

Prospects for the development of strategic management at the mining enterprises of the Republic of Kazakhstan through the use of new technologies

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Abstract: Modern trends in the technological readiness of the main industries of Kazakhstan indicate the need for a targeted state policy to improve the innovative and technological level of the mineral resource complex, primarily through the initiation and implementation of research activities and the introduction of modern information and communication technologies in all aspects of production and processing of raw materials.

The existing management system of mining enterprises does not satisfy the ever-increasing conditions for the development of a competitive environment in the world market of raw materials due to the globalization of the economy, the intensification of crisis phenomena due to political decisions of developed countries and various integration associations, and other restrictive moments.

Key words: mining enterprises, mineral resource complex, modern technologies, innovative technological level, Industry 4.0, BigData.

The global mining industry is under pressure. In the near term, falling commodity prices are limiting the flow of cash. In the long term, many existing mines and cuts are “aging”, working out their life, as a result of which lower grades of ore are mined at a fairly far distance from the place of slaughter, the replenishment of the ore layer is reduced, and the development time of new mines is increased. In addition, now all over the world, mining is 28 percent less productive than ten years ago, and this is taking into account the declining quality of the ore [3-5]. Based on the identified problems, priority areas for improving the management system of the mineral resource complex have been developed, including the appropriate mechanisms for solving:

- creation of an integrated system for the reproduction of the mineral resource base for the development of the economy of Kazakhstan;
- increasing the level of innovation and technological readiness of industries and enterprises of the mining industry;
- implementation of a full (end-to-end) cycle mineral resource management system for mining enterprises in Kazakhstan;
- introduction of elements of mineral resource logistics in mining enterprises.

The mining industry has shifted its focus to increasing productivity by “loading” existing assets, but this strategy will soon exhaust itself [6]. Despite the ups and downs of the mining industry, production levels have remained the same for decades. Achieving a breakthrough in productivity requires rethinking how the mining industry operates and how its mineral resource base will be reproduced.

The potential to achieve such a breakthrough is now within reach for the industry, thanks to digital and technological innovations that have the potential to transform key aspects of the mining industry. In this direction, it is digital technologies that should be noted that have been working for quite a long time and are currently quite accessible to start functioning on the scale of the entire mining industry. Their applications include developing a better understanding of the resource base, optimizing the flow of materials and equipment, improving failure prediction, increasing mechanization through automation, and real-time performance monitoring.

When considered individually, each of these possibilities has real potential; and together they represent a fundamental shift in both the potential safety outcomes and the amount of scale that can be achieved in the mining sector.

This also applies to the readiness of the domestic mineral resource complex to changing innovation and technological trends, and the following trends are currently observed in the world in the field of mining and metallurgical industry [7-10]:

- increase in steel consumption in the long term by 1.5 times;
- production of new types of high-grade steels;
- development of small-tonnage industries;
- tightening the requirements for environmental friendliness of production and increasing energy efficiency;
- increasing the role of steel production based on waste processing;
- development of production of traditional and complex ferroalloys for growing consumption.

The analysis shows that the technologies existing at the metallurgical plants of the Republic of Kazakhstan in comparison with foreign enterprises are generally competitive. Moreover, Kazakhstan has a number of advanced developments in the field of lead, copper and aluminum technology. In general, the effectiveness of the technology is determined by the final effectiveness of all technological solutions along the entire chain of raw materials processing. Many of them do not correspond to the current level of development of technology and technology.

The Industry 4.0 platform is integrating many innovations in ICT and production management systems. A short list of key technologies in Industry 4.0:

Internet-Smart sensors, interconnected by a global network, are beginning to take root in our homes, clothing and accessories, cities, transport, energy networks and production processes. They will change the usual ways of managing processes and automating manual labor. All this will lead to increased productivity and efficiency in performing routine tasks:

- 1) intelligent search and collection of information;
- 2) automation of call centers and support services, based on speech recognition and analysis systems;
- 3) empowering professionals (eg doctors and lawyers);
- 4) development of analytical systems of a new generation of predictive modeling systems;
- 5) detection of complex relationships and correlations between various factors;
- 6) automatic content generation.

In general, despite the positive dynamics of the growth of industrial indicators, it should be noted the low level of mastering high technologies by industrial enterprises in their production activities.

Vazhnym elementom dlya sprosa na promyshlennuyu produkciyu yavlyayutsya Projekty Budushchikh Rasshireniy Tengizshevroyl, Karachaganak-Petroleum i prochikh nedropol'zovateley. Klyuchevym momentom pri rabote s otechestvennymi zavodami i predpriyatiyami so storony krupnykh TNK yavlyayetsya tekhnologicheskaya osnashchennost', standartizirovannost' i kachestvo vypuskayemoy produkcii otechestvennykh predpriyatiy. Drugim vazhnym generatorom sprosa yavlyayetsya rynek Yevraziyskogo ekonomicheskogo Soyuz a i VTO. Po dannym otcheta BCG «Industriya 4.0: Budushcheye proizvoditel'nosti i rosta v promyshlennosti», bol'shoy tekhnologicheskii sdvig, nachavshiysya v promyshlennosti segodnya, zavershitsya k 2025 godu, radikal'no izmeniv oblik predpriyatiy, tovarov, partnerskikh otnosheniy. Naprimer, proizvoditel'nost' truda v promyshlennykh otraslyakh uvelichitsya na 30%, effektivnost' raboty — na 25%. Tak, v Germanii, po otsenkam BCG, v blizhayshiy pyat'-desyat' let primeneniye podkhodov i tekhnologiy Industrii 4.0 povysit proizvoditel'nost' vo vseh proizvodstvennykh sektorakh promyshlennosti s 90 do 150 mlrd. yevro, povysit proizvoditel'nost' truda na 20–30% i obespechit rost zanyatosti na 6% v blizhayshiy 10 let. Po otsenkam McKinsey, primeneniye BigData i sistem predskazatel'noy analitiki pozvolit snizit' neproizvoditel'nyye prostoi do 40%. Vnedreniye programmy Industriya 4.0 prineset povysheniye proizvoditel'nosti pri sravnitel'no

maloy zamene oborudovaniya (ot 40 do 50 protsentov ot ustanovlennoy bazy) v techeniye blizhayshikh 10 let. V tselom po tekhnologicheskimi razvitym stranam ozhidayut, chto Industriya 4.0 uvelichit dokhodnyuyu chast' na 23%, a proizvoditel'nost' truda na 26%.

An important element for the demand for industrial products are the Future Growth Projects of Tengizchevroil, Karachaganak-Petroleum and other subsoil users. The key point in working with domestic factories and enterprises on the part of large TNCs is the technological equipment, standardization and quality of products produced by domestic enterprises. Another important generator of demand is the market of the Eurasian Economic Union and the WTO. According to the BCG report "Industry 4.0: The Future of Productivity and Growth in Industry", the great technological shift that began in industry today will be completed by 2025, radically changing the face of businesses, products, partnerships. For example, labor productivity in industrial sectors will increase by 30%, work efficiency - by 25%. For example, in Germany, according to BCG estimates, in the next five to ten years, the application of Industry 4.0 approaches and technologies will increase productivity in all manufacturing sectors of the industry from 90 to 150 billion euros, increase labor productivity by 20–30% and ensure employment growth by 6 % over the next 10 years.

According to McKinsey, the use of BigData and predictive analytics systems will reduce unproductive downtime by up to 40%. The implementation of the Industry 4.0 program will bring productivity gains with relatively little equipment replacement (40 to 50 percent of the installed base) over the next 10 years. In general, for technologically advanced countries, Industry 4.0 is expected to increase revenue by 23%, and labor productivity by 26%.

For Kazakhstan, the increase in labor productivity can be up to 15%. The transition to total "digitalization", the development of complex digital models of materials, processes and systems based on the integration of scientific knowledge and the use of statistical methods for processing large amounts of data (BigData) will allow most companies to significantly change existing business models and production systems.

The main economic effects for the industry of Kazakhstan will be:

- increasing the productivity of the domestic industry through digital technologies;
- management of resources and processes, control of the process of material consumption, increasing the speed of processing and obtaining the final product through the use of automated systems for optimal control;
- asset management, repair planning system, prevention of emergencies and risks;
- labor optimization, calculation of optimal technological maps, operational calendar planning, optimal schedules and cyclograms of processes;
- order management, reduction of surpluses in warehouses, formation, assembly and shipment of products, constant monitoring of non-productive stocks and optimization of storage facilities;
- adaptation to customer requests, order management via the Internet;
- quality management systems, lean manufacturing, TPS-Lean systems;
- digital design, conceptual design, prototyping, modeling of new products, modern engineering tools and production technologies.
- However, the main barriers to the development of the digital industry in Kazakhstan remain:
 - complexity of new management processes;
 - lack of necessary personnel competencies for the implementation and operation of solutions (developers, top management, etc.);
 - import dependence and inaccessibility of the necessary solutions of foreign developers;
 - low level of competencies for the creation, implementation and operation of technological solutions;
 - data security and systems protection;
 - a single standard for the integration of various production systems and data transmission systems;
 - end-to-end connection via wireless networks.Для развития основ Индустрии 4.0 в

минерально-сырьевой секторе Казахстана необходимо принятие следующих мер и инициатив:

1) creating a model of ideal production. Model plant system using reference information systems. Service model for building a customer-oriented information system adapted to a specific production. Integration, creation of strategic partnerships. Standardization and reference architecture for ensuring the interaction of various companies within networked value chains. Development of a single set of common standards;

2) creation of design centers. Creation of integrated design centers for collective use, with the capabilities of modern software and computing systems based on a supercomputer, to model, analyze and visualize (Multi-D design) all stages of creating the value of manufactured products. Processing an array of data related to their subsequent operation and life cycle management;

3) creation of distributed integrated working environments - "smart pipelines". Organization of the conveyor for engineering work, equipped with powerful tools for automation, modeling, communication and information processing. Integration into the global design and design networks, using modern computer communication and collaboration tools. Increasing the productivity of engineering work, cooperation in obtaining and transferring competencies at any time to anywhere in the world. Creation of an intelligent collective working environment for developers, designers, engineers, technologists and designers with the ability to quickly develop products and systems of almost any complexity based on the information support service model;

4) development of an integrated software environment for computer engineering;

5) lean manufacturing and quality management systems. New management practices, carried out in a mode that is increasingly approaching real time, new technologies for optimal control and calculation of technological processes and working conditions. New forms of labor organization, focused on project work on reference models;

6) education and continuing professional training. New education and workflow strategies with a focus on encouraging on-the-job training, retraining, and ongoing professional development. The achievement of these goals will be helped by the widespread introduction of practices for the implementation of standard projects, "network exchange of best practices", digital learning techniques;

7) other necessary initiatives:

- assessment of the level of ICT at industrial enterprises;
- harmonization and adoption of NIST standards;
- attraction of technological partners and co-investors to create model plants;
- replication of the model plant experience among enterprises;
- expansion of state support measures for reimbursement of costs for automation within the framework of the Productivity 2020 Program. Financial support for projects (grants, investments, co-financing);
- stimulating the implementation of project results in industry, government orders;
- support of educational projects, training of competent personnel;
- introduction of an additional automation measure as part of the support for "national champions".

Advances in robotics are making fully autonomous equipment more affordable and efficient. In manufacturing, the cost of industrial robots has fallen 50 percent since 1990, while U.S. labor costs have risen 80 percent over the same period. Meanwhile, technological advances in fields such as artificial intelligence are increasing the complexity of robotics and expanding their productive applications. In the mining industry, the use of remote control and auxiliary control equipment is becoming more common, as well as the introduction of fully autonomous equipment for transportation, drilling and other processes [16-18].

Together, these technologies are revolutionizing the way the mining industry operates, a change marked by both the use of information flow to reduce variability (fluctuation) in decision

making and the introduction of more centralized, mechanized operations to reduce variability (fluctuation) in execution.

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Қазақстан Республикасының агроөнеркәсіптік кешенін цифрландыру

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Түйіндеме: Мақалада Қазақстан Республикасының агроөнеркәсіптік кешенін цифрландыру бағдарламасы қарастырылған. Агроөнеркәсіптік кешенді толыққанды түрде цифрландырудың төрт бағытына көңіл бөлінген. Цифрландыру бағдарламасы аясында жүргізіліп жатқан жұмыстар мен шаралар, күтілетін нәтижелер баяндалған.

Кілт сөздер: агроөнеркәсіптік кешен, мемлекеттік басқару, мемлекеттік қолдау, мемлекеттік реттеу, цифрландыру.

Агроөнеркәсіптік кешен - ұлттық экономиканың айрықша салаларының бірі саналады. Әлемнің дамыған елдерінде ауыл шаруашылығы экономиканың маңызды саласы болғандықтан, агроөнеркәсіптік кешенді дамытуға көптеп көңіл бөлінуде [1].

Аграрлық салаға мұншалықты деңгейде көңіл бөлінуі, халыққа қажетті азық-түлік өнімдерін өндіретіндігіне, жұмысшы күштерін толықтырып, тиісінше өндірістік мақсаттағы өнімдермен қамтамасыз ететіндігімен түсіндіріледі. Көпшілік жағдайда, ауыл шаруашылығы саласының даму деңгейі, ел экономикасының даму көрсеткішін көрсетеді.

Қазақстан Республикасының агроөнеркәсіптік кешені ашық та, біртұтас жүйе болып табылады. Ол өз кезегінде бірқатар құрылым құраушы элементтерден тұрады. Агроөнеркәсіптік кешенді алға қарай дамыту, ең бірінші кезекте мемлекеттік өзін-өзі реттеу жүйесіне, басқару механизмінің дұрыс құралуына тікелей байланысты[2].

Қазақстан Республикасында ауыл шаруашылығы саласын цифрландыру жұмыстарын жүргізу өз деңгейінде игеріліп жатқан жоқ. Оған мысал, ауыл шаруашылығы мақсатында пайдаланылатын жерлерді нысаналы мақсатында игере алмай отыруымыз және ауыл шаруашылығы өнімдерін нарыққа сапалы, қолжетімді түрде шығара алмауымыз. Сондықтан да, агроөнеркәсіптік кешенге цифрландыру бағдарламасын енгізудің маңызы зор. Ауыл шаруашылығы саласын дамытуға бағытталған «Цифрландыру» бағдарламасы аясында еліміздің өсімдік шаруашылығы саласына «Telematiks» жүйесін енгізу көзделген. Бұл аталған жүйенің көмегімен егін орағында жұмыс жасайтын комбайнның немесе трактордың жұмыс жылдамдығын және қандай алқапта жүргендігін, қанша түсім жинап, қандай көлемде жаңар-жағар май қолданғанын анықтауға болады. Егіс алқабын бақылау, барлау және талдау үшін дрондарды да қолдану алға қойылған. Мал шаруашылығы саласында GSM навигаторларын қолдану арқылы мал басының жайылымның қай тұсында жүргенін, қанша км қашықтықта екенін көруге мүмкіндік береді. Сонымен қатар, ауыл шаруашылығы өнімдерін сату және сатып алу үшін электронды сауда алаңы қалыптастыру мақсатында Е-коммерция жобасы іске асырылуда. Егер, цифрландыру бағдарламасы іске асырылатын болса, алдағы уақытта Республика деңгейіне 20 цифрлы ферма мен 4000 ферма құрылып, электронды коммерцияның үлесі 3%-дан, 20%-ға дейін арттырылмақ[3].

Қазіргі таңда, ауыл шаруашылығы саласында цифрлық технологияларды қолданатын, ауыл шаруашылығы өнімдерін өндірушілердің үлесі төмен. Бұл аталған жағдай ауыл шаруашылығы өнімдерінен түсетін өнімділіктің төмендеуіне, шығындардың ұлғаюына ықпал етеді. Ауыл шаруашылығы саласында цифрландыру шараларының толыққанды түрде