



Strategic management of the potash industry in Russia



D. Dmitrieva^a, A. Ilinova^{a,*}, A. Kraslawski^{b,c}

^a Organization and management department, Saint-Petersburg Mining University, Vasil'evsky Ostrov, 21 liniya 2, Saint-Petersburg 199106, Russia

^b LUT School of Business and Management, Lappeenranta University of Technology, P.O. Box 20, FI-53851 Lappeenranta, Finland

^c Faculty of Process and Environmental Engineering, Lodz University of Technology, ul. Wolczanska 213, 90-924 Lodz, Poland

ARTICLE INFO

Keywords:

Strategic management
Fertilizer
Phosphates
Potash
Nitrogen
Mining and chemical companies
Environmental turbulence
Fertilizer company
Industry characteristics
Analysis

ABSTRACT

Mineral resources and the mining industry play an important role in economic development of many countries. The unique Russian mineral raw material base – phosphate and potash ore reserves in the case under consideration in this work – allows domestic mining and chemical companies not only to meet domestic demand but also to act as significant players on a global scale. Russian fertilizer companies enjoy a significant share of the global fertilizer market and have considerable strategic and social importance to the national economy. The objective of this paper is to identify and adopt the most appropriate methods and tools applicable to the peculiarities of fertilizer market and industry, as well as its highly dynamic environment. The paper briefly reviews research of strategic management in industry. We analyzed the current state of the mineral fertilizers market, identified main development trends and presented the unique characteristics of fertilizer (mining and chemical) companies in an oligopolistic market. The paper presents characteristics of industry environment using Ansoff's environmental turbulence matrix to evaluate appropriate management response and highlights the key features of fertilizer companies' strategic management. We find the study of mineral assets, as well as event analysis to be the key elements in defining rather appropriate strategic responses of mineral fertilizer industry to its turbulent environment.

1. Introduction

The use of fertilizers increased vastly over the twentieth century, and fertilizer use is estimated to continue to grow also in the near future (Enger, 2010). The global scope of the fertilizers production industry means that global market is a competitive environment and its development, which currently ensures steady growth of demand for fertilizers, is subject to a number of macroeconomic factors. These factors include population growth, reduction in arable land per capita, growth of per capita GDP and greater purchasing power in developing countries, and increasing demand for alternative energy sources (biofuels) (Cherepovitsyn, 2012). For instance, global population has grown from 1 billion in 1800 to 7 billion in 2012. It is expected to keep growing, where estimates have put the total population at 8.4 billion by mid-2030, and 9.6 billion by mid-2050 (Population Reference Bureau 2016). The change in the use of agricultural land in recent years has been significant (from 0.69 ha in use per person in 1960 to 0.47 in 2015) and it is expected to be 0.19 ha in use per person in 2050 (Bruinsma, 2009). World GDP per capita has grown from 450 US dollars in 1960 to 10,000 US dollars in 2015 (World Development Indicators, 2016). Biofuels production based on agricultural commod-

ities increased more than fivefold from 2000 to 2015 (Food and Agriculture Organization of the United Nations, 2016). Limited supply caused by resource exhaustibility also influences the situation on the market.

Global consumption of fertilizers in the agricultural years (beginning of July–end of June) 2009–2016 is presented in Fig. 1. The dynamic growth of consumption of fertilizers is seen in all three segments. The greatest increase is observed for nitrogen fertilizers, which are the most commonly used fertilizer worldwide.

Table 1 presents main indicators of fertilizer market development for 2013 and 2017.

Fig. 1 shows that in the recent years the annual growth rate of fertilizer consumption has stabilized at 1–2%. The data in Table 1 show that, in the short term, a surplus of supply over demand is foreseen for all segments of the industry despite the attractive fundamentals. This oversupply is connected with production growth and active development of world production capacity. The most significant surplus is observed for potash fertilizers and the estimated surplus of supply over demand is expected to reach 30% of world production by 2017 where North America, Eastern Europe and Central Asia would account for 70% of world incremental potash supply between 2015 and 2020. For

* Corresponding author.

E-mail addresses: diana-dmitrieva@mail.ru (D. Dmitrieva), iljinovaaa@mail.ru (A. Ilinova).

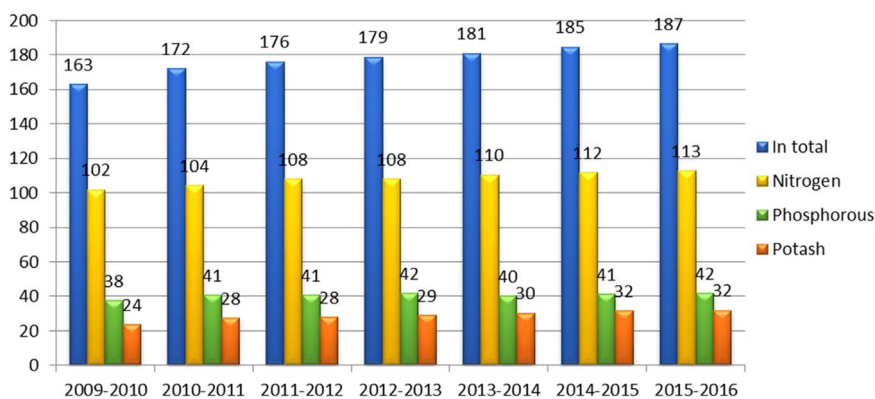


Fig. 1. Global consumption of fertilizers (agricultural years), million tonnes.

Table 1
Main indicators of fertilizer market development, million tonnes.

Indicator	Potash		Nitrogen		Phosphate	
	2013	2017F	2013	2017F	2013	2017F
World production capacities	49.7	59.6	173.5	199.5	54.6	63.7
World production	41.7	49.7	150.4	159.8	45.5	52
World consumption (including industrial)	32.7	34.7	141.5	154.2	42.1	46.5
Supply-demand balance and excess (% of supply)	9	15	8.9	5.6	3.4	5.5
	22%	30%	6%	4%	7%	11%

nitrogen fertilizer, overproduction is forecast to increase to 4% of production, and for phosphorus to 11%. However, the current recession is forcing many companies to postpone the increase the production capacity, thus slowing production growth. In consequence, the forecasts may overestimate market surplus.

The global fertilizers market significantly influences the development and prospects of many modern Russian mining and chemical industries, particularly integrated enterprises. The global fertilizers market is affected by many factors, for example (Ponomarenko, 2011):

1. The balance of supply and demand
2. The limited geographic accessibility of mineral resources (potash and phosphate ores);
3. The characteristics of arable farming, including different scales of agricultural activities in different countries and different levels of fertilizer consumption;
4. The concentration of industrial facilities near the sources of raw materials, market outlets and seaports;
5. Directions of agricultural policy in different countries;
6. Conditions for international agricultural trade, etc.

In addition, changes in prices for raw materials and energy have a significant impact on fertilizer prices. The geographical mismatch between production and consumption means that the fertilizer markets are international in nature and a significant share of the products is exported.

When considering the above factors, it should be mentioned that some of them affect the industry in a long-term or predictable way (such as growth in world population and the availability of various natural resources) whereas others can change dramatically, becoming weaker or stronger or even changing direction (for example, agricultural policy or regulation of foreign and domestic trade). The complexity of the interaction of these and other dynamic and multidirectional factors generates turbulence in the external environment and poses challenges for strategic decision-making in integrated mining and

chemical companies. Environmental turbulence (Bruno, 2015) should be understood as “a measure of the degree of changeability and predictability of the companies’ environment” (Ansoff, 1993). The faster the changes occur, the higher the degree of turbulence.

However, the competitive advantages of Russian manufacturers, which are largely resource-based, can be partially or completely lost as a result of changes in the industry environment. Growing price competition in the fertilizer market, increasing levels of dynamism of the external environment and greater volatility of global markets have forced mining and chemical companies around the world to focus on managing costs and improving the effectiveness of strategic management and marketing activities.

2. Literature review

Despite the wide range of existing methods and tools for strategic management (Aaker, 2013; Barney, 1991), no optimal strategic approach that takes into account the industrial and market peculiarities of the fertilizer manufacturing industry in a highly turbulent environment has been found. Previous studies have addressed fertilizer markets and forecasts of fertilizer consumption (Al Rawashdeh and Maxwell, 2011; Al Rawashdeh et al., 2016; Geman, 2013), demand and supply sides of the fertilizer industry (Al Rawashdeh and Maxwell, 2014), the role of fertilizers in the global food system (Cordell, 2015), and also the development of phosphate and potash resources and reserves (Mew, 2016; Ciceri, 2015; Cooper, 2011). From the point of view of strategy, many studies have considered issues of strategic management of large companies (Freeman, 1984, Glueck, 1980, Lorange, 1980, Worrell, 1988, Grant, 2011, Pitere, 2001, Ansoff, 2007, Spender, 2014). Previous research has also addressed recent evolution of the fertilizers market and has assessed likely developments in the coming decades (Al Rawashdeh and Maxwell, 2014), as well as questions concerning fertilizer availability in a resource-limited world (Dawson, 2011).

There are a small number of papers devoted to development of fertilizer companies and the management of these enterprises. In particular, previous study has attempted to analyze the technical efficiency performance of major global corporations involved in phosphate recourses mining using the BCC (Banker, Charnes, and Cooper) and CCR (Charnes, Cooper, and Rhodes) models of data envelopment analysis (Geissler, 2015). In addition, papers have considered capital investment in fertilizer companies (Geman, 2013), the supply behavior of state mining enterprises (Al Rawashdeh, 2008), and efficiency performance of the world’s leading corporations in phosphate rock mining (Geissler, 2015). However, there are no research papers focusing specifically on strategic management of fertilizer mining companies operating in conditions of a highly turbulent external environment.

Practically all phosphate and potash resources used for fertilizer

production originate from exploitable deposits concentrated in a rather small number of countries and mined predominantly by a limited number of global enterprises (Geissler, 2015). These enterprises differ by size, types of fertilizers they produce, degree of vertical and horizontal integration, access to raw materials, and legal form or type of ownership. Their overall goal is production optimization, which is impossible without effective strategic management.

The structure and operating environment of companies operating in the mining and chemical industry necessitate formation of an approach to strategic management taking into account industrial and market characteristics in a highly turbulent environment. Therefore the issue of strategic management in highly turbulent environment is analyzed in this paper. The paper is organized as follows: first, we determine the features of the oligopolistic fertilizer market using Porter's model; next, we identify turbulence level for Russian fertilizer companies using Ansoff approach; finally, we suggest strategic management methods for Russian fertilizer companies in conditions of high environmental turbulence. Some of them, such as event analysis and analysis of mineral assets are applied for potash companies. The conclusions related to the current situation in Russian fertilizers industry are made on the basis of application of the above mentioned methods.

3. Features of the oligopolistic fertilizer market according to porter's model

We determined characteristic features of the oligopolistic fertilizer market and specificities of mining and chemical holdings using Porter, Thompson and Strickland's (Thompson, 2003) methods. Industry characteristics are presented in Table 2.

The high degree of competition in the industry determines the direction of company activities; strategic decisions are made in a context of close interdependence between market participants with implementation of company strategies affecting competition in the industry as a whole.

At the same time, phosphate and nitrogen industries are not so much concentrated as the potash sector. The phosphate market, though concentrated, is still competitive. The potash industry has been operated as a cartel coordinated by two exporting companies ("Canpotex" in North America (owned by "Potash Corp", "Agrium" and "Mosaic") and the "Belarusian Potash Company" (owned by "Uralkali" and "Belaruskali"). Nevertheless, oligopolistic features of

the fertilizer industry may also relate to nitrogen or phosphate industry, because, as it was already mentioned, the share of eight of the largest phosphate mining companies reaches about 40% (Jenny, 2012, Taylor, 2013).

An important problem faced specifically by Russian mining and chemical companies is that they are almost exclusively export-oriented. It results from poor solvency of the Russian market due to the poor financial condition of the domestic agricultural sector, where the need for fertilizers is not completely satisfied.

4. Turbulence level for Russian fertilizer companies using Ansoff approach

Effective strategic decision-making that addresses specific problems and characteristics of the fertilizer mining industry is only possible through proper consideration of the interaction of the mining and chemical industry with its dynamic environment. In this context, the approach of Igor Ansoff, the founder of modern strategic management, becomes extremely relevant. In his work, the industry environment, and hence strategic approach, is defined based on different levels of environmental turbulence – from repetitive (Level 1) to unpredictable (Level 5). Each of the turbulence levels is described by four characteristics: complexity of the environment, familiarity of events, rapidity of changes and the possibility of predicting their consequences. Table 3 shows modified characteristics of environmental turbulence levels (Ansoff's method) and responsiveness of management response to change (Ansoff, 1993; Bolotov, 2010).

The table shows that strategic management responses vary depending on the characteristics of the external environment and the level of turbulence; whereas in low environmental turbulence it is possible to use passive (reactive) management, with increasing levels of turbulence the need for responsiveness by the company's management grows, which requires preventive action (proactive management).

The environmental turbulence was characterized using the suggested method.

The fertilizer market is described as a developed global market characterized by considerable variations of production and consumption patterns. For example, Russian mining and chemical companies export about 70% of their products to the main consumer markets of China, India and Brazil, as well as to Europe and North America.

The fertilizer business, potash in particular, can be considered quite volatile when considering the speed of market changes. One of the

Table 2
Characteristics of mining and chemical holdings in an oligopolistic market.

Characteristic features	Industry peculiarities
Limited number of sellers	The presence of large firms with considerable market power. Nitrogen fertilizers can be made anywhere where there is a reliable source of natural gas, whereas integrated potash and phosphate producers are typically miners. Separate mining and chemical companies control a significant share of the market, which allows them to influence market parameters. The high degree of concentration in the market determines the level of competition. Potash has the most concentrated industry structure, whereas, nitrogen has the most fragmented industry structure with about sixty producing countries. Market share of phosphate mining and chemical company OCP is about 14%, and the share of the 8 largest mining companies about 40%. Mosaic Company's share of production of industrial phosphates is about 20%; the share of the 8 largest companies is about 60%. The total share of the four main world exporters of P2O5 is about 60%. The potash market is controlled by only 11 companies; the total share of the world's top four producers is about 70% (information-analytical center "Mineral", 2016). Rivalry is the highest for nitrogen and the lowest for potash companies.
Huge number of customers	Customers of fertilizer products in most cases are the final consumers (several hundred thousand farms). In producing countries, fertilizers are sold through companies' own sales divisions and international traders. None of the customers can affect the terms and conditions of market transactions and the level of competition in the market. In global scale main customers are India and China, and they considerably influence the supply-and-demand balance on the world market.
Standardized product	Fertilizers from different manufacturers are identical and completely interchangeable. The consumer buys product based on price. There are no substitute products.
Barriers to market entry	Entry into the market requires considerable investment, related primarily to the necessity to capture a significant share of the oligopolistic market. Threat of entry is really high for potash and lower for nitrogen. Additionally, production is very capital intensive (construction of new facilities costs about 1.5 billion USD for 1 million tons P2O5). It takes up to seven years to develop a potash mine, three years for nitrogen plants and four to five years to develop a phosphate project.
Interaction and interdependence of companies	Decisions by individual mining and chemical companies affect the market situation and decision-making occurs taking into account the possible reaction of other market participants. There is the possibility of collusion and cartel-like behavior.

Table 3
Characteristics of environmental turbulence levels.

Characteristics	Turbulence levels, their characteristics and peculiarities				
	1	2	3	4	5
Environmental turbulence	Repetitive (no change)	Expanding (Slow Incremental Change)	Changing	Discontinuous	Suprisedful
Complexity of market environment	Non-competitive market (national economic)	Weakly competitive market	Developed market (regional, technological)	Developed international market	Intensively growing global market
Familiarity of events	Familiar, repetitive	Notable trends	Extrapolable events	Constantly changing events	Continually changing and unexpected events
Rapidity of change	Very slow	Moderate; simple reaction	Average; clearly defined changes	Rapid; poorly defined changes	Very rapid changes
Visibility of future	Recurring	Forecastable	Predictable	Partially Predictable	Unpredictable
Responsiveness of general management capability (Strategy, characteristics of strategic management)	Search for stability, rejects changes	Search for efficiency, adapts to changes (reactive)	Market driven, seeks familiar changes	Environment driven, seeks related changes (active)	Creating an environment (proactive)
Information support	Historical precedents	Historical experience	Extrapolation	Future opportunities	Event-analysis

fundamental reasons of the high volatility of the mining and chemical market is its oligopolistic market structure with a small number of producers worldwide. In particular, the potash market is oligopolistic, with the three largest companies controlling nearly 60% of the market.

There is some evidence of the fluctuating and volatile state of the fertilizer market:

1. One of the most recent signs of turbulence was seen after August 2013, when the largest producer of potash - Russian company, "Uralkali" - announced its withdrawal from its trading partnership with the Belarusian company "Belaruskali", and stopped export sales through the joint trader, Belarusian Potash Company (BPC). "Uralkali" decided to start exporting itself. This decision destabilized the whole market, prices began to falter for all types of fertilizers, resulting in a significant loss of profitability and capitalization for mining and chemical companies (Figs. 2 and 3).
2. Changes in the market caused by currency fluctuations, for example, a significant weakening of the Russian ruble.
3. Unexpected decisions to postpone the launch of new production capacities, which make forecasts about world production unreliable.

Based on the above characterization, it can be seen that the fertilizer market is undergoing rapid, poorly defined changes, and management of companies acting on the market consequently have to adopt an appropriate approach. Using Ansoff's matrix and following analysis of the environment of Russian mining and chemical companies, it was concluded that the degree of turbulence is at Level 4, and occasionally, even at Level 5.

In the context of relatively high turbulence on the mining and

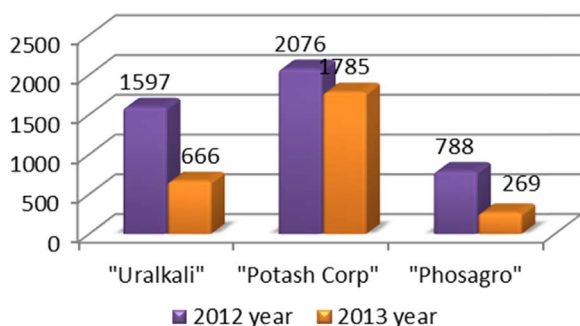


Fig. 2. Drop in profits of the largest mining and chemical companies from 2012 to 2013 (in millions of USD).

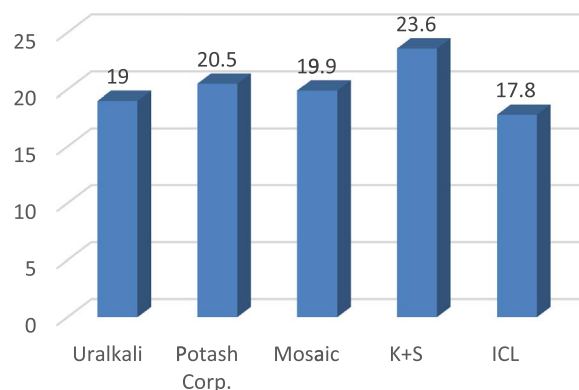


Fig. 3. Loss (in % of the previous year) of the largest mining and chemical companies' capitalization in 2013.

chemical production market, the planning horizon should be narrowed from 10 to 5 years. Further, implementation of the strategy should not be interpreted as implying strict implementation and immutability over a long period of time. The strategy must be flexible on the one hand, and at the same time, ensure stable achievement of the companies' goals.

It is necessary to know how to plan the company's activities, bearing in mind the possibility of changes, and to understand how often it is necessary to review strategy to keep up with the market and market changes while not focusing disproportionate efforts on strategic planning at the expense of operating activities.

Thus, the high level of environmental turbulence, increasingly tough competition and current world economic situation demands that mining and chemical companies monitor the global environment and exhibit flexibility in their actions. Foreign and domestic experience shows that such demands can only be met with advanced and effective strategic management. In a modern economy, a huge number of factors affect the formation of a company's strategy and their interaction is specific to the industry and enterprises involved.

5. Methodology: mineral assets and event analysis

Strategic analysis of mining and chemical companies should be carried out not only using common tools such as SWOT-analysis, PEST-analysis, analysis of competitive forces (M. Porter) (Porter, 1998), SWN-analysis, Ohmae diagram etc., but with the help of methods that specifically take industry characteristics into account (Dmitrieva, 2016).

A significant influence on mining companies' strategic choices, unlike companies in other sectors, is the condition and allocation of mineral assets, and so it is important to carry out mineral assets analysis (Ponomarenko, 2011). Such analysis requires monitoring of information about existing resource allocation and completed and planned tenders and auctions. In addition, information about the launch of new production facilities and the expansion of existing capacity of competitors should be tracked.

Most common methods of strategic analysis take into account only the influencing factors; they do not allow for the consideration of unexpected events occurring in the market and market's response to them. This weakness has been recognized and the concept of event analysis is increasingly appearing in the literature. It was introduced into economic sciences from the social sciences, primarily political and psychological sciences. Such event analysis could be a part of strategic analysis in economics and management. The classic definition of event analysis is as follows: "event analysis is a method of producing a sequential description of an incident that accounts for the logical relationships between the facts presented" (Sociological Dictionary, 2015). These events are put into chronological order and linked together by identifying logical relationships. These links are then tested to ensure that each event is explained satisfactorily. The approach has been used in a number of fields. For example, in politics, events such as elections and revolutions that are followed by significant changes are analyzed, and in psychology, event analysis allows psychological development and the influence of various events on a person's life to be traced.

Economic development at the micro-, macro- and mega-level indicates the emergence of events that are either positive or negatively influence the economy as a whole and the activity of a separate company in particular. Thus, event analysis in the economic context requires monitoring of information that is important for behavior change of the market. In most cases, such information encompasses items like macro-economic indicators, significant statements by important political figures, reports of natural and technological disasters, terrorist acts, global crises, restructuring of companies, and changes in legislation that affect the market. Event analysis includes assumptions about the most probable market reactions in response to changes in the macroeconomic and political context and other indicators and measures, and event analysis can be used as a tool for the analysis of the external or internal environment of the company (Dmitrieva, 2012).

A systematized scheme of strategic management methods applicable to mining and chemical companies, including those methods adopted and examined by the authors (in bold), is given in Table 4. Most attention is given to strategic analysis processes.

6. Results and discussion

Analysis of industry reveals key characteristics related to strategic management of fertilizer companies. The following features of strategic management of mining and chemical companies are to be highlighted:

1. Institutional regulation of subsoil usage (Sergeev, 2011);
2. High capital intensity of production and strategic investment decisions;
3. Uniqueness of mineral deposits;
4. Long period of implementation and the irreversibility of management decisions;
5. High level of transaction costs;
6. High degree of asset specificity;
7. High strategic and social value of companies, which necessitates that strategy formulation takes into account the interests of regional and governmental structures and the local population;
8. Necessity to integrate the environmental considerations into strategy development and realization;
9. Lack of opportunities to reduce risks by product diversification.

Based on the above results it is possible to develop and apply new methods of strategic analysis to mining and chemical Russian companies. As an example, analysis of mineral assets is considered for the potash industry.

Russian mineral resources of potassium salts are characterized by an extremely high degree of concentration. More than 80% of proven reserves are concentrated in the Verkhnekamskoe potassium field (Perm Territory). The remaining reserves and resources are located in the Gremyachinskoe and Eltonskoe fields (Volgograd region) and the Nepskoe field (Irkutsk region). During the last 70 years, Russia has only developed the Verkhnekamskoe field, the world's second largest potassium field (the largest is in Saskatchewan, Canada) and 10 areas of the field have been explored, 5 of which are currently in operation. Until 2011, production was carried out only by two companies - JSC "Uralkali" and "Silvinit", which decided to merge in 2011. The remaining parts were in areas of unallocated subsoil reserves. In view of this development pattern, the structure of the industry has been stable (Table 5 and Fig. 4).

On March 12, 2008, the Russian federal government held an auction for the sale of areas of the Verkhnekamskoye potash field, despite the request of the Berezniki and Solikamsk municipalities for replacing the auction with more subjective competition. As a result of fierce bidding, three lots were sold at prices several times higher than expected. This competitive situation was unprecedented for the global potash market as the number of producers, which had been unchanged for decades, increased with the arrival of a serious competitor - JSC "EuroChem".

As a result, the former duopoly was faced with increasing local competition for industrial and raw material resources and the staff, and furthermore, market changes with long-term strategic implications. Construction of several new mining sites and processing factories in areas of the Verkhnekamskoe field was planned for 2012–2017, and a subsidiary of JSC "Uralkali" - LLC "Kama Mining Company" announced plans to start production at one of the areas previously mined by "Silvinit".

In addition, JSC "Kovdor GOK", included in OAO "EuroChem", and LLC "Verkhnekamsk Potash Company", a subsidiary of the producer of complex fertilizers JSC "Akron" received licenses for areas in the Verkhnekamskoe potassium field. A notable change was that companies engaged in the production of other types of fertilizers began to show interest in potash raw materials, which suggests the likely emergence of new producers in Russia (Table 6).

According to forecasts, by 2018 the structure of the potash market resource base will change significantly. About 40% of currently exploited areas are being developed by JSC "Uralkali", and the company also has plans for the commissioning of production in new areas in addition to those areas to be exploited by "EuroChem" (Fig. 5).

Changes in the market structure have led to changes in the competitive strategies of major manufacturers in the industry, for example, JSC "Uralkali" and "Silvinit" decided to merge because of the threat of new competitors in the Russian market.

The "EuroChem" company is presently investing about \$3 billions in their new potassium-magnesium projects (in the Palashersky and Balahontsevsky areas of the Verkhnekamskoe field). The company expects to ensure project financing from foreign banks. In total, it invested about \$600 millions in potash projects in 2013. In 2014 their investments approximated \$2.3 billions, and in 2015 amounted to ca. \$400 millions. According to the conditions of the auction, extraction has to begin in 2017. In the first stage of operations, production is planned at the level of 2.3 million tonnes per year, and then to increase by 1.4 million tonnes annually during the second stage.

In addition to parts of the Verkhnekamskoe field, "EuroChem" has acquired rights to another potash field, Gremyachinskoe, with a planned production capacity 4.6 million tons. Its launch was originally scheduled for 2013, but problems with development of the mine meant that the launch was moved to 2017. Calculations show that the project

Table 4
Strategic management methods for mining and chemical companies.

Strategic management method	Characteristics of the method	Application and relevance to the mining and chemical industry
1. Strategic analysis		
SWOT-analysis	SWOT-analysis identifies strengths and weaknesses, opportunities and threats to the company to allow creation of an effective strategy.	SWOT analysis is significant because mining and chemical companies have specific threats and opportunities that needed to be addressed.
PEST-analysis	PEST analysis specifies the political, economic, social and technological factors influencing the environment and activity of the company and its strategy.	In the mining and chemical industry, PEST factors have, in general, a restraining influence. The analysis should be supplemented by consideration of environmental factors that have particular significance.
Porter's five forces analysis	Porter's five forces analysis allows identification of the most important factors determining strategy formation, the attractiveness of the industry and market competition conditions.	Porter's five forces analysis has limited applicability to the mining and chemicals industry due to the stable market structure and high barriers to entry.
GAP-analysis	GAP analysis establishes the discrepancy between achieved and planned (expected, best) results and determines the cause of the mismatch.	GAP analysis is highly important because the analysis reveals weaknesses of current strategy and thus helps to avoid them when designing a new strategy.
Event analysis	Event analysis allows estimation of the market's reaction to various events and establishes the relationship between them to make founded assumptions about the future state of the company, the market and the industry.	Event analysis is very important in the mining and chemical industry due to the unstable political and economic situation, the significant dependence of companies on social and economic processes, as well as the oligopolistic market and the close interdependence of market participants.
Analysis of mineral assets	Analysis of mineral assets allows identification of the current and projected state of the mineral assets in the industry and the characteristics of their distribution as part of formulation of an effective strategy.	Analysis of mineral assets should be an obligatory component of strategic analysis of mining and chemical companies.
2. Formulation of the mission and goals of the organization		
"Goal tree"	A "goal tree" is a structured hierarchical system of goals with definition of the main goal and its decomposition into goals of lower order.	In view of the high degree of vertical integration of mining and chemical companies, the objectives tree should be detailed and should include specific goals for all structures.
S.M.A.R.T. goals	S.M.A.R.T. goals refer to making "specific", "measurable", "achievable", "realistic" and "timely" goals.	S.M.A.R.T. goals are especially important because of the large number of units in chemical and mining industry company structures.
Company mission and goals analysis	Company mission and goals analysis identifies the mission and strategic goals of the company and determines their compliance with the required criteria.	Company mission and goal analysis is of high importance due to the significance of mining and chemical companies' objectives and mission to a large number of stakeholders, as well as for the development of regions and national economies.
Formation of strategic alternatives		
BCG matrix, The McKinsey 7-S framework, Model ADL/LC, Ansoff's matrix, Steiner's model, Abell framework	These approaches allow available strategies to be generated taking into account different markets and types of businesses.	Little applicable, because it does not take into account the characteristics of industry, in addition for mining and chemical companies the ability to enter new markets is limited.
Shell directional policy matrix	The Shell directional policy matrix is applicable to oligopolistic markets and characterizes strategic decisions in terms of the prospects of the industry and business competitiveness.	Analysis using the Shell directional policy matrix is important because of the oligopolistic nature of the mining and chemical market. It is possible to develop strategic decisions at the same time depending on the interests the manager focusing either on the life cycle of a business or cash flow.
Strategic choice		
Multicriteria choice methods (Roy, 1996)	Multicriteria choice methods allow the selection of alternatives on the basis of defined criteria.	When using multicriteria choice methods it is necessary to develop relevant criteria that take into account industrial and market characteristics and the company's potential.
Strategy implementation		
Business engineering	Business engineering is a technique based on development of a system model of the enterprise (its organizational structure, production units, etc.) and existing and planned business processes in conjunction with the environment model.	Business engineering is valuable because of the necessity of coordination of a large number of business processes with each other and with environmental conditions.
Strategic control and evaluation of the effectiveness of the strategy		
Balanced scorecard. system of KPI (key performance indicators)	Implementation of the balanced scorecard system of key performance indicators developed according to the strategic and tactical objectives of the company allows evaluation of the strategic effectiveness of a particular company in specific circumstances.	In the balanced scorecard system it is necessary to develop a set of indicators that reflects both the characteristics of the company and is applicable to similar companies in the industry.

can break even only if the price of potassium is \$ 600 per ton.

The "Acron" company originally planned to start production from the Talitsky area in 2017 and to reach full production capacity of 2 million tons in 2018. However, after the change in strategy of JSC

"Uralkali" in 2013 and a sharp drop in the market price for potassium, launch of the Talitsky operations was postponed to 2021.

For mining companies, especially in view of the high degree of concentration of reserves, analysis of the structure of mineral assets as

Table 5
Status of mineral potash assets before the auction of 2008 and the merger of the potash market ("Uralkali" and "Silvinit").

Subsoil areas of the Verkhnekamskoe and other Russian fields	Geological reserves, billion tons	Company	Share,%
Verkhnekamskoe field			
Durymansky	1.68	JSC "Uralkali"	9.3
Bygelsko- Troitsky	1.8	JSC "Uralkali"	10.0
Bereznikovskiy	0.72	JSC "Uralkali"	4.0
Solikamsky	1.2	JSC "Silvinit"	6.6
Novo-Solikamsky	1.8	JSC "Silvinit"	10.0
Unallocated subsoil fund			
Other areas of the Verkhnekamskoe field	7.29	–	40.3
Eltonskoe field	1.0	–	5.5
Nepskoe field	1.7	–	9.3
Gremyachinskoe field	0.9	–	5.0
Total	18.09		100

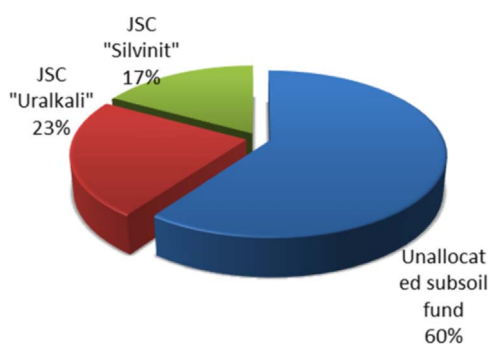


Fig. 4. Allocation of mineral assets of the Russian potash market before the auction in 2008.

Table 6
Current distribution of mineral assets of the Russian potash market.

Subsoil areas of Verkhnekamskoe and other Russian fields	Geological reserves, billion tons	Company	Share,%
Verkhnekamskoe field			
Durymansky	1.68	JSC "Uralkali"	9.3
Bygelsko-Troitsky	1.8	JSC "Uralkali"	10.0
Bereznikovskiy	0.72	JSC "Uralkali"	4.0
Solikamsky	1.2	JSC "Uralkali"	6.6
Novo-Solikamsky	1.8	JSC "Uralkali"	10.0
Ust-Yayvinskyy	1.29	JSC "Uralkali"	7.1
Polovodovskiy	3.7	JSC "Uralkali"	20.5
Talitsky	0.7	JSC "Acron"	3.9
Palashersky	1.2	JSC "EuroChem"	6.6
Balahontsevskiy	0.4	JSC "EuroChem"	2.2
Gremyachinskoe field	0.9	JSC "EuroChem"	5.0
Unallocated subsoil fund			
Eltonskoe field	1.0	–	5.5
Nepskoe field	1.7	–	9.3
Total	18.09		100

an element of strategic analysis is extremely important. At present, the introduction of new production capacity is being delayed worldwide due to falling demand and reduced product prices, which allows existing companies to take proactive measures to ensure competitive advantage.

As noted earlier, in addition to mineral assets analysis, it is important that companies in the mining and chemical industry conduct event analysis. Here, the potash industry was chosen as an example, and an outline of strategic events in the potash industry was created,

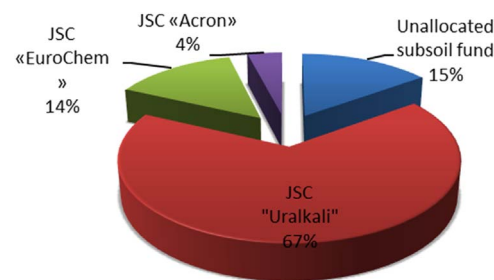


Fig. 5. Current distribution of mineral assets of the Russian potash market.

presented in Table 7. The data were taken from different sources including websites of large fertilizer companies and analytical agencies.

After carrying out this analysis, we identified the following facts, which need to be taken into account in strategic analysis:

- The accident in the JSC "Uralkali" mine in 2006, the global economic crisis and the threat of the emergence of new producers after the auction in 2008 led to the merger of "Silvinit" and "Uralkali" in 2011, considerable reorganization of business activities (because two companies became one of a changed structure), and a monopoly market for potash fertilizers in Russia.
- A sharp increase in demand and higher prices for potash in 2009–2010 stimulated interest in the industry, which accelerated the introduction of new production capacity.
- Termination of anti-dumping measures in the European Union increased Russian fertilizer supplies to these countries. It expanded the market for JSC "Uralkali" products and for other Russian producers.

Based on the second part of the outline of strategic events in the potash industry – "Projections of events in the market", the following forecasts can be made:

- Due to the market expansion resulting from the withdrawal of antidumping measures by the European Union in 2011, raw material deficit for internal consumption may possibly appear, which could make it necessary to adopt government-proposed regulatory measures.
- Due to the emergence of new players in the potash market and new production capacity put in place in 2014–2018, supply may exceed demand leading to the reduction in prices.
- Further strengthening of the position of JSC "Uralkali" after the merger in 2011 and launching of its new capacity (2018) may provoke a consolidation of other global mining and chemical companies (such as BHP Billiton and Potash Corp.)

Thus, event analysis allows different market reaction to events to be revealed and suggests new relationships can be established between the actors involved. It also enables to forecast some of the future market conditions and tendencies.

Ensuring effectiveness, increasing investment attractiveness and the creation of long-term prospects are issues for every company independent of its field of activity. Development of an objective strategy allows highly effective results to be achieved in both current activity and over the long term. In current market and industry conditions, mineral-raw companies in general and the mining and chemical sector in particular are influenced by numerous factors and events that create high turbulence of the environment. At the same time, despite the wide range of existing methods and instruments for strategic management, no approach exists that allows full consideration of the specific characteristics of the industry and markets in which mining and chemical companies operate. Thus, it is important to develop new approaches and extend existing methods of strategic analysis to allow

Table 7

Outline of strategic events in the potash industry.

Year	Market events => <i>Their influence</i>	Technological events => <i>Increase or decrease in production</i>	Status of mineral resource assets and price events => <i>Their influence</i>
1983	Division of the state monopoly into two large potash companies, JSC "Uralkali" and JSC "Silvinit". Creation of the duopoly led to completion but did not resolve efficiency weaknesses.	–	–
1990-s	1. A decrease in demand by nearly a quarter in the CIS that led to sharp decline in world production and consumption of potash products. 2. Anti-dumping regulation in Europe. In 1992 the European Commission set anti-dumping quotas for imports into the EU of potash produced in Russia and Belarus. (so, fees for imports exceeding the anti-dumping quota were 12.3% for "Uralkali", 23% for "Silvinit" and 27.5% for "Belaruskali").	–	–
2004	–	–	JSC "Uralkali" acquired a license for development of the Ust-Yaivinsky area of the Verkhnekamskoe field. That led to 1.29 billion tons increase in reserves.
2006	Prospect of compensation payments because of an accident at the 1st Mine of "Uralkali". Unsuccessful IPO. That led to Shortfall in planned profits from growth of the company's capitalization.	An accident and flooding of the 1stMine of "Uralkali" that led to 1.2 million tons decrease in production.	Loss of reserves (about 120 million tons) because of the accident and flooding of the 1stMine of "Uralkali".
2008	A risk of bankruptcy because of payments related to the 1st Mine accident. Minimum payment of 16.7 billion rubles and maximum payment - 50 billion rubles. The beginning of the global economic crisis. That led to the sharp drop in demand.	Iran started to develop the Ildzhak field. The annual production capacity is 100 thousand tons of potassium chloride. The beginning of development of the Gremyatchinskoe field. That led to the appearance of a new player in the market with proposed production of 2.3 million tons (in the first phase).	Auction for the right to develop three areas of the Verkhnekamskoe field: Polovodovsky, Talitsky, Palashersky.
2009	Significant growth in global demand for potash.	An increase in production of JSC "Uralkali" and "Silvinit" to 5.1 million tons for each company.	Sharp increase in prices for potash.
2010	An IPO of "Uralkali" that led to the growth of the company's capitalization	Beginning of the Ust-Yaivinsky project	A record high price – 608 \$ - was reached.
2011	Merger of JSC "Uralkali" and JSC "Silvinit" that led to creation of a monopoly and the need for government regulation. At the same time, creation of the world's largest company in the field.	Completion of the construction of the Dehkanabad potash fertilizer plant. (2.1 million tons increase in production in Uzbekistan).	Ending of EU anti-dumping measures on July 13, 2011. Export of Russian and Belarusian potash to the EU is no longer limited. It led to expansion of the market for Russian companies.
2013	Announcement of the termination of cooperation between "Uralkali" and "Belaruskali", "Uralkali" came out of "BPC". That led to the drop in stock prices and drop in demand	–	Significant decrease in world market prices
Projections of events in the market			
2017	–	Beginning of production at the Gremyatchinskoe field (JSC MCC "EvroChem") (2.3 million tons increase in production).	–
2018	–	Predicted start of production at Ust-Yaivinsky area and other areas of the Verkhnekamskoe field (2.8 million tons planned increase in production of potash).	–

accurate analysis of industry-specific factors that influence the activities of mining and chemical companies.

The Russian fertilizer industry is strategically important and potentially competitive in world markets, while also having good conditions for stable growth in Russia. Russia accounts for about 10% of world production of fertilizers, and only 1.8% of world consumption, that is, most of the industry's production is exported. Export of fertilizer material is not a trade in primary commodity; it is the export of goods with high added value, which is associated with significant multiplicative, budget and socio-economic effects.

In addition, modern industry and the market situation between fertilizer producers require improving the efficiency of the strategic management system. An approach to strategic management was formed based on the research results and the identified characteristics and problems associated with mining and chemical company operations. It was proved that strategic analysis of mining and chemical companies should take into account the effect of dynamic and multi-directional factors by using the analysis of the mineral assets and event analysis.

7. Summary and conclusions

The fertilizer industry is characterized by sector-specific market and industry features and high level of turbulence of its external environment. It exhibits several distinguishing features, which must be taken into account when developing the company's strategy, e.g. oligopolistic market, institutional regulatory framework of the industry, high capital intensity of production and strategic investment, high strategic and social significance of companies creating a need for careful consideration of the interests of regional and state stakeholders.

In literature there are a large number of methods and tools for strategic analysis and management. However, they are not adapted to the specificity of the particular industries. Due to this fact, it is necessary to identify and adopt the most appropriate methods and tools applicable to the peculiarities of the market and industry as well as highly dynamic environment. We determined characteristic features of the oligopolistic fertilizer market using Porter's model, analyzed the issue of strategic management in highly turbulent environment and determined the turbulence level for Russian fertilizer companies using

the approach of Ansoff. We suggested a systematized scheme of strategic management methods applicable to mining and chemical companies. As an example, we presented the analysis of mineral assets and event analysis. The analysis of mineral assets was carried out for the Russian potash industry. For fertilizer companies, based on mineral resources, analysis of the structure of mineral assets as an element of strategic analysis is extremely important. In addition to mineral assets analysis, it is important that companies in the mining and chemical industry conduct event analysis. The potash industry was chosen as an example. Event analysis of the market of potash fertilizers allows us to formulate assumptions about the most probable market reaction in response to specific changes in the environment. Along with the above presented researches and results, successful operation of Russia fertilizer companies requires not only the application of the above presented methods but also modifications of the strategy in response to changing market and industry situation.

Acknowledgement

The paper is based on research carried out with the financial support of the grant of the Russian Science Foundation (Project no. 14-38-00009, The program-targeted management of the Russian Arctic zone development). Peter the Great St. Petersburg Polytechnic University.

The authors are grateful to Peter Jones for his help in editing the paper.

References

- Aaker, D.A., 2013. *Strategic Market Management*. Wiley.
- Al Rawashdeh, R., 2008. The supply behaviour of state mining enterprises: a case study of the Jordanian phosphate industry. *Resour. Policy* 33, 196–202.
- Al Rawashdeh, R., Maxwell, P., 2011. The evolution and prospects of the phosphate industry. *Miner. Econ.* 24, 15–27.
- Al Rawashdeh, R., Maxwell, P., 2014. Analysing the world potash industry. *Resour. Policy* 41, 143–151.
- Al Rawashdeh, R., Xavier-Oliveira, E., Maxwell, P., 2016. The potash market and its future prospects. *Resour. Policy* 47, 154–163.
- Ansoff, H.I., 2007. *Strategic Management*. Palgrave Macmillan.
- Ansoff, I., Sullivan, P., 1993. Profitability optimizing in turbulent environment: a formula of strategic success. *Long. range Plan.* 5, 11–23.
- Barney, J.B., 1991. Firm resources and sustainable competitive advantage. *J. Manag.* 17, 99–120.
- Bolotov, S.P., 2010. The dynamics of the environment and the adaptation of the company to market conditions. *Bull. Res. Cent. Corp. Manag. Ventur. Invest. Syktyvkar State Univ.* 4, 6–20.
- Bruinsma, J., 2009. The resource outlook to 2050: by how much do land, water and crop yields need to increase by 2050? *Food Agric. Organ. U. Nations* (<ftp://ftp.fao.org/docrep/fao/012/ak971e/ak971e00.pdf>), (accessed 15.09.16).
- Bruno, S., 2015. Sustainable supply chain management in emerging economies: environmental turbulence, institutional voids and sustainability trajectories. *Int. J. Prod. Econ.* 167 (C), 156–169.
- Cherepovitsyn, A., Ilinova, A., 2012. Key competitive factors In The industry Of phosphorus fertilizers. *Sci. Notes Petrozavodsk State Univ.* 1 (122), 94–99.
- Ciceri, D., Manning, D., Allanore, A., 2015. Historical and technical developments of potassium resources. *Sci. Total Environ.* 502, 590–601.
- Cooper, J., Lombardi, R., Boardman, D., Carliell-Marquet, C., 2011. The future distribution and production of global phosphate rock reserves. *Resour., Conserv. Recycl.* 57, 78–86.
- Cordell, D., White, S., 2015. Tracking phosphorus security: indicators of phosphorus vulnerability in the global food system. *Food Secur.* 7, 337–350.
- Dmitrieva, D., Ilinova, A., 2016. Application Of Strategic analysis methods And tools In Russian mining And chemical complex. *Int. J. Appl. Eng. Res.* 11 (8), 5567–5572.
- Dawson, C.J., Hilton, J., 2011. Fertilizer availability in a resource-limited world: production and recycling of nitrogen and phosphorus. *Food Policy* 36, 14–22.
- Dmitrieva, D.M., 2012. *Strategic Event Analysis of the Market Of Potash Fertilizers (Scientific Reports on Resource Issues) Latest Developments in Mineral Industry – Geology, Mining, Metallurgy, and Management 1*. TU Bergakademie Freiberg, Germany, 332–335.
- Enger, E.D., 2010. *Environmental Science: A Study of Interrelationships* 12th edition. McGraw-Hill Higher Education, Boston, MA.
- Food and Agriculture Organization of the United Nations. (<http://www.fao.org/statistics/en/>). (accessed 15.09.16).
- Freeman, R.E., 1984. *Strategic Management: A Stakeholder Approach*. Boston
- Geissler, B., Mew, M.C., Weber, O., Steiner, G., 2015. Efficiency performance of the world's leading corporations in phosphate rock mining. *Resour., Conserv. Recycl.* 105, 246–258.
- Geman, H., Vergel Eleuterio, P., 2013. Investing in fertilizer–mining companies in times of food scarcity. *Resour. Policy* 38, 470–480.
- Glueck, W.F., 1980. *Business Policy and Strategic Management*. McGraw-Hill, New York.
- Grant, R., 2011. *Modern Strategic Analysis*. 5th ed.
- Jenny, F., 2012. Price instability and competition law: the case of the potash cartel. Presentation. OECD Glob. Forum Trade Compét. 2012 (<http://docplayer.net/5266839-Price-instability-and-competition-law-the-case-of-the-potash-cartel.html>), (accessed 01.11.16).
- Lorange, P., 1980. *Corporate Planning: An Executive Viewpoint*. Prentice Hall.
- Mew, M.C., 2016. Phosphate rock costs, prices and resources interaction. *Sci. Total Environ.* 542, 1008–1012.
- Pitere, T., Waterman, B., 2001. In search of effective management. *Progress.*
- Ponomarenko, T.V., Dmitrieva, D.M., 2011. Methodological foundations of the external environment Strategic analysis of an integrated mining company. *Min. Inf.-Anal. Bull.* 10, 57–70.
- Porter, M.E., 1998. *The Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press, NY.
- Roy, B., 1996. *Multicriterial Methodology for Decision Aiding*. Kluwer, Dordrecht, (Chapter 1–2).
- Sergeev, I., Ponomarenko, T., 2011. Methodological aspects Of sustainable development: particularity Of Russia. *Manag. Theory Stud. Rural Bus. Infrastruct. Dev.* 2 (26) (<http://vadyba.asu.lt/26/201.pdf>), (Accessed 07.12.2015).
- Spender, J.C., 2014. *Business Strategy: Managing Uncertainty, Opportunity, and Enterprise*. Oxford University Press.
- Taylor, R., Moss, D., 2013. The Fertilizer Oligopoly: The Case for Global Antitrust Enforcement. American Antitrust Institute (<http://www.antitrustinstitute.org/sites/default/files/FertilizerMonograph.pdf>), (Accessed 01.11.2016).
- The Sociological Dictionary. (<http://www.slovarus.ru/>). (accessed 12.12.15).
- Thompson, A.A., Strickland, A.J., 2003. *Strategic Management: Concepts and Cases*. McGraw-Hill/Irwin.
- World Development Indicators (WDI), 2016. July. (<http://knoema.ru/mhrzolg/gdp-statistics-from-the-world-bank?Country=World>). Accessed 15.09.16.