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The Mining and Metallurgical Industry of Kazakhstan: Current State of Problems, and Strategic Development Priorities

Rashit S. Karenov[a], Yerkenazym D. Orynbassarova[b], Yekaterina B. Romanko[a] and Turlybek B. Kazbekov[a]

[a] E. A. Buketov Karaganda State University, Karaganda, KAZAKHSTAN;
[b]Karaganda Economic University, Karaganda, KAZAKHSTAN.

ABSTRACT

The sustainable growth of the mining and metallurgical industry and its integration into the world economy becomes relevant in the context of Kazakhstan's competitive position in terms of mineral raw materials reserves and production thereof. The goal of the research is to analyze the current state of Kazakhstan's mining and metallurgical complex, identify its problems, and formulate strategic priorities for the development of the complex in modern conditions. The article provides a detailed analysis of the current state of the large vertically integrated companies of the mining and metallurgical industry of Kazakhstan. It was concluded that integrated multinational companies and industry associations have proven their effectiveness on the global market; moreover, they made a considerable contribution to the economy of the country. The SWOT analysis of the mining and metallurgical industry showed that the main problems and threats for the development of the national mining industry came from external circumstances, global trends, and internal conditions. The prospects for the mining and metallurgical industry and the main strategic background for its long-term development on the domestic and foreign markets were identified.

KEYWORDS
Mining & metallurgical industry; primary metals; SWOT analysis; problems & threats; modernization

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Introduction

Different areas of the world economy demonstrate a trend of consolidation and globalization of production. The world experience shows that the only way to create competitive industrial structures is to concentrate capital and production capacities and to integrate them vertically. This integration improves production efficiency by reducing transaction costs and indirect taxation of intermediate products.

In the late twentieth century, countries with market economies experienced a growth in steel consumption and innovative restructuring of the mining

CORRESPONDENCE Yerkenazym D. Orynbassarova ✉ erke.08@mail.ru

industry. This laid the foundation for the reduction of production capacity in steel manufacturing and the construction of new compact plants for processing final products with high added value (Yellishatty et al., 2011). The impetus for this was the desire of industrialized countries to achieve cleaner production (Baines et al., 2012). It caused a relative decline in steel production in developed countries in the second half of the twentieth century and contributed to the growth of its import from developing countries (Ernst & Young, 2014).

The decrease in the share of the metallurgical industry in the national output of developed countries led to the growth of metallurgical production in developing countries (EUROFER, 2014). In developing countries, metallurgical production was built mainly on a new technological basis; it had a progressive structure of production and corresponded with global development trends.

Statistical data show that China is world leader in the production and consumption of steel. In 1996, China produced almost 130 million tons of steel; in 2014, this figure exceeded 700 million tons (Horvath, 2012; Li, Jian & Jiang, 2012). The annual growth of steel production ranged from 2.1 to 26.8% on average in 2000-2011. These growth rates of steel production in China were caused by the launch of modern steel-producing facilities, which accounted for about 700-730 million tons of steel per annum ('China Iron and Steel Association', 2013).

This was more than Chinese companies could actually sell. However, the Chinese government does not plan to cease the construction of new facilities. On the contrary, in 2010, it approved the construction of a plant with a total capacity of 10 million tons of steel per annum in the Guangdong Province, which was built by the Baosteel company, and in the Guangxi Province, which was built by the WISCO company. The Baosteel, WISCO, and Angang companies combined plan to produce a total of 60 million tons of steel per annum in 2015-2016 (Wang, 2012; Bloomberg, 2015).

The mining and metallurgical industry (MMI) is one of the most important industries of any country, because of its high level of capital concentration and business integration. During the last 30 years, the volume of world mineral production has increased by more than 1.5 times; it is expected to exceed 25 billion tenge by 2050 (Galiyev & Yusupova, 2013).

The effectiveness of the MMI is very important for Kazakhstan. At present, Kazakhstan is the leader in terms of both mineral raw material reserves and its production volumes. In these circumstances, ensuring sustainable growth of the industry and its integration into the world economy is crucial.

Therefore, it is necessary to analyze the current state, identify the problems, and formulate strategic priorities for the development of the mining and metallurgical industry of Kazakhstan.

Literature Review

Current studies of the theoretical and practical aspects show the main problems of and prospects for the development metallurgy and aim to design a rational way of its development. The theoretical and practical aspects were presented in the works of many contemporary scientists, experts, and analysts (Evans, 2014; Bartelsman, Haltiwanger & Scarpetta, 2009; Sekiguchi, 2015). The current situation emphasizes the importance of solving the problem of long-term operation and development (OECD, 1998), meeting the need for innovation, and making new scientific and technological developments in the metallurgical

industry (Mittal, 2013), which can only be achieved via combined strategic actions at both the industrial and state levels (Thomas, Birat & Carvallo, 2013).

The economic substantiation and benefits for the development of the competitive advantages of Kazakhstan's metallurgy are very important. In particular, comprehensive and detailed analyses of demand and the economic aspects of production at metallurgical companies, which were presented in many studies (Hasanbeigi et al, 2013), are important for investigating ways to improve the efficiency and certain types of products (Yellishatty et al., 2011). The essential problem is the determination of priority directions for development of Kazakhstan's metallurgical companies at the current stage, measures for their comprehensive restructuring on the basis of progressive world experience, which will contribute to their growth and reduce the energy intensity of production, which is important in both theoretical and practical aspects.

Materials and Methods

This research used theoretical, general scientific, and special methods:

- historical and logical methods to analyze the current trends in the development of the metallurgical industry of Kazakhstan;
- marketing analysis, SWOT analysis, in particular, to analyze the competitive positions, strengths, and weaknesses of the national metallurgical industry;
- qualitative and quantitative comparisons to analyze the indicators that influence mining and metallurgical multinational companies and to determine the extent of the structural factors' impact on innovation and the competitive position of mining companies;
- theoretical modeling and planning to determine the priority areas for enhancing the competitive position of mining companies in Kazakhstan.

Methods of economic and statistical analysis were used to investigate the current state of metallurgical companies, to determine the trends in and features of the restructuring of said companies at the current stage of development of the market economy in Kazakhstan.

This research used the experience of the other studies that identified the characteristics of company restructuring in developed countries. The research was based on the statistical data and analytical reports of international organizations, such as World Steel, World Coal, World Steel Dynamics, Eurofer, AISI, CISI, SEAISI, and the aggregated data on the mining and metallurgical industry of Kazakhstan.

The purpose of the research is to analyze the current state of Kazakhstan's mining and metallurgical industry, identify its problems, and formulate the strategic priorities for the development of the industry in modern conditions.

Results

Despite the consequences of the world economic crisis and decline of the regional metal product markets, the output of new high-tech products in the world metallurgical industry continues (OECD, 2013), with the main investors being the leading companies of the developed countries.

Therefore, in the med-term perspective, the place of domestic metallurgy on the regional metal product markets will depend on the chosen model of its further development.

Global trends may objectively lead to a significant reduction of manufacturing and export of finished steel to the main regional markets (Sang-Heon, Hansoo & Nack, 2015), leaving the manufacturing and export of only semi-finished products. In turn, the reduction of the manufacturing and export of metal products can cause a decline in the development of the domestic metallurgical industry and become one of the most important stages of the economic crisis. This will objectively reduce the inflow of foreign currency, investments manufacturing in related branches of economy, increase the level of unemployment, and deteriorate the economic situation in the development of settlements, where metallurgic manufacturing is of city-forming importance.

In Kazakhstan, the formation of modern mining and metallurgical corporations took place mainly in 1993-1999, i.e. in the declining conditions of manufacturing, sluggish foreign economic activity, shortage of investments, and other destabilizing factors. Changes in the output of main ferrous, precious, and nonferrous metals in 2010-2014 indicates that the economic situation in the mining and metallurgical industry is currently stable (Table 1).

In 2014, mining of iron ore increased by 2.7%, chromium – by 6.3%, refined silver – by 79.2%, gold – by 99.3%, untreated lead and zinc – by 22.9 and 1.9%, respectively, when compared with 2010.

Mining of manganese ore during the period under consideration decreased by 14.3%, untreated aluminum – by 12.8%, and unprocessed refined copper – by 8.8%.

The metallurgy of Kazakhstan has a unique raw material base; the Republic of Kazakhstan is a region with a strongly developed nonferrous metallurgy. In terms of the technologies in use, raw material complexity, quality and quantity of manufactured products, the main nonferrous metal companies of Kazakhstan are on par with their leading foreign counterparts.

Ferrous metal companies of Kazakhstan specialize in manufacturing merchantable iron and chromium, ferroalloys, finished steel, and ferrous metals. The structure of this sub-sector is dominated by ferrous metal production (more than 60%), mining and enrichment of crude ore (about 25%), and ferroalloy production.

According to specialists (Mukanov, 2005), 90 of the 200 biggest companies in the world are related to mineral resources. They account for 80% of the total volume of sold products among the participants of the rating. Thirteen companies of the Republic of Kazakhstan are among the largest manufacturers of mineral resources for the ferrous and nonferrous metallurgy in the world.

Table 1. Dynamics of metallurgical production in the Republic of Kazakhstan

Production	Year					2014 versus
	2010	2011	2012	2013	2014	2010, %
Metallurgical industry						
Foundry pig iron or spiegeleisen bars, cast iron or other primary metals	2893.9	3141.1	2707.0	2634.5	3184.8	110.1
Unrefined steel	4344.8	4811.5	3775.8	3503.4	4014.9	92.4
Ferroalloys	1701.8	1668.7	1724.0	1706.9	1715.1	100.8
Ferrous metal production						
Iron ore	50189.7	51742.0	52613.6	51688.6	51540.8	102.7
Manganese ore	3044.7	2963.0	2975.0	2850.5	2608.8	85.7
Chromium	5091.7	5059.0	5233.1	5255.1	5410.7	106.3
Chromium concentrates	3502.1	3670.0	3945.6	4192.7	4475.7	127.8
Nonferrous metal production						
Refined silver, t	549.0	646.7	958.5	958.3	983.7	179.2
Fine gold, t	13.5	16.7	21.1	23.2	26.9	199.3
Raw aluminum: aluminum oxide	1867.3	1919.2	1760.4	1840.2	1628.3	87.2
Raw lead	103.4	111.5	88.1	91.1	127.1	122.9
Raw zinc	318.9	319.8	319.8	320.2	325.0	101.9
Raw refined copper, unalloyed	323.4	338.5	367.2	352.1	294.8	91.2

Source: data provided by the Statistics Committee of the Republic of Kazakhstan

Table 2 shows the information about the leading companies in Kazakhstan, which operate in the mining and metallurgy sectors. At present, the basis of the mining and metallurgical industry (MMI) of the Republic of Kazakhstan comprises of vertically integrated large companies. They are created on the basis of mining, enrichment, and metallurgic companies with common technological cycles, ranging from mining companies to those that deal with metal, electricity, and related aspects of production: ENRC LLP, Kazakhmys Corporation LLP, ArcelorMittal Temirtau JSC, Kazzinc JSC, and Kazatomprom JSC.

Table 2. The most important companies of Kazakhstan engaged in ore mining and metallurgy

№	Company name	Area of activity
1	ENRG	Ferroalloys, iron ore, aluminum
2	Kazakhmys LLP	Nonferrous metallurgy
3	ArcelorMittal Termitau JSC	Iron and steel
4	Kazzinc JSC	Nonferrous metallurgy
5	Kaztomprom JSC	Uranium mining, rare-earth elements, solar energy
6	Kazphosphate LLP	Phosphate mining, fertilizer production
7	Bogatyr' Komir LLP	Coal mining
8	Aktobe copper company LLP	Nonferrous metallurgy
9	Inkai JV	Uranium mining
10	Copper Technology LLP	Development of copper-zinc deposits
11	Varvinskoe JSC	Gold mining
12	Ust-Kamenogorsk Titanium-Magnesium Factory JSC	Nonferrous metallurgy
13	Aktobe Chromium Compounds Factory JSC	Nonferrous metallurgy
14	JV Akbastau JSC	Uranium mining

Table 2 (*Continued*)

15	MMC Kazakhaltyn JSC	Gold mining
16	FIC Alel JSC	Gold mining
17	JV Zarechnoe JSC	Uranium mining
18	Karazhyra Ltd. LLP	Coal mining
19	Stepnogorsk Mining & Chemical Factory	Uranium mining
20	ACIE Gefest MC	Coal mining
21	Voskhod Chrome LLP	Chromium enrichment
22	Geoinvest JSC	Mining and Metallurgical complex
23	Kameks LLP	Gold mining
24	Kostanai Minerals JSC	Chrysolite mining
25	Angrensor LLP, Gamma LLP	Coal mining
26	SAT&Company JSC	Mining company holding; ferromanganese and carbide lime production; chromium and nickel mining
27	Yubileynoe LLP	Gold mining
28	Kyzylkukum LLP	Uranium mining
29	Central Asia Mining LLP	Gold mining
30	Nonferrous Metal Processing Plant» (NMPP) JSC	Nonferrous metallurgy
31	Vostochnoe Rudoupravlenie LLP	Barite mining
32	JV Rusburmash-Kazakhstan LLP	Drilling operations at uranium mining companies
33	KSPSteel LLP	Steel pipe manufacturing
34	Traz Metallurgical Factory	Ferroalloy production
35	Ulba Metallurgical Factory	Uranium, beryllium, tantalum

Source: national business publications data, research of the German Trade EInvest company, Ministry of Foreign Affairs in Berlin

Brief characteristics of the five biggest companies in the Republic Kazakhstan

I. Eurasian Natural Resources Corporation (ENRC).

The Eurasian Natural Resources Corporation (ENRC) holding company is a leader in the raw ore mining and metallurgy sectors of Kazakhstan. It is a diversified group of the companies in the field of mineral resource mining and processing, with integrated mining, processing, energy, and logistics companies. The six manufacturing ENRC subdivisions produce high-, medium-, and low-carbon ferrochrome, ferrosilicon manganese and ferrosilicium, chromium and manganese concentrates, iron ore concentrates and pellets, alumina and aluminum. All these products are in demand on both domestic and global markets ('Kazakhstan truth', 2012).

The big project of the ENRC resource holding company in Kazakhstan is the construction of a factory that specializes in high-quality iron ore concentrate, iron ore pellets, and sponge iron (hot briquetted iron, HBI). According to company data, the cost of the project is $1.8 billion. The facility is expected to launch in 2018-2019 (Hartlib, 2014).

The second-most important activity of the company is iron ore mining. This business segment is managed by the affiliated branch of the holding – Socolovsko-Serbayskoe Mining and Enrichment Production Association (SSNDPA), which is based in the Kostanay Region. The plan is for the SSNDPA to implement such strategic projects as the construction of an enrichment complex for high-quality concentrate with seven million tons per annum capacity, roasting machine with five million tons per annum capacity, and a metallized product plant with 1.8

million tons per annum capacity. The launch of the plant will allow the SSNDPA to reach a new level of development. This is shown by a simple comparison: at present, the enterprise manufactures goods with 63% iron content, while the new facilities will increase this index to 93-94%.

In general, the energy subdivision of ENRC is one of the biggest power suppliers in Kazakhstan. It accounts for about 16.3% of electric power in the country.

II. "Kazakhmys" company.

Most of the copper reserves (A+B+C1 category) in Kazakhstan are distributed between Kazakhmys Corporation LLP (79%), Koksay-Muzbel LLP (6.4%), Kazzinc LPP (3.8%), and Copper Technology LLP (3%).

Nowadays 39 objects are engaged in subsurface copper management, 13 of which are engaged in mining, eight – is exploring, and 18 – in combined exploring and mining (Dzhantureeva, 2013).

The Kazakhmys company manufactures zinc, silver, and gold as a spin-off product. The company uses 16 copper mines (15 of which are underground), 10 enrichment factories in four districts, two copper smelting plants, and a precious metal plant. In addition, the company has two coal-mining facilities and three coal power stations (Hartlib, 2014).

The Bozshakolskiy Minning and Enrichment complex (MEC) has been under construction since 2012. In near future, the preliminary crushing facility, which can load an entire freight train with ore in one hour, will be tested. This facility will produce up to 100 thousand tons of copper in cathode equivalent per annum; the service life of the mine is 40 years (Levine, 2015).

In terms of the scale and volume of ore mining, Bozshokal MEC is unique for CIS states. Bozshokal is a modern world-class mining and enrichment complex.

III. ArcelorMittal Temirtau Company (AMT).

The AMT company has eight coal companies in the Karaganda Region and four iron ore companies in the Karaganda, Akmola, and Kostanay Regions. Its subsidiary company Orken is responsible for iron ore mining. The biggest deposit is the Lisakovskoe deposit, which is developed by the Lisakovskiy Mining and Enrichment Factory.

Nowadays, ArcelorMittal Temirtau JSC mostly produces the following goods (Mukanov, 2005):

- hot-rolled steel in sheets 1.6-12 mm thick and 850-1524 mm wide;
- cold-rolled steel in sheets and rolls 0.36-2.0 mm thick and 860-1400 mm wide;
- tin, white and black, in sheets and rolls 0.20-0.36 mm thick;
- cold-rolled steel with zinc and aluminum-zinc coating 0.4-2.0 mm thick and 750-1400 mm wide;
- electro-welded pipes;
- rolled slabs;
- coke chemistry products – ammonium sulfate, naphthalene, benzene, toluene, pitch, etc.
- trade cast iron;
- blast-furnace slag recycling products for the cement industry and road construction.

When analyzing the scientific and manufacturing activity of a company, it is necessary to take into consideration the complex mineralogical and physicochemical composition of the iron raw materials in use. This is the reason behind very high, when compared with related enterprises, unit costs of fuel and material resources, which result in low technical and economic indicators, considerable emissions into the environment, and a large volume of solid waste.

IV. Kazzinc Company.

Kazzinc JSC is a big integrated manufacturer of zinc with a large share of accompanying production of copper, precious metals, and lead. All facilities of the company are located in five towns in Kazakhstan (Mukanov, 2005).

The main projects of this company include the launch of a copper smelting plant and the reconstruction of an electrolysis plant, which allowed balancing the metallurgic manufacturing of the company with the ore base, processing the company's own copper concentrates generated during ore enrichment, and producing cathode copper – a product with high added value. The project made Kazzinc a unique company in terms of complexity of component extraction from raw materials – zinc, lead, copper, platinum, gold, silver, cadmium, indium, thallium, selenium, tellurium, bismuth, sulfur, antimony of mercury, and palladium – 16 metals in total (Shevchenko, 2012).

The "New Metallurgy" project became a center of cutting-edge technologies in both productions of goods and environmental protection systems.

V. Kazatomprom Company.

At present, Kazatomprom JSC is the biggest manufacturer of uranium in the world. However, the oncoming problems related to the deficit of natural uranium, conversion and enrichment services, production of fuel assemblies, and working capacities in the construction of safe nuclear power plants cannot be solved by one country. Nowadays, there is a sustainable integration at all stages of the nuclear fuel cycle, starting from the mining of natural uranium. This is understandable, because such high-technological segments of the nuclear fuel cycle as uranium enrichment, production of nuclear fuel, recycling of waste, and production of mixed uranium-plutonium fuel are the prerogative of a relatively small number of specialized companies from only a few countries. Only a few companies nowadays can create and operate a full nuclear fuel cycle. This implies real premises for the organization of large-scale international nuclear fuel companies (Kumekov & Alinov, 2012).

Based on this important trend, Kazatomprom signed agreements on the creation of conversion, enrichment, and assembly production with the leading players on the world nuclear power market, thus completing the formation of a transnational vertically integrated company.

In recent years, it has become necessary to increase significantly the volume of mining and enrichment of rare-earth elements. To that end, the Kazatomprom company founded a joint venture with the Japanese company Japanese Sumitomo Corporation – Sareco. In December 2012, the Kazatomprom company owned 51% of the shares, while the Japanese company owned 49%. Sareco finished the construction of a factory that cost $30 million with 1500 t annual capacity. It is expected that the production capacity may be increased to 5000-6000 t by 2017. Rare raw material will be mined from solid dumps and chemical industry waste.

Heavy rare earths account for about 40% of production. The target market of these goods is Japan (Hartlib, 2014).

Further transition to high limits on the basis of international cooperation increases the chances Kazatomprom of making a technological breakthrough and taking its place on the world market of nuclear fuel providers and high-tech uranium goods manufacturers.

The above analysis shows that transnational MMI companies and integrated industrial joint ventures created in Kazakhstan have proven their effectiveness on the global market and made a considerable contribution to the economy of the country.

SWOT analysis

In order to compile a real analytical picture of the state and prospects of Kazakhstan's domestic metallurgical industry, it is necessary to use a method for assessing strengths (advantages), weaknesses, opportunities, and threats that are related to the industry in general. Businesses use SWOT analysis for strategic planning purposes and for the assessment of the specific characteristics of the system and its environment (Vinokurov, 1996; Sirs, 2002; Gaponenko & Pankrukhin, 2008).

The SWOT analysis technology implies the compilation of a matrix, which is presented in Figure 1.

The strengths of an organization (sector) imply everything that gives it an advantage over competitors. The strengths are as follows: good competence, sufficient financial resources, perfect technology, good management, high work ethics, skilled management team, high-quality control system of goods and processes, etc. The most important strengths are those that give the organization (sector) a long-term breakaway from competitors, i.e. something they cannot replicate or something that is related to "exclusive superiority".

The weaknesses of an organization (sector) is what prevents it from having an advantage over competitors. The weaknesses are as follows: outdated equipment, high manufacturing costs, lack of precise development strategies, lack of financial or other resources, outdated organizational structure, poor understanding of the market, etc.

	Opportunities	Threats
	1. access to new markets 2. extension of production 3.	1. emergence of new competitors 2. market growth deceleration 3.
Strengths 1. project portfolio 2. perfect technology 3.	I Strength and Possibility SAP Field	II Strength and Threats SAT Field
Weaknesses 1. lack of current assets 2. loss of skilled personnel 3.	III Weakness and Possibilities WAP Field	IV Weakness and Threats WAT Field

Figure 1. SWOT matrix. (Source: Karenov, R., 2006.)

The development of the strategy should rely on the strong strengths of the company (sector) and minimize the impact of weaknesses.

The top of the matrix has two sections (Opportunities and Threats), which include all the opportunities and threats, respectively (Karenov, 2006).

The current state and prospects of development of the domestic MMI can be visualized accurately based on the SWOT analysis made by the experts of the Kazakhstan Industry Development Institute (Table 3).

The strength of Kazakhstan's MMI is its own mineral raw base and the fact that its potential has formed for decades, during which a developed infrastructure has been created and experience manufacturing and technological experience has been gained. Nowadays, it is a complex of large manufacturing, mining, and enrichment factories, mines, metallurgical plants and grounds, research centers, institutes, and laboratories. The other opportunity stems from the common borders of the Republic of Kazakhstan and countries with big markets. Another strength is the growing technologic need for metals and metal products.

The weaknesses of the sector are related to the poor quality and low complexity of mineral raw materials, high prime cost of MMI products due to low work efficiency and energy efficiency, poor equipment of production with progressive innovations.

Another weakness is related to the lack of necessary qualified young personnel of a various levels and scientific and technical specialization, pre-retirement and retirement age of most experienced mining and metallurgy specialists.

A serious weakness of the MMI is its dependence on imported technologies and foreign trade markets, weak connection between science and manufacturing, and a transport infrastructure that is poorly adapted to the structure of the mineral raw material base.

The impact of weaknesses can be reduced noticeably through legislative and legal support of the update of the active part of main manufacturing assets, diversification of manufacturing towards obtaining finished products with high added value, intensifications of modern scientific and technological developments, and adoption of measures for stimulating the inflow of young specialists.

Problems of and threats to the development of the domestic mining and metallurgical industry are caused by external circumstances, global trends, and internal circumstances.

A serious problem of MMI development is the reduction of output due to outdated assets, non-conformity of technologies and equipment of companies to the processing of complex ores. The scientific, technological, and technical delay us caused by insufficient funding of R&D in recent years. This causes substantial losses of the main and related product at the stage of enrichment and metal conversion, which leads to accumulation of metal in mill tailings, slags, clinker, filter cakes, fines, and other middlings. This exhausts irreplaceable raw minerals reserves and has a negative impact on the environment.

Table 3. SWOT analysis of the state of the mining and metallurgical industry in Kazakhstan

	Positive factors (SAP Field)	Negative factors (SAT Field)	
Strengths	– abundance of mineral and raw materials – developed manufacturing infrastructure and personnel potential – large branch centers and research institutes, national and university engineering laboratories – leading metal mining and manufacturing companies that have access to the world markets – common borders with countries that have big markets – considerable and sustainable growth of metal and metal product prices on the foreign markets – growing technological need for metal and metal products	– poor quality and low complexity of mineral raw materials – problems with small and medium-sized business in terms of certain strategic types of metal – high prime cost of MMI products due to of low production and energy efficiency – poor equipment of production using innovations – low limits and high dependence on imported technologies, foreign markets, and investors – weak connection of science and manufacturing, low innovative activity of companies – flawed legal and regulatory framework – transport infrastructure that is poorly adapted to the small and medium-sized business structure – poor engineering, technical, and management potential at all levels of the MMI	Weaknesses
S	WAP Field	WAT Field	W
Opportunities	– increase in MMI efficiency and stability through the creation of an adequate experimental base with the current technical and technological manufacturing equipment – development of the transport infrastructure for the development of discovered deposits – further exploration of promising and important strategic deposits using innovations – exploration of manmade mineral formations – use of industry-specific technological parks and free economic zones	– reducing output of the MMI due to considerable wear and active high loading of technological equipment – exhaustion of reserves in developed deposits – collapse of metal and metal product prices due to the world crises – high competition on the part of Russia side and Southeastern Asian countries on the world metal markets – economic tension caused by disproportional remuneration – growing number of non-resident owners of strategic MMI companies	Threats
O			T

Source: S. Galiyev & L. Yusupova, 2013.

The main threat comes from the fact that by Kazakhstan the WTO in the current situation, Kazakhstan may become raw material "appendage" for the world economy of secondary raw materials. Furthermore, the global financial crisis may cause an abrupt drop in prices on different metals and metal products.

A number of factors can form internal problems and threats:

- failure to discover new competitive zinc, copper, and lead deposits during 5-10 years;

- critical delay in realization on the part of the society and public authorities the necessity of taking careful steps towards the transition to strategic governmental regulation of the industry;
- incomplete and inconsistent open reliable information about the industry when making radical decisions;
- loss of acquired knowledge and technological experience senior specialists.

One of the basic conditions for the sustainable development of the high-tech mining complex should be the integrated role of all its components in terms of goals and tasks.

The structure of such a complex should include the following components (Galiyev & Yusupova, 2013):

1. Scientific unit, which includes all the scientific organizations, design department, higher educational institutions, scientific subdivisions of companies, design and design-and-survey organizations, experimental factories for fundamental and applied studies.

2. Scientific and production unit – corporations and companies that make scientific products (percentage of expenses on R&D in the annual added value exceeds the medium or certain level established for the industry).

3. Educational unit – high, secondary, and vocational educational institutions, management training and retraining centers (including management of innovation and innovative companies).

4. Infrastructural unit – technological innovative parks, non-budgetary R&D funds, innovative venture funds, leasing companies, business assistance funds for small and medium-sized business, and other organizational elements of said infrastructure.

5. Management unit – ministries and departments, management structures (at the national and regional levels) that supervise mining branches and ensure the functioning and development of export trading companies.

6. Social block – social security services that allow maintaining and enriching the intellectual and personnel potential of export trading companies.

Consistent work of the government, society, and business on the harmonization of all said components is essential. Without such work, the modernization of the mining complex can hardly expect to be successful.

At the legislative and government regulation level, essential conditions for achieving long-term sustainable development include appropriate laws, regulatory acts, and governmental standards. Following problems currently exist in this field (Galiyev & Yusupova, 2013):

- fragmentation of regulation, numerous regulatory legal acts, lack of direct action of laws;
- combined regulation of raw hydrocarbon deposits and solid minerals by one law;
- absence of regulation on issues related to the proceeding of mineral raw materials;
- lack of translation of national laws (English and other languages);

- inconsistency between specific legislative provisions and the world practice (terms of ownership document registration, access to geological information, procedure for granting rights to subsurface resource management, etc.).

The priority measures aimed at solving these problems should bring the legislative regulation system of the mining sector in compliance with the international practice, i.e. develop a Code "On Subsurface Resources and Processing of Raw Materials", cut the number of licensing procedures, elimination administrative barriers for business, and simplify access of investors to geological information and the procedure for granting rights to geological exploration.

Discussions

Unlike other developed and developing countries (Conseil, 2013; Sanderson, 2015), Kazakhstan did not build technologically new enterprises in the metallurgy sector. Companies simply carried selective modernization, aimed not so much at improving rolling production and manufacturing complex and high-quality finished steel as at replacing outdated equipment to reduce the raw material and energy components in the structure of product costs (Horvath, 2015). At that, the modernization based on domestic equipment and domestic technological inventions, which, despite relatively low costs, are less effective when compared with foreign counterparts.

This resulted in most domestic mining and metallurgical companies having significantly outdated equipment (50-85%), low operating efficiency, high level of material and energy consumption of manufacturing, and widely using open-hearth steelmaking, which virtually not used anywhere else in the world.

Despite the outdated technological and technical infrastructure, the products of domestic exporters are competitive (under certain competitive advantages, their quality is on par with similar products of leading world exporters) and are sold at various markets.

The main trend in the foreign metallurgical market is consolidation, which always adhered to market laws: mergers, acquisitions, and alliances are made, with a view to cutting costs on scale, proximity to sales markets or raw material sources. The analysis showed that Kazakhstan is also experiencing considerable consolidation of assents in the metallurgical complex. At that, the process of consolidation and integration in and of itself is not the goal, but merely a tool.

In order to maintain the competitive advantages of Kazakhstan's metallurgical complex and related expansion of domestic and foreign markets, it is important re-equip and reconstruct outdated facilities, cut all types of costs of production, and implement resource- and energy-saving technologies comprehensively. The concentration of capital is needed exactly for the above goals.

Nowadays, more than 80% of raw materials of the metallurgical industry (mainly low, i.e. energy-consuming products) are exported without being processed into highly technological products of the third process, which makes the industry highly dependable on the global business environment.

Therefore, Kazakhstan's industrial policy should stimulate interest of foreign investors in complex processing and development of all levels of raw mineral material conversion in the territory of Kazakhstan.

The possibilities for the development of the industry are primarily related to increasing the effectiveness and stability of the MMI by creating an appropriate experimental base, developing the transport infrastructure for the development of discovered mineral resource deposits, and further exploring strategically important mineral deposits using innovative technologies.

An important potential factor for the development of nonferrous metallurgy in the context of resource conservation is the extensive use of manmade sources and secondary raw materials. Such an approach, based on the transfer unused manmade objects (spoil dumps, tailings, etc.) to the government, strict licensing of activities on preparation, processing, and sale of scrap and waste of nonferrous metals, saves energy, and raw materials, increases the effectiveness of technological facilities, and reduces the harmful impact on the environment.

The prospects of the industry are also determined by the development of partnerships and cooperative relationships, and the formation of regional innovative clusters using industrial technological parks and free economic zones.

Conclusion

The contribution of this research to world science is the comprehensive investigation of the activities of the mining and metallurgical industry in a country in the context of its long-term development priorities and identification of problems that hinder this development. Special contribution to practice lies in the developed recommendations regarding the development of the mining and metallurgical industry of Kazakhstan in modern conditions.

The article provides a detailed analysis of the current state of the large vertically integrated companies of the mining and metallurgical industry of Kazakhstan. It was concluded that integrated multinational companies and industry associations have proven their effectiveness on the global market; moreover, they made a considerable contribution to the economy of the country. The SWOT analysis was used to determine the current state of the mining and metallurgical industry of the country. It showed that the main problems and threats for the development of the national mining industry came from external circumstances, global trends, and internal conditions. The prospects for the mining and metallurgical industry and the main strategic background for its long-term development on the domestic and foreign markets were identified.

It was shown that in order to maintain the competitive advantages of Kazakhstan's metallurgical complex and related expansion of domestic and foreign markets, it is important re-equip and reconstruct outdated facilities, cut all types of costs of production, and implement resource- and energy-saving technologies comprehensively.

The concentration of capital is very important for achieving the abovementioned goals. The main strategic directions for increasing the efficiency of Kazakhstan's metallurgical industry imply changing the "export-consumption"

ratio towards the increase in domestic consumption, introducing market consolidation, analyzing the feasibility of creating vertically integrated market structures, upgrading the technical and technological base, and implementing new technologies of raw material processing.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Rashit S. Karenov is a Doctor of Economics, Head of the Management Department, E. A. Buketov Karaganda State University, Karaganda, Kazakhstan.

Yerkenazym D. Orynbassarova is a PhD, Researcher of the Economics and Management Department, Karaganda Economic University, Karaganda, Kazakhstan.

Yekaterina B. Romanko is a PhD, Associate Professor of the Management Department, E. A. Buketov Karaganda State University, Karaganda, Kazakhstan.

Turlybek B. Kazbekov is a PhD, Associate Professor of the Management Department, E. A. Buketov Karaganda State University, Karaganda, Kazakhstan.

References

Baines, T., Brown, S., Benedettini, O. & Ball, P. (2012) Examining Green Production and Its Role within the Competitive Strategy of Manufacturers. *Journal of Industrial Engineering and Management, 5(1)*, 53-87.

Bartelsman, E., Haltiwanger, J., & Scarpetta, S. (2009) Measuring and Analyzing Cross-country Differences in Firm Dynamics. *National Bureau of Economic Research, 6(15),* 15–76:

Bloomberg, (2015) *Morgan Stanley Sees China Peak Steel Now as Goldman Differs*. Direct access: www.bloomberg.com/news/articles/2015-02-02/peak-steel-arrives-in-china-thisyear-morgan-stanley-predictsU21T

China Iron and Steel Association. (2013*) China Steel Yearbook*. Beijing: Metallurgy Industry Press, 586p.

Conseil, L. (2013) *The Determinants of Profitability of large Steel Companies*. Direct access: http://www.laplaceconseil.com/LaplaceConseil/htdocs/admin/upload//File/Steel%20competitivenessdeterminants.pdf

Dzhantureeva, E. (2013) Subsurface Resource Management in 2000-2012: Stocks, Production, Investments. *Kazakhstan, 3*, 36-42.

Ernst & Young. (2014) *Global steel 2014*. Direct access: http://www.ey.com/Publication/vwLUAssets-/EY_-_Global_steel_2014/$FILE/EY-Global-steel- 2014.pdf

EUROFER. (2014) *Steel Trade Policy Messages*. Direct access: http://www.eurofer.org/News-%26Media/Press%20releases.itpl

Evans, M. (2014) An alternative approach to estimating the parameters of a generalized Grey Verhulst model: An application to steel intensity of use in the UK. *Expert Systems with Applications, 4(4)*, 29-33.

Galiyev, S. & Yusupova, L. (2013) Sustainable development of the MMI. *Kazakhstan, 3*, 76-80.

Gaponenko, A. & Pankrukhin, A. (2008). *Strategic management*. Moscow: Omega. 464p.

Hartlib, P. (2014) Review of the market of mineral raw materials. *Glyukauf Mining Report, 4*, 25-28.

Hasanbeigi, A., Price, L., Chunxia, Z., Aden, N., Xiuping, L. & Fangqin, S. (2013) Comparison of iron and steel production energy use and energy intensity in China and the U.S. *Journal of Cleaner Production, 65*,108-119

Horvath, L. (2012) *World Steel Association – Steel Industry & En MS, Presentation to IIP En MS Shandong workshop*. Direct access: http://www.iipnetwork.org/EnMS_WSA_2012.pdf.

Horvath, L. (2015) *World Steel Association*. Direct access: http://www.worldsteel-.org/faq/about-steel.html

Karenov, R. (2006) *Strategic Management*. Karaganda: Vocational Education. 362p.

Kumekov, S. & Alinov, M. (2012) Nuclear power of Kazakhstan in the context of the new power-ecological strategy. *The Economist, 2*, 72-75.

Levine, R. M. (2015) Bozshakol. *Industrial Karaganda*, 20, 3-7.

Li, P., Jian, Z. & Jiang, F. (2012) Entry-exit, Competition and the Productivity of China's Industry. *Journal of Quantitative & Technical Economics, 9*, 3–21

Mittal, A. (2013). *CSR report Steel: stakeholder value at every stage*. Paris: Grand Duchy. 78p.

Mukanov, D. (2005*) Metallurgy of Kazakhstan*. Almaty: RGP "NTs KPMS RK". 290p.

OECD (1998) The situation in the East Asian steel industry. *Directorate for Science, Technology and Industry*, (98)7, 254-264.

OECD (2013) Improving Energy Efficiency in the Iron and Steel Sector. Paris, France. 232p.

Sanderson, H. (2015) *Concerns raised as China enters peak zone. Financial Times. Accessed online 2015-04-22* Direct access: http://www.ft.com/intl/cms/s/0/ea7af92e-b1e9-11e4-8396- 00144feab7-de.html#axzz3XsucnHWh

Sang-Heon, K., Hansoo, K. & Nack, J. K. (2015) Brittle intermetallic compound makes ultrastrong low-density steel with large ductility. *Nature*, *518*, 77–79.

Sekiguchi, N. (2015a) *The falling oil prices might affect steel demand*. Direct access: 21TUhttp://www.japanmetaldaily.com/metal/2015/steel_news_20150108_1.html

Shevchenko, V. (2012) The basis of sustainable development. *The Kazakhstan truth*, *1*, 4-5.

Sirs, A. (2002) *Strategic management*. Moscow: UNITY-DANA. 240p.

The Kazakhstan truth (2012), New boundaries of the mining and metallurgical giant. Almaty, 4p.

Thomas, J. S, Birat, J. P., Carvallo, A. (2013) A metrics for the sustainability value of steel, collogue. *Which transition for our societies*, *2,* 14-21.

Vinokurov, V. (1996) *The organization of strategic management at companies*. Moscow: Economics and Marketing Center. 160p.

Wang, L. (2012) Prediction of the Long-term Demand for Iron and Steel Resources in China. *Geology and exploration, 48*(6), 1129-1133.

Yellishatty, M., Mudd, G., Ranjith, A. & Tharumarajah, A. (2011) Environmental life-cycle comparisons of steel production and recycling: sustainability issues, problems and prospects. *Environmental science & policy, 14*, 650-663.