THREATS TO FUTURE DEVELOPMENT RELATED TO PECULARITIES OF PERFORMACE OF THE MINING AND METALLURGICAL INDUSTRY

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Abstract. The article deals with the problem of future development threats based on the methodology of industry foresight. As an empirical basis for this direction of forecasting, the authors study the mining and metallurgical complex of the Republic of Kazakhstan as a leading factor in the development of the entire national economy. The study is a pilot and focuses on assessing the risks that have formed that could pose a serious threat to the development of the industry, the economy and the country as a whole in the future. Summarizing the world experience in applying the foresight methodology, the authors use it to predict the security and sustainability of development in the medium-term. Using the risk mapping method, the authors identify safety zones in the development trends of the mining and metallurgical industry. The assessment of threats and risks also highlights the leading actors that affect the development of the industry. The main risks for Kazakhstan's mining and metallurgical enterprises are the lack or shortage of local labor and its low skills. Automation of production processes and digitalization of production are becoming the leading trends in the development of the industry. The problem of improving the quality of workforce training and mastering the necessary skills by specialists is a serious threat to the development of the industry. The authors suggest using foresight tools not only to assess risks, but also to prevent their development into future threats.

Keywords: foresight; mining and metallurgical industry; risks; threats; security; stability; Kazakhstan

1. Introduction

The mining and metallurgical industry is the leading sector of the Kazakh economy, accounting for 15.2% of the total industrial production. Many mining and metallurgical enterprises are city-forming enterprises. The activity of the mining and metallurgical industry creates up to 200,000 jobs and forms the development of territories. However, in business development of mining and metallurgical industry of Kazakhstan, there are problems: administrative barriers, legal restrictions, lack of infrastructure, unavailability of financing, lack of knowledge, etc., which need to be addressed in the framework of public policy, where mining and metallurgical industry is one of the priority directions for the future development of the economy.

The relevance of this research is explained by the important role of the mining and metallurgical industry of Kazakhstan in the country's economy, the growth of production efficiency, and support for priority industries that consume metal. The mining and metallurgical complex (hereinafter – MMC) also provides economic and defense security, is a leader in exporting finished products to domestic and foreign markets, accelerating scientific and technological progress and the dynamics of its development in the medium and long term.

In the study, we used data of industrial enterprises, the Ministry of industry and new technologies of the Republic of Kazakhstan the Association of mining and metallurgical enterprises of Kazakhstan, scientific publications in the field of problems of development of mining and metallurgical industry of Kazakhstan, statistical data of the statistics Committee of the Ministry of national economy of the Republic of Kazakhstan, international statistics. The presented research develops the data of the national project on the development of an Atlas of new professions and competencies in the Republic of Kazakhstan in the mining and metallurgical industry, in which the authors were directly involved.

2. Method of research

Foresight as a technology for predicting the future was born in the 1950s. The first publications summarized the use of expert methods that became the basis of the foresight methodology (Dalkey N.C., Helmer-Hirschberg O., 1962). The development of the practice of using foresight in different countries has led to the enrichment of its methodology with quantitative and qualitative research methods (Havas A., Keenan M., 2008, Popper R., Medina J., 2008). In the current century, technological forecasting has become a priority technology for foresight (Georghiou L., Cassingena Harper J., Keenan M., Miles I., Popper R., 2008). The active development of digital technologies and their clear impact on the changing economic structure have put the problem of predicting technological changes among the main tasks of foresight research. A comparative analysis of modern foresight shows that "technological forecasts have demonstrated that achievements in the areas of sustainable development, ecology and IT are a prerequisite for progress in other technological areas" (Zweck A., Braun A., Rijkers-Defrasne S., 2014).

In the present study, the authors consider technological foresight in the interpretation of the concept "technology foresight provides support to innovation, and incentives and assistance to enterprises in the domain of technology management and technology transfer, leading to enhanced competitiveness and growth" (UNIDO., 2020). As noted by UNIDO, the technology foresight initiative also provides suitable methodologies to promote sustainable and innovative development, fostering economic, environmental and social benefits at national and regional levels. Its outcomes are policies and programmes that deal with innovation, industrial growth and competitiveness. Technology Foresight' (now changed to simply 'Foresight') is to be understood as a systematic means of assisting the scientific and technological development which could have a strong impact on industrial competitiveness, wealth creation and quality of life carried out by joining the experience of researchers, business people and government officials.

In recent decades, foresight has been widely used for strategic planning and management at the level of countries and industries. The foresight methodology assumes the possibility of creating a future based on proactive thinking. Foresight is a strategy for moving into the future through the implementation of consistent management decisions in the present. Foresight considers various options for possible future development that may occur if certain conditions are met (Mikova N., Sokolova A., 2014). Important conditions for the development of future development scenarios are the identification of the most likely risks and dangerous threats, influential partners and their level of agreement in assessing the parameters of the future.

Foresight research has accumulated about 50 empirical, creative, interactive and evidence-based methods (Popper R., 2012). In recent years, strategic planning has focused on assessing factors that disrupt the stable development of markets and organizations. In the foresight methodology, the development of trends that may negatively affect the future is based on analytical methods. The following methods are used: SWOT analysis, TEEPSE factor analysis, network analysis, Joker evaluation, and others. The authors are based on the princi-

ples of predictive analytics and use data mining of expert data to visualize the results of calculations (Calof J., Richards G., Smith J., 2015).

In the foresight study, the authors were guided by the Rapid Foresight 0.4 methodology (RAPID FORESIGHT, 2017) and the author's methodology "Methodological tools for conducting predictive foresight surveys of industry experts". One of the tasks of the applied methodology is to assess the probability of threats to the future of the mining and metallurgical industry due to the development of emerging risks, and to determine the opportunities for involving key players in countering threats. During the research, 132 experts participated in in-depth interviews with industry stakeholders. During the study of expert opinion, a Delphi survey was used, in which 132 experts took part, which is about 20% of the expert community in this industry. The survey was conducted in April 2020. The expert community consisted of the following characteristics.

The experts evaluated the future according to various criteria and in several stages. A number of evaluations used a 10-point scale, which allowed mapping the results of the evaluation. Using the mapping method allows you to get a visual representation of the problem and improve the management of the object under study (Zinkevich V. A. Cherkashenko V. N., 2004, Oehmen J., Guenther A., Herrmann J. W., Schulte J., Willumsen P., 2020).

## 3. Analysis of the current situation in the industry

According to scientists from the leading countries of the world, Kazakhstan ranks sixth in the world in terms of natural resources, although it can not yet use this advantage with the greatest effect for itself. According to the calculations of some scientists, the explored subsoil of Kazakhstan is estimated at about 10 trillion us dollars. Evidence of the rich natural resources of Kazakhstan is that of the 110 elements of the table of D. I. Mendeleev, 99 have been identified in its depths, 70 have been explored, but 60 elements are still being extracted and used. Kazakhstan is one of the richest countries in the world in terms of reserves of oil, gas, titanium, magnesium, tin, uranium, gold and other non-ferrous metals. On a global scale, Kazakhstan is already one of the leaders in uranium production, second in reserves of chromium and phosphorous ores, fourth in lead and molybdenum, and eighth in total reserves of iron ore (16.6 billion tons) after Brazil, Australia, Canada, the United States, India, Russia and Ukraine (Karibaev E. G., 2014). In total, there were 493 deposits on the territory of the country in 2018, where more than 1200 varieties of mineral raw materials were extracted (see table 1).

Table 1. Analysis of Kazakhstan's reserves

Type of mineral resources	Balance sheet reserves (tons) production	Volumes (tons / year)	Place in the world		
			in terms of production	by the proven volume of reserves	the grade of ore (% of element content)
Iron ore	18 600 000 000	22 000 000	12	6	7
Manganese ore	635 200 000	2 361 000	6	4	10
Chrome ore	382 700 000	3 600 000	3	2	1
Bauxites	365 400 000	5 200 000	10	12	no data
Lead	17 200 000	120 000	11	5	41
Zinc	39 800 000	377 000	10	5	40
Copper	39 300 000	440 000	11	12	63
Titanium	24 100 000	3700	16	10	15
Tungsten	2 100 000	2600	4	1	25
Gold	2 233	47,5	17	15	2
Silver	53 204	77,39	10	4	31
Uranium	1 600 000	17 800	1	2	no data
Coal	150 000 000 000	108 700 000	10	8	no data

Source: based on the source (Karibaev E.G., 2014)

Having a significant resource base of minerals, Kazakhstan is one of the leading suppliers of ferrochrome, titanium sponge and magnesium (Fig. 1).
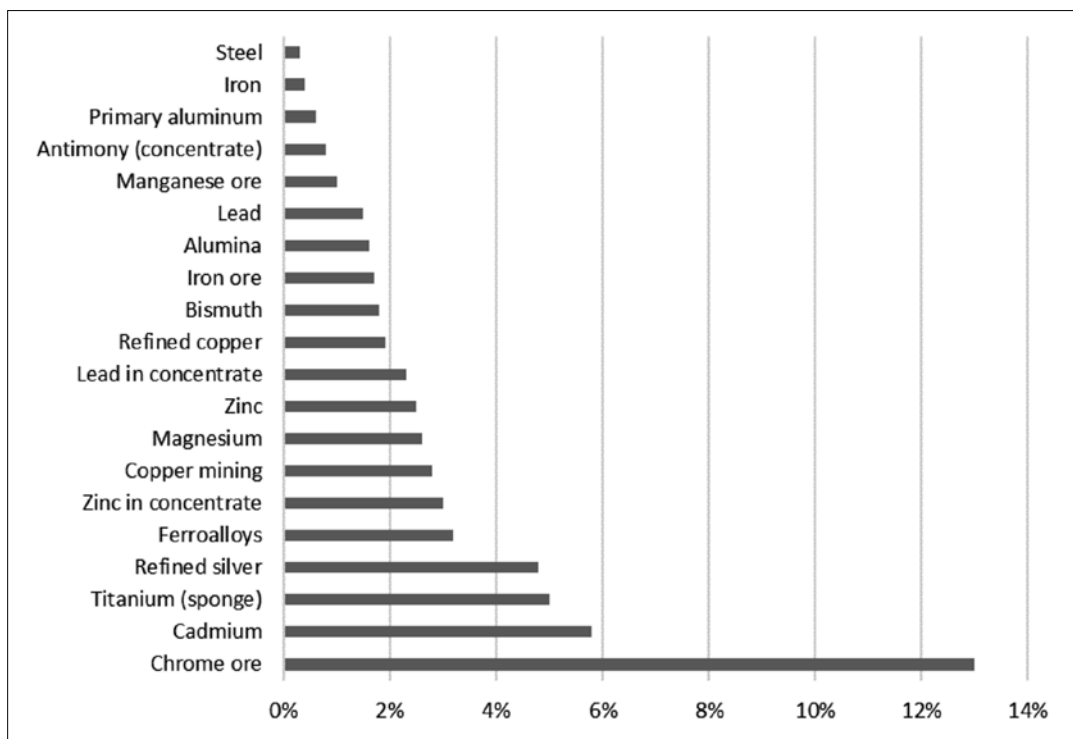
Figure 1. Kazakhstan's share in world production in 2018

Source: compiled by the authors based on the source (Statistics Committee of the Ministry of national economy of the Republic of Kazakhstan)

Kazakhstan ranks first in terms of economically viable chromium reserves, significant reserves of iron ore, zinc, lead and manganese (with a production duration of at least 20 years according to current rates).

According to the State Classifier of economic activities in the Republic of Kazakhstan, the mining and metallurgical industry is represented by 2 sub-sectors: metal ore mining and metallurgical industry.

In 2018, 79 large and medium-sized enterprises (excluding small enterprises) were engaged in metal ore mining in Kazakhstan, including 10 in iron ore mining; 69 in non-ferrous metal ore mining.

There were 76 large and medium-sized enterprises operating in the metallurgical industry, including 30 in the ferrous industry; 36 in the production of basic precious and non-ferrous metals.

The largest enterprises in the field of non-ferrous metallurgy are the following: Kazakhmys Corporation LLP, Kazzinc LLP, Aluminum of Kazakhstan JSC, Kazakhstan electrolysis plant JSC, Ust-Kamenogorsk titanium and magnesium combine JSC, Kazakhaltyn MMC JSC, Varvarinskoe JSC (Polymetal JSC), Altynalmaz JSC.

In the field of ferrous metallurgy-JSC "ArcelorMittal Temirtau", LLP "Casting", LLP "KSP Steel".

To understand the trends in the industry, consider the indicators of mining and processing of metals in dynamics over 18 years. At the end of 2018, the volume of metal ore production amounted to 1,462,139 million tenge, which is 224.53% compared to 2010 (table 2).

Table 2. Production volumes of metal ores in Kazakhstan for 2010-2018

	2010	2012	2014	2016	2018	2018/2010
Production of metal ores total, million tenge	651197	722893	882332	996317	1462139	224.53
Including:						
Iron ore production, million tenge	258192	235763	223342	192861	290470	112,50
Production of non-ferrous metal ores, million tenge	393005	487130	658990	803456	1171669	298.13

Source: compiled by the authors based on the source
(Statistics Committee of the Ministry of national economy of the Republic of Kazakhstan

In the overall structure of industrial production in Kazakhstan, the share of metal ore production in 2018 accounted for 5.3%, including the share of iron ore production -1.05%; non-ferrous metal ore production -4.25%.

In physical terms, iron ore production is declining (by 10.72%) in 2010-2018, and non-ferrous ore production is growing (on average, 94.63%). However, there are different trends within the ore groups. Over the past period, growth rates have increased for the following products: copper concentrates– 592.86%; lead concentrates – 411.14%; copper ores - 237.23%; lead in lead concentrate – 118.27%; gold – containing ores – 77.27%; chrome concentrates – 46.42%; chrome ores – 42.98%; copper in copper concentrate – 42.09%, aluminum ores-18.99%; non-agglomerated iron ores-19.57%. The growth rate decreased for the following products: manganese concentrates-52.05%; manganese ores-43.68%; zinc in zinc concentrate-27.43%; zinc concentrates-23.39%; lead-zinc ores – 15.84%; iron ore agglomerate-12.46%; iron ore concentrates – 7.03%; copper – zinc ores-5.4%.

The volume of production of the metallurgical industry of Kazakhstan in 2018 at current prices amounted to 4,655,995 million tenge, or 296.57% compared to 2010. In the overall structure of industrial production in Kazakhstan, the share of metallurgy in 2018 accounted for 16.88%, and in the structure of the manufacturing industry – 44.65%. The growth rate of non-ferrous metallurgy production in value terms for 2010-2018 was 328.42%.

In 2010-2018, the production capacity of metal ore mining increased for almost all products in the industry. Production capacity in the production of iron ore remained almost at the level of 2010, but there was a decrease in production capacity in the production of lead-zinc and manganese ores.

The main reasons for the decline in capacity utilization were:
- China's reduction in steel production, which led to a decrease in iron ore consumption;
- ongoing modernization of production facilities of JSC "Arcelormittaltemirtau";
- lack of orders for products from the state and in General in the domestic market of Kazakhstan;
- decrease in the competitiveness of JSC "Arcelormittaltemirtau" products in all foreign markets (except Iran) due to high logistics costs;

External factors also had a negative impact on the development of Kazakhstan's ferrous metallurgy enterprises:
- reduced consumption of rolled products in Russia, Brazil, and the United States. The increase in demand for steel is observed only in South-East Asia and some Latin American countries, but this does not compensate for the overall drop in prices;
- formation of significant surpluses of steel products in China, Russia, Japan, Turkey and other exporting countries, which creates an excess of supply on the world market, with limited demand;
- competition has a negative impact on the prices of ferrous metallurgy products. In Asia (including India) in 2015, Japanese, Korean and Russian exporters lowered their quotations, which entered into a struggle with Chinese enterprises for sales markets;
- activation of Chinese enterprises in the Middle East, offering cheaper semi-finished products, rebar and wire rod to customers from Turkey, Africa and the Middle East;
- reduced demand for sheet steel in the Turkish market;

- growth of protectionist sentiment in the global steel market caused by aggressive policy of exporters;

- strengthening the protection of the domestic market in Australia, some countries in South-East Asia and Latin America;

- the introduction of new restrictions increases the pressure on relatively free markets, including the Kazakh market. Russian steel producers are expanding supplies to the European Union, Turkey, and India. China is increasing its activity in the markets of the Middle East, Latin America, South Korea, in open niches for them in the United States and South-East Asia. Turkish companies are increasing exports to the United States. Japan is fighting for Vietnam and the Gulf States. As a result, the volume of supply continues to grow, and prices are constantly under pressure.

In non-ferrous metallurgy, the main reasons for the decline in the level of production capacity utilization were the following:

- decrease in the content of useful components in the ore;

- lack of "long" and available financial resources;

- decrease in refined copper output at Kazakhmys Corporation LLP due to temporary shutdown of Zhezkazgan copper smelter for reconstruction;

- decrease in output due to the sale of copper concentrate;

- decrease in alumina and primary aluminum output due to falling prices for primary aluminum sold, which depend on the price of aluminum on the London metal exchange.

4. Analysis of investment activity

Investment activities of the mining and metallurgical complex of Kazakhstan are carried out in all its sub-sectors: in the extraction of iron ore, non-ferrous metals, ferrous metallurgy and the production of basic precious and non-ferrous metals. In 2018, the mining and metallurgical complex of Kazakhstan attracted 706.7 billion tenge of investments in fixed assets, or 211.5% compared to 2010. In 2018, the volume of enterprises' own funds in fixed assets amounted to 646.3 billion tenge (or 91.45 % of the total investment in MMC), Bank loans -4.05 billion tenge (or 0.57%), other investments -56.4 billion tenge (or 7.98%). In 2010-2018, the same trend was observed in the formation of sources of investment in fixed assets in the mining and metallurgical complex of Kazakhstan. Thus, in the total volume of investments in fixed assets, the largest share is accounted for by enterprises' own funds. During this period, the share of enterprises' own funds increased from 85.27% to 91.45%. Investments in fixed assets of sub-sectors of the mining and metallurgical complex were mostly directed to the purchase of machinery and equipment, tools and inventory.

In 2018, the mining and metallurgical complex of Kazakhstan had 166 enterprises with foreign capital, including 8 enterprises in the extraction of iron ore, 85-in the extraction of non-ferrous metals, 42-in ferrous metallurgy, 23-in the production of basic precious and non-ferrous metals and 8-in the casting of metals. The number of operating enterprises with foreign capital is shown in table 3.

Table 3. The number of operating mining and metallurgical enterprises of Kazakhstan with the participation of foreign capital

	Total	Joint companies	Foreign companies
Iron ore extraction	8	4	4
Mining of non-ferrous metal ores	85	43	42
Production of cast iron, steel and ferroalloys, steel products, by primary processing	42	20	22
Production of basic precious and non-ferrous metals	23	10	13
Metal casting	8	4	4
Total	166	81	85

Source: compiled by the authors based on the source
(Statistics Committee of the Ministry of national economy of the Republic of Kazakhstan)

However, despite growth of volumes of production of enterprises with foreign capital participation, operating enterprises with participation of foreign capital 70-80% of products are exported abroad in the form of raw materials, products 1 and 2 value added of mining and metallurgical industry.

The investment climate in Kazakhstan today is one of the best conditions for doing business among the CIS countries. Thus, Kazakhstan is included in the list of the 25 most investment-attractive countries according to the rating of the internationally recognized consulting company AT Kearney.

5. Analysis of export and import of industry products

Imports of metals and their products in 2011-2018 decreased from $ 3.7 billion in 2011 to $ 3.43 billion in 2018, or 7.3%. In terms of Kazakhstan's total imports, metals and products from them accounted for 10.1% in 2011, and 11.59% in 2018, or an increase of 1.5%. The ratio of imports from CIS countries to non-CIS countries in 2011 was 55.6% to 44.4%, respectively; in 2018 – 53.6% and 46.4%, i.e. over these years there has been a slight increase in imports from the rest of the world. Exports of metals and their products for 2011-2018 decreased from 9.7 billion us dollars in 2011 to 8.4 billion us dollars in 2018, or by 13.4%. Metals and their products accounted for 11.5% of Kazakhstan's total exports in 2011 and 13.7% in 2018, or the share of the industry increased by 2%. The ratio of exports to the CIS and non-CIS countries was 25.4% and 74.6%, respectively, in 2011; in 2018 -30.95% and 69.05%, respectively, i.e. in 2011-2018 there was a trend of growth in exports to the CIS countries and a decrease in exports to the rest of the world. Despite the fact that exports of metals and their products exceed imports, the potential of the industry is significant, but its implementation is hindered by various restrictive measures of the trading partner countries.

According to the WTO, metallurgy is one of the most active users of trade policy tools aimed at reducing import volumes and reducing its price competitiveness. Before joining the WTO, foreign countries applied trade policy instruments and used discriminatory measures with impunity in relation to exports of metallurgical products from the CIS countries. As of December 2019, 126 measures have been identified that have a negative impact on the conditions of access of goods of the Customs Union and the Common economic space member States to foreign markets. The largest number of measures in the field of metallurgy relates to the Russian Federation and the Republic of Belarus. The Republic of Kazakhstan has an anti-dumping measure in respect of hot-rolled flat rolled products (applicable to all member countries of the Customs Union of the CIS countries and the Common economic space) and silicomanganese. According to the center for integration studies of the Eurasian Development Bank, trade within the Eurasian Union is also not going too fast. Non-tariff barriers increase business costs by 15-30% of the cost of goods.

There are barriers to enterprises in Kazakhstan and Russia in the form of poor condition of roads and Railways, cargo aviation, transit hubs, electric networks; actions of authorities that restrict the development of entrepreneurship, as well as industry barriers to entry to a larger and diversified market of Russian metallurgy products produced by large vertically and horizontally integrated holdings.

6. Risks and trends in the industry

For a long time, the EY's Global Mining & Metals Center has been compiling the Top 10 business risks - priorities of the mining and metallurgical sectors, which are affected by global megatrends. These include:
- Digital transformation
- Changes in the way we work
- The global marketplace
- The urban world and its demands on infrastructure
- A resourceful planet allocating scarce resources
- Health re-imagined to meet growing needs

The megatrends by their nature are medium to long term in relevance.

EY's Global Mining & Metals Center in its analytical study "Business risks facing mining and metals 2020" (Top 10 business risks and opportunities – 2020.) emphasizes that for the third year in a row, the global mining and metals industry has seen significant fluctuations in risks, as well as new risks that fall into the top 10. The dynamics of changes in the risk focus can be seen in table 4.

**Table 4.** Top risks of the global mining and metallurgical industry

Ranking	2020	2014	2008
1	License to operate (SLTO)	Productivity improvement	Skills shortage (now balancing talent needs)
2	Future of workforce	Capital dilemmas – allocation and access	Industry consolidation
3	Digital and data optimization	Social license to operate (SLTO)	Infrastructure access
4	Reducing carbon footprint	Resource nationalism	Social license to operate
5	High-impact risks	Capital projects	Climate change concerns
6	Maximizing portfolio returns	Price and currency volatility	Rising costs
7	Cyber	Infrastructure access	Pipeline shrinkage
8	Replacement of production	Sharing the benefits	Resource nationalism
9	Innovation	Balancing talent needs	Access to secure energy
10	Rising costs	Access to water and energy	Increased regulation

Source: compiled by the authors based on the source (Top 10 business risks and opportunities – 2020.)

Moreover, risks 4, 5, 8 and 9 appeared in the world ranking for the first time in 2020.

Taking into account global trends, it is relevant to consider the views of Kazakhstani experts on current country trends: what risks and opportunities exist in the Kazakh mining and metallurgical industry. As part of the rapid foresight of the mining and metallurgical industry of Kazakhstan, 132 experts were interviewed, who mainly occupy the position of functional managers and employees of the production sector of enterprises. All experts have sufficient professional experience to justify their assessments of the current and future state of the industry.

The assessment of the future development of the industry is an important point of the survey, allowing you to determine the first approximation of the difference and coincidence in the vision of the future (fig. 2).
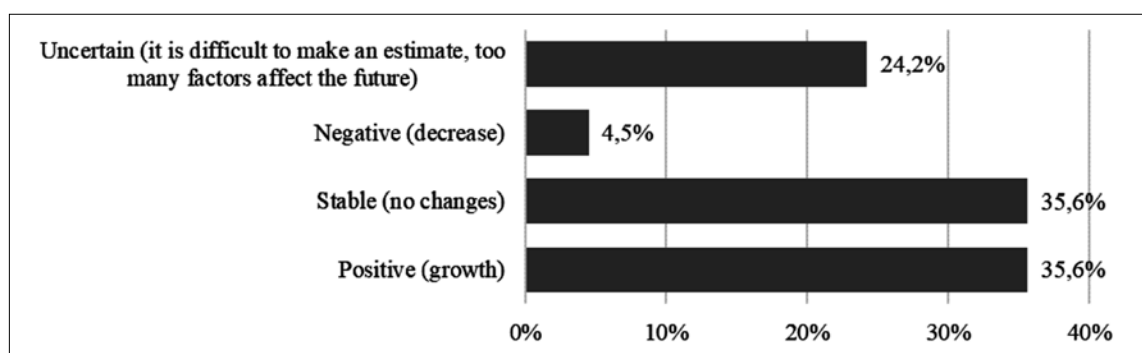

Figure 2. Kazakhstan's share in world production in 2018

Source: compiled by the authors

The weighted average rating of experts on the 10-point system is 7.42 points, which is closer to the stable position of the industry. We can note that the entire set of expert assessments is divided into three approximately equal parts. A third of experts believe that the situation in the industry does not inspire optimism, and another two-thirds Express cautious or obvious optimism. In General, the expert community can act as a stakeholder in future changes.

The ability to identify current and potential risks of industry development is an indicator of professional critical thinking. The survey participants were asked to evaluate 15 groups of problems that form potential risks for mining and metallurgical enterprises (fig. 3).
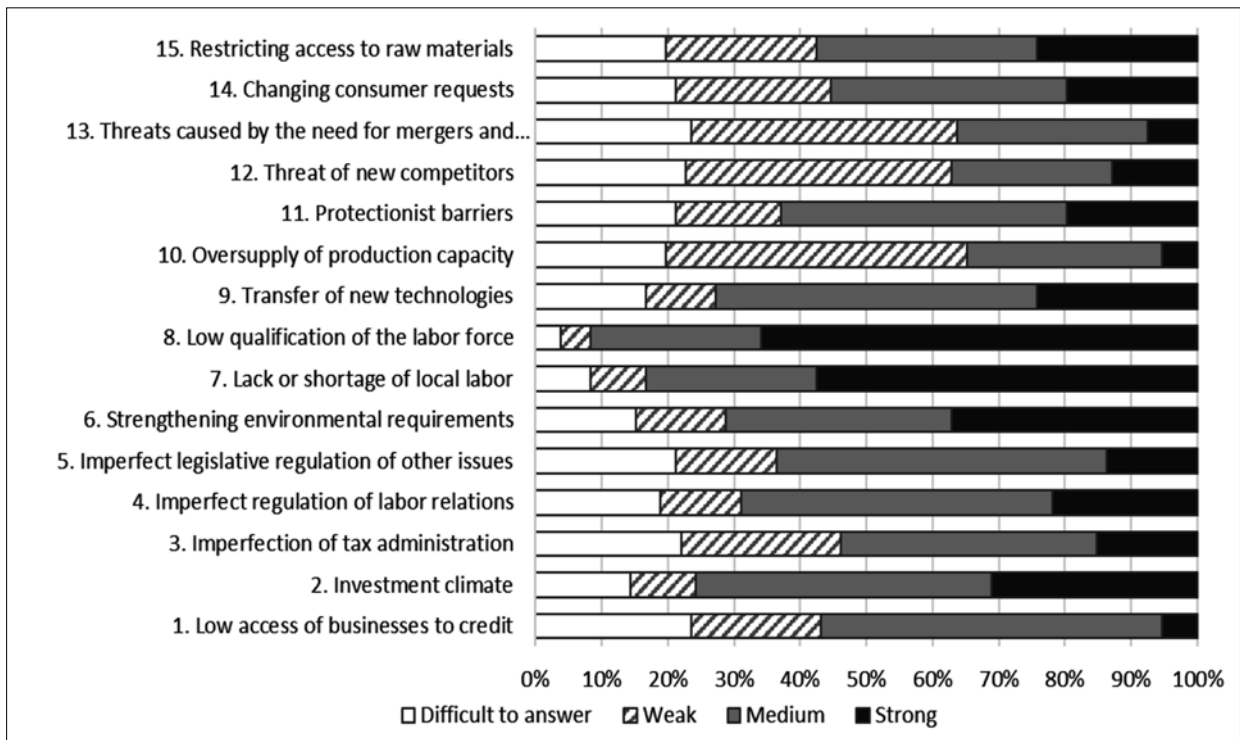
Figure 3. Assessment of the current state of groups of problems
that form the risks of negative development in the industry

Source: compiled by the authors

The weighted average probability of occurrence of each risk was determined based on the total estimates of experts, which made it possible to map risks for the mining and metallurgical complex of Kazakhstan (fig. 4).
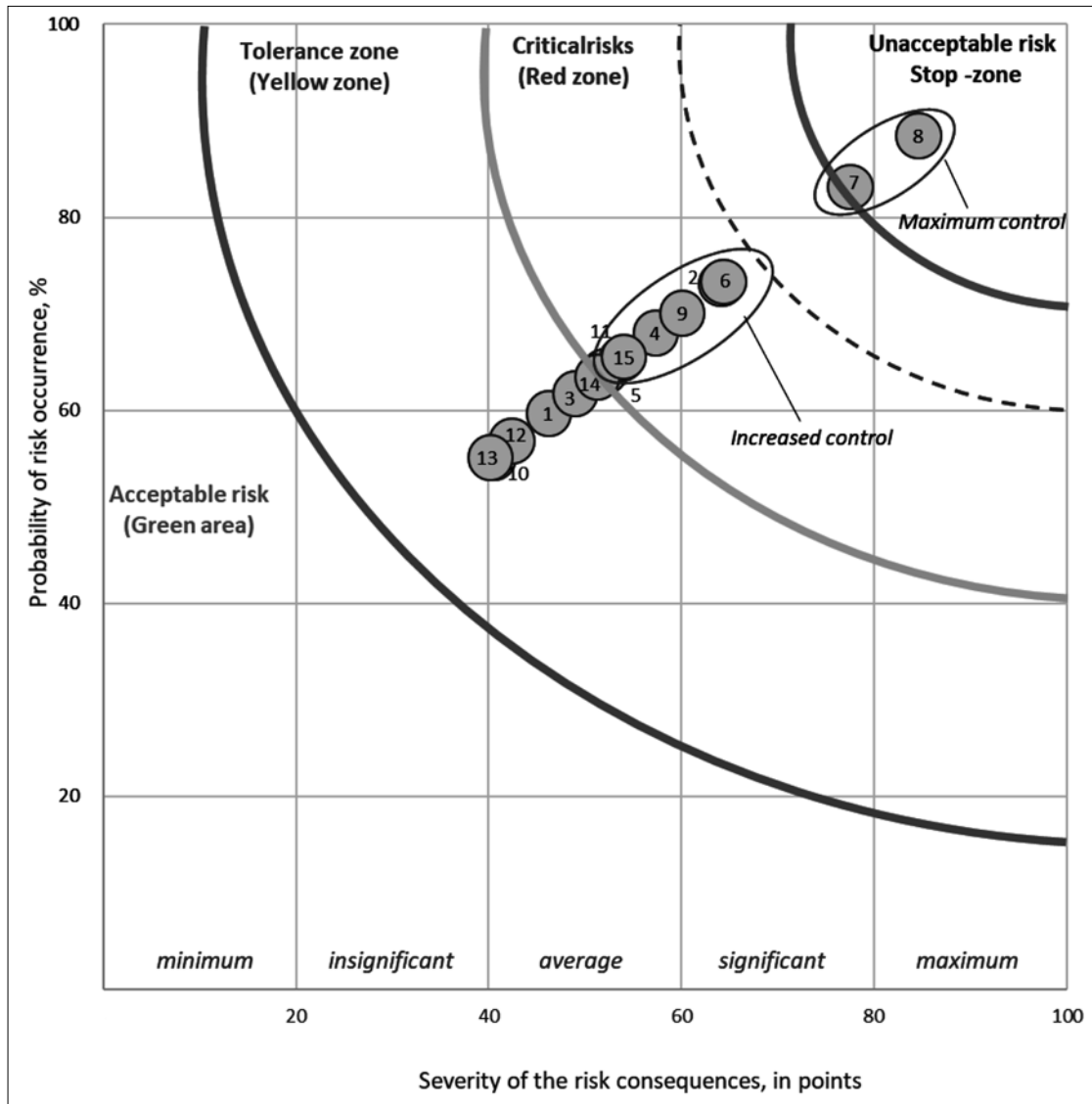
Figure 4. Risk mapping of mining and metallurgical complex of Kazakhstan

Source: compiled by the authors

Fig. 4 uses the same numbering of risks as shown in fig. 3. As can be seen from the figure, unacceptable risks that require immediate resolution and corrective action are risk 7 "Lack or shortage of local labor" and risk 8 "Low skill of the labor force". The high probability of occurrence and severity of the consequences of these risks for mining and metallurgical enterprises is also explained by the fact that low automation of production, lack of technological innovation makes the workforce the main element of efficiency. Therefore, the sufficiency of labor and its qualification directly affects both the volume of raw material production and the cost of production.

The availability of the necessary professional competencies is an important condition not only for maintaining current efficiency, but also directly affects the implementation of long-term plans of enterprises. Fig. 5 shows the distribution of expert responses on self-assessment of professional competence of employees of mining and metallurgical enterprises.
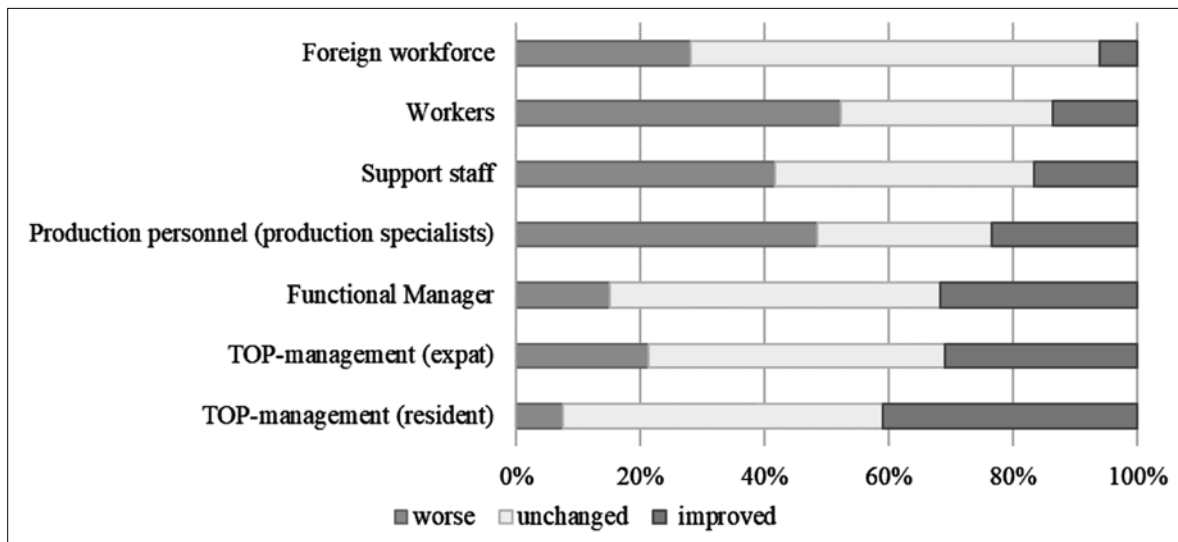
Figure 5. Assessment of the trend of professional competencies of managers,
employees, specialists, and workers in the industry in recent years

Source: compiled by the authors

Experts note the greatest improvement in the competence of TOP-management and functional managers of the industry, such responses were given by 29.5% and 38% of experts, respectively.

At the same time, experts note a significant deterioration in the competencies of workers (52.4%), production staff (48.6%) and support staff (43.8%). The growth of managers 'and specialists' competencies makes it possible to develop development models, but the lack of necessary skills in production personnel makes it impossible to implement progressive scenarios fully. It is necessary to pay special attention to the formation of modern competencies among workers in the industry. It is noteworthy that the risk of the quality of the workforce, its availability of certain competencies and skills, is also in second place in the Top 10 risks identified by EY's Global Mining & Metals Center in 2020.

The group of critical risks includes (in order of decreasing probability of occurrence and severity of consequences):

6 - "Strengthening environmental requirements",

2 - "Investment climate",

9 - "Transfer of new technologies",

4 - "Imperfect regulation of labor relations",

15 - "Restrictions on access to raw materials",

11 - "Protectionist barriers",

5 - "Imperfect legislative regulation".

Some of these risks are also relevant to Global Top-10 risks:

- the risk of increased environmental requirements corresponds to risk 4 from the Top 10 list,

- risk of restricting access to raw materials corresponds to risk 8 from the Top 10 list,

- the risk of transfer of new technologies corresponds to risk 9 from the Top 10 list.

The last four critical risks largely reflect the country-specific features of socio-economic relations in Kazakhstan. These risks require close attention at the level of industry regulation and joint actions by the Association of mining and metallurgical enterprises.

The remaining risks identified by experts belong to the zone of tolerance, have an average probability of occurrence and severity of consequences:

14 - "Changing consumer requests",

3 - "Imperfection of tax administration",

1 – "Low access of enterprises to credit",

12 - "Threat of new competitors",

10 – "Excess production capacity",

13 - "Threats of mergers and acquisitions".

The low significance of these risks is primarily due to the fact that despite the decline in prices for some metals on the world market (for example, copper), the modern world's heavy and knowledge-intensive industry remains a stable consumer of Kazakhstan's ferrous and non-ferrous metals. Therefore, some of these risks may be significant only in the short-term market period. In the medium and long term, demand remains constant and the consequences of this group of risks are not significant for enterprises even when they occur.

The choice of management methods risks identified depends on the industry development trends, which are expected in the near future and from actors and stakeholders, whose influence is most significant in this sector of Kazakhstan's economy.

As a result of the survey, experts identified the most influential trends that show a consolidated, but technocratic model of the future of the industry (fig. 6). The leading trend that determines the development of the industry is considered to be automation of production processes (36.2% noted a dominant and 59% a strong influence).
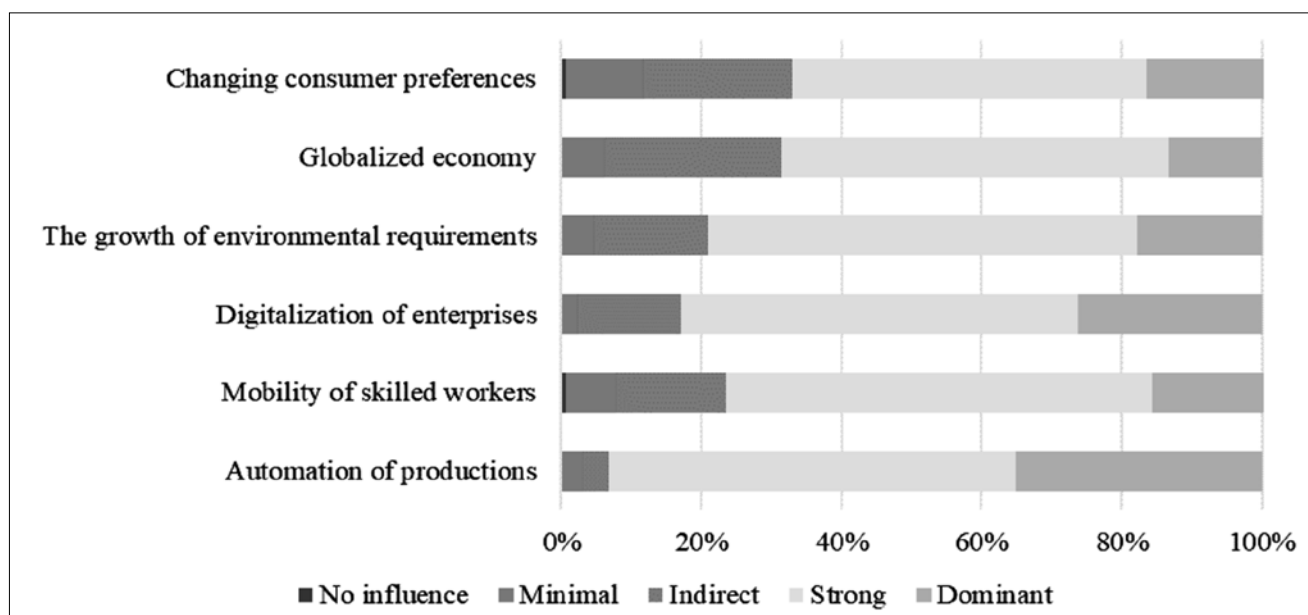

Figure 6. Assessment of the impact of major trends on the future of the mining and metallurgical industry

Source: compiled by the authors

Also revealed as the technocratic model of the future, according to experts, is the trend of "digitalization of production". Experts believe that the development of the industry will be ensured by the widespread introduction of machines and mechanisms, full automation, providing a deserted production based on the use of digital data transfer technologies, up to the use of artificial intelligence.

Experts indicate, although they underestimate, a possible change in consumer demand. The development of technologies will take place in all spheres of human activity and it is possible to completely or partially replace one type of raw material with another. The economic forecast presented by the group of experts is marked as moderately influential.

Ecology is an accompanying but mandatory part of the development of MMC. The growth of requirements for environmental friendliness of production is a global trend that Kazakh experts could not ignore. Almost 80% of responses consider this trend very strong and important.

The noted vision of industry trends and the probability of risks for experts will be implemented by them with varying degrees of activity. In many ways, the participation of experts in building the desired future of the industry depends on how much they themselves position influence on the development of the industry. The survey of experts allowed to determine the strength and possibility of influence of the main stakeholders of the mining and metallurgical industry of Kazakhstan (fig. 7).
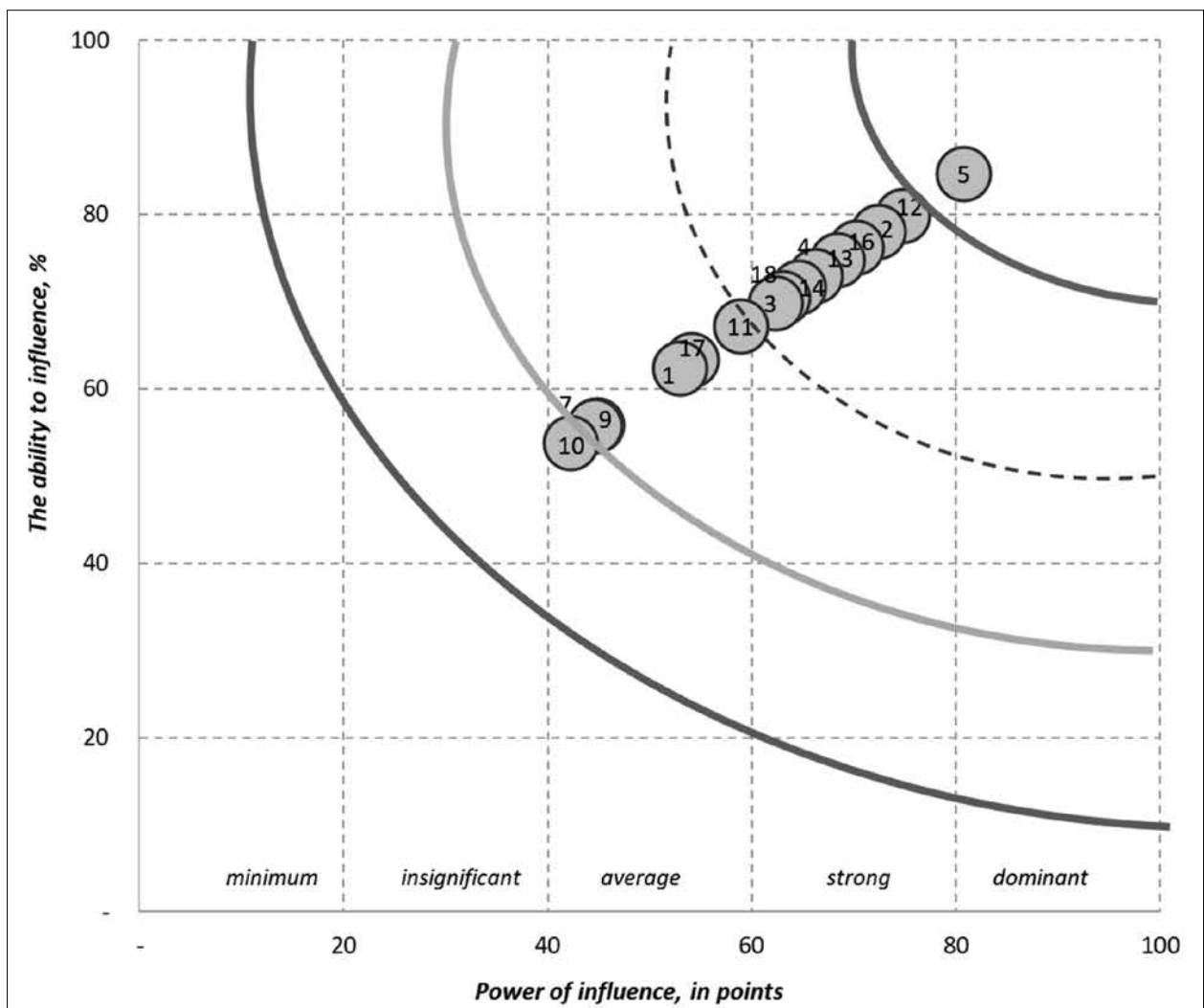

Figure 7. Assessing the impact of stakeholders on the future of the mining and metallurgical industry

Source: compiled by the authors

According to the experts' responses, the dominant influence on the future of the industry has: owners and shareholders (5 in Fig. 7) who determine the strategic direction of development of mining and metallurgical companies.

In the area of strong influence fall Top-managers (residents) (12 in Fig. 7) - given that Kazakhstan in 2020 ranked 25th out of 190 countries in the Ease of Doing Business Index, this assessment is reasonable. The influence of the government of Kazakhstan is in third place (2). next in the group of strong influence are the stakeholders (in order of decreasing strength and possibility of influence):

16-production personnel (production specialists),

13-Top-managers (expat),

4-multinational companies (transnational corporations),

14-functional management,

18-workers,

3-branch ministry.

The following stakeholders are included in the zone of average influence (in order of decreasing power and possibility of influence):

11-banks and credit institutions (Investments),

17-support staff,

1-international organizations,

9-universities, colleges, secondary educational institutions,

7-local executive authority,

10-educational and R&D centers,

6-trade unions and industry associations,

8-local community (population in the regions where the Company operates).

Experts attributed little influence on the industry to foreign labor (15) and public organizations (19).

Thus, in order to adequately account for real and potential risks, it is necessary to actively cooperate with the owners and Top management of enterprises with the active support of the government of Kazakhstan in terms of strategic determination of the future of the industry and the introduction of educational programs for training industry specialists. It is also necessary to increase the involvement of specialists and emphasize their leading role in the development of future competencies.

Conclusions (the future of the industry)

The mining and metallurgical industry of Kazakhstan has a number of favorable conditions for the successful development of the industry in the long term, including the following:

- transport and geographical location of enterprises and access to world markets (the proximity of the Republic to South-East Asia and Russia, large exporting enterprises also have extensive access to the EU and US markets);

- availability of energy resources and its own raw material base, represented by ferrous and non-ferrous metals, coking coals, rare, rare earth, radioactive and noble metals;

- availability of a powerful production base and developed infrastructure of enterprises with specialized research centers (factory laboratories);

- external investment attractiveness of the industry;

- the existing raw material orientation of the economy in the absence of any alterations.

However, there are a number of constraints that directly affect the pace of development of the industry. In the long term, the development of the metallurgical industry will mainly be characterized by the introduction of incremental (gradually increasing) innovations: improvement and development of already established technological processes in the medium term will increase productivity, reduce material consumption, increase the range and quality of products, as well as reduce the burden on the environment and introduce new labor safety

standards and organize "lean production". It is extremely important to pay attention to energy-saving and resource-saving technologies, to introduce technologies aimed at processing accumulated in large volumes of solid man-made waste in the industry. Radical innovations (in this case, they can include the creation of new directions in the metallurgy of Kazakhstan, as well as the organization of the industry itself) will significantly strengthen the position of the Republic as an exporter of high-tech products and technologies.

The main risks for Kazakhstan's mining and metallurgical enterprises are the lack or shortage of local labor and its low skills. These same risks are included in the Top 10 risks of the global mining and industrial complex. Given that the leading trends in the industry in Kazakhstan are defined as automation of production processes and digitalization of production, the issue of the quality of training and possession of the necessary competencies of the workforce is a real threat to the development of the industry.

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