also required. It contains best decisions and practice, more over this material can be included in a portfolio of company intangible assets.

The internal corporate knowledge base supplemented by personal contact and communication with skilled employees makes an intellectual basis of company. It often turns out that existence of such base makes search and hiring of new employees much easier. Even for positions with much responsibility it is enough to hire a suitable talented person and train him in the company: long working experience of company managers (and those who work and those who have already quited the company) will help a new employee to make decisions until he gets enough experience<sup>13</sup>.

The knowledge base helps also in the thinking organization of those who has work in this field for a long time. The written-down methods of making decisions are always possible to look through, describe everyone's efficiency and select the decision which is most suitable in each case. As a result there is a considerable time reduction for frequent and repeating tasks but not for creative ones which the knowledge base allows to automate a little.

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<sup>13</sup> Volkov A.: Information innovations; <http://www.moscowuniversityclub.ru/home.asp?artId=1981.15.06.2005>.

*Communications in the form of dialogues with partners and clients, blogs, professional communities and social networks* become very perspective view of information innovations now.

Free Internet telephony distribution (for example, via the Skype service (<http://skype.com/>)), e-mail and instant communications (ICQ, MSN) considerably reduce amount of conventions which need to be observed in order to communicate or get acquainted with someone. There is no hierarchy habitual in usual life in forums and bulletin boards, status symbols remain outside. It has strongly affected on how people communicate with each other.

Communications became simpler, cheaper, quicker, and it has made direct communication between client and partners. Companies prefer personal communication with consumer even in big markets. This personal contact becomes pledge of the fact that client will perceive you not only as impersonal supplier and can get with you some friendly relations. Such relations are appreciated by people much more than true benefit from the transaction that allows not to enter price war with competitors in hard markets. Currently it is often said that in process of increasing pace of life for mass media remains less time. It means that clients should be looked for not in the form of the impersonal markets any more but in the form of certain people. The era of close communication with a consumer at all levels from top managers to ordinary sellers has already begun.

Firstly blogs appeared as personal magazines posted on the personal website or on the website of special service. Some managers and businessmen have decided to write not only about life and company but about how it develops what happens to it. By the format the blog belonging to public and noticeable person is something between personal mass media an advertising resource and the knowledge base. If blog is interesting to readers and its author will manage to maintain this interest there will be a community of readers around the website who gets news from the blog. Currently it is widely spread that blogs are created not only by certain people but also by companies who try to master new information means<sup>14</sup>.

One of the most known professional business communities in Russia is the website [e-xecutive.ru](http://e-xecutive.ru) which is completely devoted to a company management subject. Its greatest value for active managers is made not only by editorial articles but much opportunity to communicate to other CEOs and top managers from various companies, discussing interesting subjects. Acquaintances via general subjects and discussions can become a basis for business relationship at the level of real projects.

In recent years there was a whole class of services providing business challenges solution from which actually social networks are the newest and so far only the perspective and developing direction with getting much profit in the future.

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<sup>14</sup> Volkov A.: Information innovations; <http://www.moscowuniversityclub.ru/home.asp?artId=1981.15.06.2005>.

One of the most noticeable is LinkedIn service (<http://linkedin.com/>). Its idea is professional groups formation around each user of the website and each user can try to find a person who could help to solve the necessary problem via the contacts. This principle is similar to call-down of acquaintances or poll them to find who can know coordinates of a certain person and who could introduce them to each other. That is the main task of LinkedIn – mutual presentation each other via some mutual friends, friends or partners.

All these services (blogs, professional communities and social services) have an important advantage: communicating with each other, people exchange experience and information therefore there is no feeling of "information vacuum". When a worker starts a new project without any data, except technical specifications, it works in the same way.

Such experience accumulation in community allows to learn very quickly about the latest events and changes together with accumulation of acquaintances and being a member of this or that community. Knowledge "is synchronized" between different members of society and at the same time there is always an element of randomness as two different persons will never go in absolutely identical ways. As a result the best decisions are developed by mutual work efforts which each participant in individual way could look for and develop much longer.

Databases analysis, communication, communication between consumer and producer, the organization of knowledge has big future. It is trend beginning which will strongly change life tomorrow. It is a well-known fact that information is the main resource where it is possible to scoop infinitely competitive advantages in every sphere you work. And only now there are opportunities allowing to work with this resource. Computer capacities are applied for communications and manager's life facilitation. Companies begin to realize the original potential of information innovations only now. The markets are formed very gradually and it happens in new way: communication becomes free, software is often free too and services are the main expenses. They are both a surplus value and goods<sup>15</sup>.

Except the mentioned above directions allowing to gain effect in all spheres of business there are some types of information innovations arising only in fuel and energy and mineral complexes. First of all, it is *national cadastre of mineral resources* containing a set of necessary data characterizing mineral resources in general and each certain mineral deposit (MD). All data of the national cadastre are processed by a uniform technique for all MD and kept in a computer databank. On his basis many optimizing problems of planning and development of prospecting works and extracting branches are solved.

By means of national cadastres which are periodically filled up and corrected, optimum planning and forecasting of MSB and minerals production and processing is provided. Economic revaluation of all MD of the national cadastre is required for its successful use.

One of the newest examples of information innovations in fuel-power and mineral complexes is the *complex mining-and-geological system for the coal enterprises* "Gemcom

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<sup>15</sup> Volkov A.: Information innovations; <http://www.moscowuniversityclub.ru/home.asp?artId=1981.15.06.2005>.



Minex" allowing to be focused on the choice of the best options for expenses decreasing, risk reduction and reducing negative impact on environment at the same time taking the maximum benefit from the industrial potential of object. The program provides an exact assessment of deposit reserves and rational carrying out mining. This system is suitable for stratal deposits modeling and development of such minerals as phosphorites, platinoids, chromites, limestones and mineral sand.

Various *Internet-platforms of databases* are of great interest for the enterprises of fuel-power and mineral complexes, for example [www.nelikvidi.com](http://www.nelikvidi.com). There are in many industrial and trade enterprises. They are not demanded in production or remained unsold. Commercial services of enterprises are faced by the task where and how they can be sold at a profit. The platform "Illiquid Assets — the Secondary Market" gives an opportunity to place illiquid assets lists and to draw buyers' attention from Russia and the CIS states. Thus it is possible to sell not only the illiquid overstocked inventories, non-core assets: the second-hand equipment, second-hand spare parts, materials, but also fixed assets such as buildings, constructions and land plots as illiquid assets can be useful in other production or business. Among regular customers of the Internet platform there are such companies as JSC "Karelsky Okatysh", JSC "Uralkali", JSC "Arkhangelsk Pulp and Paper Mill", JSC "Syzran Refinery", "Kalugaenergo" and other enterprises.

#### **4. Conclusions**

The information market just realizes itself but those prospects which it has for usual business make us look at information technologies with interest. People always want to optimize, improve, increase efficiency and business profitability. In the past genius directors and talented managers could achieve such business success having the gift of seeing the events from the other side than majority of people able to catch chances and use opportunities. Now each company has real chance to make its business more effective. This allows us to solve the introduction of information innovation. For example, data mining allows to optimize the internal processes of the organization and to carry out commercial exploration. Information architecture helps to organize properly and build a website that allows you to attract more target audience. Knowledge management, the creation of its internal corporate knowledge base is the intellectual backbone of the company. Information technologies will easily remove routine tasks giving a chief more time for creative tasks such as communication with partners and clients, the choice of strategy and direction of development.

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## **Omówienie**

Innowacje informacyjne rozwiązują problemy organizacji związane z racjonalnym przepływem informacji w obszarze osiągnięć B+R i działalności innowacyjnej, usprawniają niezawodność i efektywność otrzymywania informacji.

Obecnie istnieją cztery kierunki rozwoju i wdrażania innowacji informacyjnych z największymi perspektywami we wszystkich sferach biznesu; są to: eksploracja danych, architektura informacyjna, zarządzanie wiedzą i sieci społecznościowe. Można również wskazać niektóre rodzaje innowacji informacyjnych, które są typowe tylko dla klastrów mineralnych i surowcowych, do których zalicza się: monitoring stanu zapasu surowców, złożony system mineralno-geologiczny dla przedsiębiorstw górniczych oraz platformy internetowe, zawierające bazy danych. W artykule, w powiązaniu z innowacjami informacyjnymi, przedstawiono także przegląd głównych rodzajów ryzyka, związanych z branżą górniczą oraz rekomendację dla szerszego zastosowania innowacji informacyjnych jako metody zwiększenia wydajności branży górniczej w warunkach niedoboru kapitału i inwestycji.