Master Thesis

Strategic management of innovation in the coal sector

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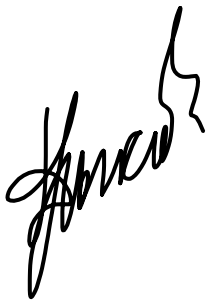
Declaration of Authorship

„I declare in lieu of oath that this thesis is entirely my own work except where otherwise indicated. The presence of quoted or paraphrased material has been clearly signaled and all sources have been referred. The thesis has not been submitted for a degree at any other institution and has not been published yet.”

19.06.2021 

Abstract

Key words: Innovation, strategic management, innovation strategy, industry, development, coal, Russian coal industry, competitive advantages, factors affecting innovation and enterprise management, efficiency, strategic analysis.

The purpose of this paper is to find and implement directions for improving innovation activities in the coal industry. The first chapter considers theoretical aspects of strategic innovation management and defines the role of innovation management in the coal industry. The second chapter analyses the methodology of strategic innovation management in the coal industry and presents the main methods of strategic management. The third chapter conducted a strategic analysis of the industry, then developed a strategic direction of innovation activities in the coal industry, then assessed the effectiveness of the proposed implementation aimed at improving innovation activities in the coal industry.

Zusammenfassung

Schlüsselwörter: Innovation, strategisches Management, Innovationsstrategie, Industrie, Entwicklung, Kohle, russische Kohleindustrie, Wettbewerbsvorteile, Faktoren, die Innovation und Unternehmensführung beeinflussen, Effizienz, strategische Analyse.

Das Ziel dieser Arbeit ist es, Wege zur Verbesserung der Innovationsaktivitäten in der Kohleindustrie zu finden und umzusetzen. Das erste Kapitel betrachtet theoretische Aspekte des strategischen Innovationsmanagements und definiert die Rolle des Innovationsmanagements in der Kohleindustrie. Das zweite Kapitel analysiert die Methodik des strategischen Innovationsmanagements in der Kohleindustrie und stellt die wichtigsten Methoden des strategischen Managements vor. Das dritte Kapitel führte eine strategische Analyse der Branche durch, entwickelte dann eine strategische Ausrichtung der Innovationsaktivitäten in der Kohleindustrie und bewertete anschließend die Effektivität der vorgeschlagenen Umsetzung zur Verbesserung der Innovationsaktivitäten in der Kohleindustrie.

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1 Introduction

Global trends, such as digitalization and the emergence of new breakthrough research that improves the quality of life, increase the relevance of introducing innovative technologies in all areas of life to improve innovative development of business and the economy. Innovation is now a key component of competitiveness. Therefore, there is a need for all industrial enterprises in Russia to switch to an innovative way of development to increase their competitive advantages on the domestic and global markets and improve their financial results.

Strategic management of innovation activities is applied for qualitative and smooth transition of enterprises of the industry to innovative development. Innovative development of the coal industry is currently a complex and resource-intensive element of the strategic management system, since the solution of this issue depends not only on the regulatory and legal acts of the Russian Federation, but also on the willingness and ability of investors to use new technologies in the activities of the enterprise. To improve innovation activities, it is necessary to develop a management strategy based on a comprehensive strategic analysis, as well as financially evaluate the innovative implementation and obtain an assessment of the effectiveness from the use of certain innovations.

The object of this dissertation research is the coal industry of the Russian Federation.

The subject of the research is organizational and managerial mechanisms of innovation activities in the coal industry.

The purpose of this dissertation research is to find and implement ways to improve the strategic management of innovation activities in the coal industry.

To achieve the goal of the dissertation research, the following tasks were set:

- Analysis of existing research on the topic.

- Study of existing experience of strategic innovation management.

- Development of a system of strategic management of innovation activity.

- Formulation of methods for managing innovation development of the service enterprise.

- Searching of directions for improvement of strategic management of coal industry innovation activity and evaluation of its effectiveness by the example of JSC SUEK.

Degree of development of the topic. The theoretical and methodological basis of the dissertation research was based on the works of foreign and domestic scientists in the field of strategic management of innovation activities of enterprises such as Schumpeter J., Drucker P., Novak S.O., Lapygin Y.N., etc.

Approbation of the research results. The main provisions and results of research were presented at scientific conferences and competitions, within the framework of the 10th All-Russian Scientific and Practical Conference of Young Scientists and Students "Past Experience - Future Outlook" (Tula, 19 - 20 November 2020), as well as at the 2nd International Scientific Conference "Priority areas of innovation in industry" (Kazan, 27-28, February 2021).

The practical significance of the work lies in the fact that the developed direction can be used and implemented in the coal industry to form additional competitive advantages in the global coal market.

2 Theoretical aspects of strategic innovation management: the role of innovation management in the coal sector

2.1 Innovation as a factor of scientific and technological progress

The first appearance of the term 'innovation' dates to the 19th century, meaning the introduction of new elements from one culture into another. However, thorough research did not take place until the 20th century and led to the creation of an entire scientific discipline - innovation. Its main researchers were scientists J. Schumpeter with his "Theory of Economic Development" and N. D. Kondratiev, who was the first to reveal the role of inventions and innovations in the change of great cycles. In the mid-20th century, the role of innovation grew industry worldwide was gaining momentum, the need for competitive advantage was growing, new inventions, methods and approaches in production carried a pioneering character for companies, which made them stronger in the external market and more competitive.

Thus, the emergence of innovation itself is related not only to the need of society, companies, and the world economy for innovation, but also to the need of the individual (the scientist) for self-realization through invention.

There are many variations in the definition of what innovation is, and innovation is mainly defined as a process, a result, and a change taking place. Table 1 is compiled within these three lines of formulations.

Direction/ approach	Content of the formulation	Author
Process	a deliberate search for and process of change that can be exploited by entrepreneurs	Drucker P.
	a process in which an idea may produce an economic result	Twist B.
	the process of introducing something new	Huchek M.
	the process of introducing new methods in the organization and implementation of business activities	Korshunov I.A. and Trifilova A.A.
Result	is the result of introducing an innovation in order to change the object of management and obtain economic, social, environmental and managerial effect from it	Fatkhutdinov R.A.
	It is the result of creative activity aimed at creating and developing new technologies and types of products, implementation of new management methods and organizational forms	Borisov A.B.
Change	Changes aimed at the introduction and use of new types of goods and technologies; new production means and forms of organization in industry	Schumpeter J.
	Involvement in economic turnover of the results of intellectual activity, containing new, including scientific, knowledge to meet public needs and (or) profit	Volynkina M.V.

Table 1: A variation on the concept of innovation

Having considered all the above-mentioned formulations of the term "innovation", an author's formulation is proposed. Innovation is the ability of a country, an industry, an enterprise to increase its key performance indicators by several times by introducing new technologies, management methods, organizational systems, and performance evaluation methods.

Under the influence of numerous changes in the global economy, innovation has become a necessity at all levels of production. The innovation process now requires better management techniques to make innovation itself more open to use.

In developing countries, such as Russia, unsystematic and fragmented innovation movements prevail, so the issue of managing innovation creation is highly relevant. For the most part, innovation in such countries is of a closed nature, in which innovation work is generated internally without information being brought to the outside [15]. Such information is kept strictly secret, while external sources of ideas are regarded as suspicious and undesirable.

According to G. Chesbrough [3], companies make the serious mistake of hiding their research results in the field of innovation by fixating on the internal environment. They do not generate additional financial returns without exploiting the synergies between internal and external capabilities, unlike those organizations that allow the results of their research to be exploited.

The innovation process has become more complex and multidimensional, requiring improved management towards innovation openness. Due to the changes in the focus of innovation, a plan is needed to find promising ideas for their effective implementation, their correct evaluation by the company's management. The innovation process is a set of temporal stages from the emergence of an idea to its dissemination and implementation, whose main objective is the generation and continuous, cyclical implementation of innovations that satisfy consumer demand.

Depending on the fields of application covered, some types of innovation are distinguished.

Technological innovations, which are related to the process of creating new products, technologies and materials and putting them into operation, are the most common in practice. This type of innovation is divided into two components, namely product innovation and process innovation. The first innovations are created with the aim of radically changing the product, where quality and cost characteristics are significantly modified. Process innovations are responsible for the improvement of production methods and algorithms, the goal of which is to improve the efficiency of the enterprise [12].

Organizational and managerial innovations are the next type of innovation. They are responsible for the development and implementation of a new or improved organizational management structure of the enterprise, the introduction of modern technological tools for managing the organization (technology with the use of modern computing equipment), the use of new control and regulation systems, the development and modification of corporate strategy, innovations in the logistics component of the company.

Socio-economic innovations include the use of previously unused systems and forms of remuneration, as well as the use of previously unused forms of labor motivation, updating and implementation of the labor social package to simultaneously promote

technological innovation, improve the lives of employees and reduce social conflicts within the enterprise.

Marketing innovations are responsible for the development of new markets and the implementation of an improved marketing policy. These are the implementation of new methods of selling products and services on the market, the formation of improved pricing strategies.

Environmental innovations are particularly relevant today. At a time when there is one more technological innovation, the need for an environmental innovation increases, but at the same time the implementation of an environmental innovation is in most cases possible with the creation of a technological innovation. Environmental innovations include innovations in resource conservation and reduction of environmental impact.

Information innovations are responsible for the use of new information technologies at all stages of production, as well as at all levels of management and control.

In the overall flow of innovations for the coal industry, each type of innovation is certainly important, but the most significant are technological, organizational, and managerial and environmental innovations. Each of these is highly costly and knowledge intensive.

The manifestation of innovation in a particular field can be very different and this is due to the different concepts of the term "innovation". Innovation is the obtaining of something new in any field or area of life, while innovation activity is in turn aimed at the commercialization of a set of organizational, financial, and technological measures developed during the creation of an innovation.

The most important characteristic of innovation activity is innovation activity, which in turn should have the following characteristics for the organization:

- The existence of already implemented and implemented innovations in the practice of the enterprise.

- The extent of the organizations' involvement in the development of the innovations used.

- Identification of the reasons/discontinuities for which innovation activity has not taken place.

When assessing the innovation activity of an enterprise, it is possible to identify the degree of intensity of innovation activity within a project or enterprise, after which the necessary conclusions can be drawn, and new strategic objectives can be set.

An innovation-active enterprise is one that actively uses various types of innovation in its activities to improve production and management processes, increase financial efficiency, and the presence of completed (implemented) innovations in practice during the last 5 years of operation [18].

The main factors for successful implementation of innovations in the production process are scientific and technical potential, production and technical base of the enterprise, main type of resource, large investment investments, non-contradictory management system. To obtain the necessary positive financial and technical result from the implementation of innovation, the correct correlation of these factors should be selected, as well as the presence of interrelation of innovation, production, and financial activities of the enterprise. In this case, innovation activities will lead to the desired outcome in key performance indicators.

Innovation activities certainly require knowledge, experience, and focus on the part of the employees and the team responsible for the innovation component of the enterprise. Managers need to identify prerequisites and new opportunities for innovation activities using strategic management and analysis tools. Effective development, implementation, and control of innovation in different structural areas enables the organization to succeed not only in established segments, but also in opening new financially and productively promising areas.

2.2 Strategic management of innovation: the emergence and essence

Strategic management is one of the areas of management, which has its own specifics, methodology and tools.

"Strategic management is the development and implementation of actions that lead to the long-term improvement of a firm's performance level over that of its competitors [9]".

As a management concept, strategic management developed in the 1950s and 70s of the 20th centuries.

Strategy is how an organization achieves its long-term goals. It is used in industries such as: oil and gas, mining, processing precious stones and metals, rocket and space production, and others, so this theme is relevant in today's world [21].

One of the main prerequisites for strategic management was the need to develop companies, to increase their competitive advantage, and to monopolize the market.

A. Chandler was one of the first to link the concepts of strategy and planning. Further on, I. Ansoff offered his variant of defining strategic management, namely "a complex socio-dynamic process with the purpose of strategic adaptation in contrast to the linear interpretation of interrelations between an organization and its environment that is characteristic of strategic planning". Strategy was further developed in the writings of G. Mintzberg. He viewed strategic management from 5 positions: from the side of action, behavior, market position, "deceiving" the competitor and as a way for an organization to operate [25].

Particular attention is paid to the study of the mechanism for creating competitive advantage. Competitive advantage is the main result of implementing a well-designed organizational strategy.

In the 1980s a new approach to the study of competitive advantage was developed. Based on the resource capabilities approach, this approach involves the selection of a single firm, its strategy, resources, strengths, and weaknesses as the objects of study. The resource approach helps to explain why some resources contribute more to competitive advantage than others and the fact that resource asymmetry and incremental increases in competitive advantage are possible even in markets that are close to perfect competition.

Thus, this area of management is still not fully understood, and we see it evolving every year.

Strategic management is now involved in all types of production. The mineral resource complex is one of the most important sectors in the development of the country's and the world's economy. Therefore, the application of strategic management and its components in an enterprise is an integral part of successful functioning (profit making).

A correct and effective development and management strategy for the mineral complex is a key element for the existence of a company in the sector. Assessing global trends and analyzing the mineral market, studying the most important aspects of government

policy in subsoil use, and identifying strategic priorities for mining companies and trends in the development of innovative and energy-saving technologies are aspects to be studied when implementing a company's strategic management. Based on these data a plan is made, alternatives are developed, then they are evaluated and one of the alternatives is adopted [23,24].

Production, processing, enrichment, logistics, sales are the components of strategic management. It is important for a mineral company of any size to have both short-term and long-term management strategies.

Innovative development of the enterprise is impossible without strategic management, namely constant improvement of internal and external environment by using new methods of market research, search for reliable and objective sources of information for further analysis, search for new market segments and expansion of commodity products. Any innovation introduces changes to the organization as a structure, so timely intervention regarding management and the future vision of the organization is a very important element of an effective enterprise. Strategic management works precisely to stabilize possible and temporary imbalances in the organization. This stabilization must not contradict the organization’s original innovative development goals. And it should not stand in opposition to becoming a market leader.

Thus, strategic management provides, based on a detailed analysis of internal and external environment, the formation of the mechanism of behavior of the firm in conditions of constant change, implementing timely innovations, responding to the influence of external environment, and allowing the achievement of competitive advantage, which allows to achieve the goals in the long term. This allows the flexibility to regulate the activity of the firms in the direction of consumer satisfaction [8].

Innovation management ensures economic growth and enhances firm performance. Mainly, innovation strategy means the creation of such conditions for the functioning of the organization, in which the maximum growth of profits and revenues is ensured. The company needs to constantly adapt to the rapidly changing market conditions and make the most of external and internal opportunities.

One of the main objectives of the innovation strategy and its management is the reorientation of the enterprise to the development of knowledge-intensive production, which in turn requires the creation of high technology and staff skills through the introduction of high-tech solutions. The implementation of innovative production

strategy in the enterprise requires a gradual transition to a new level of a set of organizational and technical tasks [18].

2.3 Intensifying the innovation process in the Russian coal industry

According to recent data, the world's oil and gas reserves are together several times smaller than those of coal, whose deposits are distributed in roughly equal proportions over the territories of the largest countries.

The leading countries in terms of coal reserves for 2020 are the US, Russia, Australia, China, and India. About a quarter of the world's proven reserves are in the US at 250 billion tons, Russia has proven reserves of 160 billion tons, Australia has proven reserves of 147 billion tons and China has proven reserves of 138 billion tons of coal for 2020.

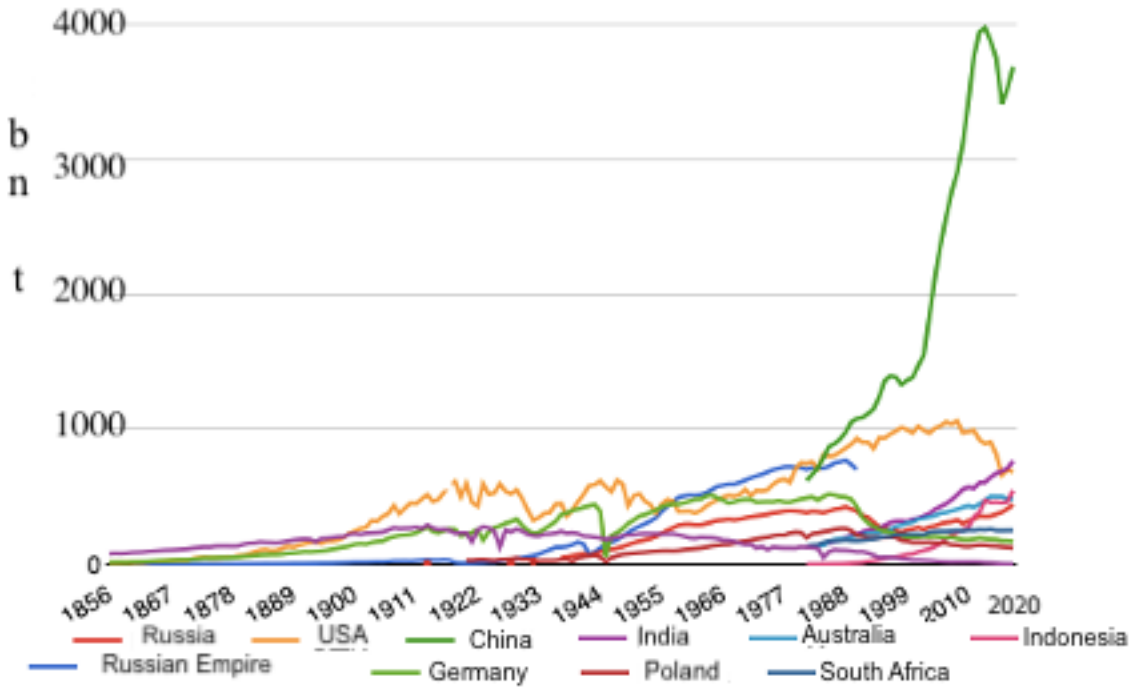

Figure 1:World's coal production statistics

Figure 1 shows coal production statistics for the last two centuries. For a long time, the US and the USSR led the way, but since 1985 a new world leader in coal production has been established - China. Today, China's coal production exceeds 3 billion tons annually, with India in second place with 765 million tons, the US in third with 685 million tons, followed by Indonesia with 548 million tons and Australia with 486 million tons. Russia ranks sixth in the overall coal production ranking with an estimated production level of 402 million tons for 2020.

Experts from the US Energy Information Agency have made a forecast for their field for the next twenty years. According to their calculations, the use of coal will increase by more than half a percent every year. At the same time, it is assumed that the production of electrical energy from coal will be 34% [22]. But thus, the figures in this projection contradict the Clean Power Plan.

Coal is recognized as a major emitter of greenhouse gases. But for Russia, due to its large land area and ample forests, CO2 emissions from coal are negligible. This contrasts with countries like China, India, or the US.

The main issues of the status and possible future development of the coal industry have been a focus of attention for many years. Coal is one of the main sources of energy globally.

There were two major technological stages in the 20th century, dating from 1920 to 1945 and from 1970 to 1995. A new stage meant a transition from existing technologies to fundamentally new ones. For example, in the coal industry, as early as the first stage, the extraction of minerals was carried out by means of jackhammers, which were replaced using comprehensive automation and mechanization of cleaning and preparatory work with the second stage of technological development. Moreover, such introductions led to essential result - average increase of labor productivity by 11 times and mining volumes by 1,5-2 times. It was in the 70-80s. USSR became a leader in invention, design and construction of mechanical supports and shearer loaders, which made it easier and increased effectiveness of face lifting operations. The equipment corresponded to the best world mining technology and as a result the dependence on foreign models was considerably decreased. The phenomenon of a continuous increase in productivity and extraction volumes can be explained by the then rapid development of the open-cut mining method and the introduction of the previously designed new transport and mining equipment in the coal mines.

Currently there is a third technological stage in the coal industry, which began in 2010 and will last until 2035. It is characterized by robotization of production processes, as well as creation of "smart" safety systems for mines and surface mines, and new high-tech mining complexes. The main difference of the third stage of technological development is the change of priorities, namely the priority is given to efficient management of resources rather than their production volumes. With the beginning of the new technological stage, the world's leading countries, such as the USA, Germany,

and France, began a new innovative path of post-industrial development, the meaning of which is to strengthen the role of innovation for the socio-economic development of countries and society. That is, in the coming years, the trend will come to form a new technological base of economic systems, which will be based on the latest technology. In this case, countries will be able to increase the efficiency of enterprises and reach new high-tech levels of production development. Such changes also affect the coal industry. For the coal industry not to lose its competitive advantages, but on the contrary, to increase them, the need to implement innovative projects to increase productivity and management efficiency is urgent for the government and managers of major coal companies [11].

The present time is marked by an increasing role of knowledge-intensive and high-tech industries. Thanks to them, the content of labor activity is changing, solutions to complex production tasks are accelerating, and the level and efficiency of management is significantly increasing.

Today, the coal industry is on the threshold of a new stage of technological development, modernization and restructuring of production, and introduction of new technologies. The main strategic benchmarks are defined in the long-term program for the development of Russia's coal industry until 2035. A special feature of this program is that the emphasis is placed on coordinated measures to modernize logistics systems, port routes, production facilities, as well as on improving safety and environmental systems, developing the scientific and technical potential of the industry, and introducing the latest developments to achieve new competitive advantages.

The key directions of development of innovative activities of coal industry enterprises are as follows:

- Wide use of informatization, partial robotization of production processes in working cycle.

- Optimization of mining modelling processes, cost-effective mining of mineral resources (MR).

- Minimization of negative impact of PI production on the environment.

- Use of non-conventional energy sources, applying coal bed methane and residual heat of coal mines.

- Improving the skills of personnel to meet new technological requirements [19].

3 Methodology for strategic management of innovation in the coal sector

3.1 Stages of strategic management

In the paper, we have assumed the main points and drafted a more detailed possible scenario on strategic innovation management.

In the first stage, the company's development and operational objectives are generated to develop innovation activities. Objectives for innovation activities are also structured. The main aspect of the stage is to link the innovation goal of the company to its overall strategy, mission, and objectives.

The second stage in strategic management of innovation is in-depth strategic analysis of the company, possible influence of external environment, and search for innovative potentials that can provide a competitive vector of the company's development. In simple words, it is a strategic analysis of internal and external environment, forecasting opportunities for innovative development. Currently, to assess the security and effectiveness of innovative development of the company much attention is paid to the macroeconomic environment and its dynamics over time, as identified factors in the analysis of macro environment can help to understand the feasibility of innovative direction in the overall innovative state of the country and predetermine the main prospective directions of development.

The third step is the process of developing an innovation strategy. For each enterprise, the development process and model can be completely different, as each company has its own unique organizational system. At this level of development, it is very important to generate as many suitable development and implementation scenarios as possible and to select from all alternatives only the one that is most effectively implemented. The innovation strategy is shaped by the strategic analysis carried out in the second stage.

The fourth stage - the development of a business process for the implementation of the innovation strategy develops a set of measures for implementation, considering the responsibility and timely control, their time frame, namely:

- Initially, the selection of innovation projects is carried out.

- Next, a list of innovative projects considered for further implementation is generated, with an estimated amount of financing, implementation timeframe, responsible persons for the project and an estimate of expected results in kind.

- The selection of targets and their specification for project appraisal.

- This is followed by an innovation risk assessment [5].

To ensure that the developed innovation strategy is flexible and adaptable to unplanned changes in the external and internal environment, a strategy performance evaluation should be applied, which includes economic, non-economic (technical) and social evaluation. Strategic plans can be developed for any term, but analyzing the practice of Russian companies, this term does not exceed 3-5 years, but the strategy itself can be planned for a longer period.

The final stage is the monitoring and control of the company's innovation strategy, where the company's innovation strategy is adjusted if necessary.

The step-by-step process of strategic innovation management proposed above will allow the organization to achieve a new technological and organizational level, and to ensure that future desired outcomes are achieved through a planned innovation process.

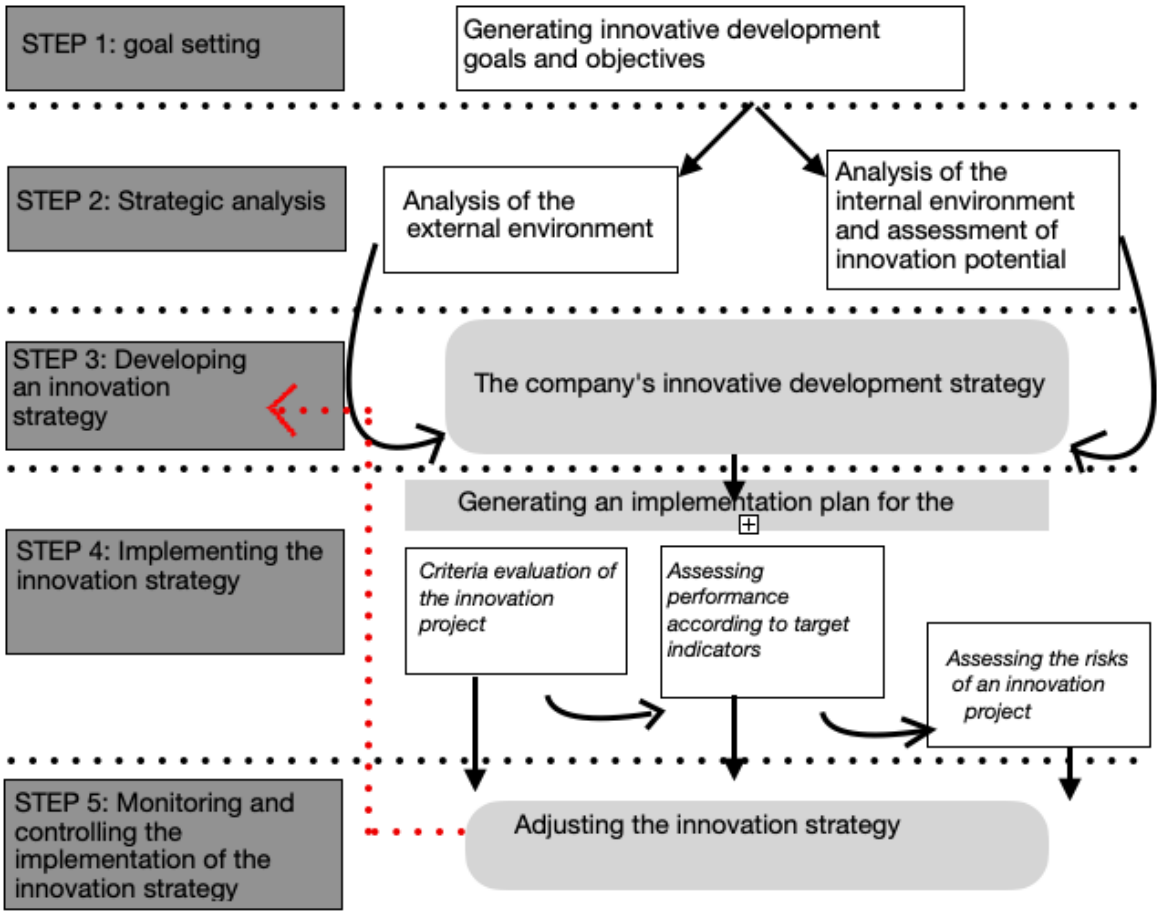

Figure 2: Steps of the strategic management of innovation

The peculiarity of strategic innovation management is the forward-looking orientation of activities, flexible response to changes and timely adjustment of actions based on market competition, strengthening of competitive advantages through the development of intellectual potential of the company. This increases the potential of the company in the management system of a modern organization in the context of innovative development of the global economy [14].

As demonstrated by domestic and foreign experience, there are a variety of methods and models of strategic management. They differ in application, purpose of implementation and the desired result.

Therefore, the transition of the coal industry to a new innovative stage of development requires the formation of a common innovation strategy for all participants, setting a clear goal and giving a clear trajectory for its achievement. The basis of such a strategy could be the idea of transition to the concept of open innovations, interaction of the state, business, domestic and international developers to create and subsequently implement breakthrough innovative technologies.

3.2 Strategic management methods and models

As noted by Bhat A. [1], strategic analysis, or enterprise analysis, is a process that involves examining the business environment of the company in which it operates. Strategic analysis and its tools are essential for strategic management. Such a set is necessary for quality decision making and the smooth as well as effective functioning of the organization [2]. In the continuous pursuit of improvement, organizations should conduct periodic strategic analysis, which in turn will help them determine which areas need improvement and innovation, and which are resistant to change and do not require major interventions.

Strategic management methods can be:

- Graph-analytical (extrapolation, trending, correlation, matrix methods).

- Computational-analytical (balance and normative methods).

- Economic-analytical (methods of linear, nonlinear, and dynamic programming).

- Heuristic (scenario and expert judgement methods).

The literature distinguishes between several methods for analyzing a company's internal and external environment, but Lynch W. notes the following important methods, among which are [13]:

1. SWOT analysis.

2. the PEST analysis.

3. SNW-analysis.

4. GAP-analysis.

Thus, the SWOT analysis is one of the most common tools of strategic analysis, which helps to find out both the strengths and weaknesses of the organization, usually internal to the organization, its opportunities, and threats (usually external), related to the company, project, or business activities. The analysis starts with defining the project objective, then identifies those external and internal factors that are important for the successful realization of a particular objective.

The PEST analysis is responsible for analyzing the external macro environment of the company. It is needed to understand and analyze the impact of the political, economic, social, and technological environment in which the company operates. Moreover, the

PEST analysis can be used to assess market changes, to determine the position of the organization in the market, its competitive advantage, potential, and directions for business development [17].

GAP analysis. It is a method of assessing the differences between the plan and the fact of the enterprise to determine whether business requirements are being met and, if not, what steps should be taken to ensure successful implementation. The gap refers to the space between the current state and the target state [7].

A preliminary prediction of situations that may be the cause of the 'gap' is the main purpose of using the method. This is a positive experience, rather than encountering such a "gap" later without an operational plan.

Thus, using gap analysis, it is possible to find the best and most effective way from the current state to the desired state, and to identify in advance those constraints to timely elimination which may weaken and prevent success on a particular point and/or indicator.

Main categories of gaps:

- Market gaps.

- Product quality, service quality.

- Organizational.

- Business management.

- Information technology [7].

Sequence of actions when performing a GAP analysis:

1. analysis of the company's activities, its main goals, and objectives (the desired outcome of the company's activities).

2. Diagnostics, identification of gaps.

3. Planning of prevention actions for each individual gap.

4. Implementation of corrective actions for the gaps.

5. Monitoring of the set of measures implemented.

The firm's micro-environment is those elements in the firm's environment that are under its control and that it can choose to use under certain circumstances. An analysis of the firm's micro-environment includes:

1. Competitor Analysis (A competitor analysis should provide a brief description of the main competitor companies, their key performance indicators, and consider their strengths and weaknesses;)

2. an analysis of suppliers (analyze the main suppliers to identify the most suitable for the company).

3. consumer analysis (identify and analyze main consumers and their preferences);

4. stakeholder analysis (analysis of the main production/project stakeholders, their attitude towards the activities of the organization; the main ones: investors, customer, project organization, public organizations, population, government) [23].

To find out how perfectly a company works or the process of creating a product is going, the '7s' model can help you find out. The name contains seven key points: strategy, sum of skills, shared values, structure, systems, style, and staff. The elements are divided into two categories: hard (structure, strategy, and systems) and soft (value system, sum of skills, staff composition and management style). By analyzing a company along these dimensions, the model can reveal how well the organization is performing and how its external and internal capabilities are being used. All elements of the model must be analyzed separately within the company and possible contradictions and if there are any, the need to remove them must be clarified. There is a certain sequence in the process of eliminating contradictions which hinder the development and reduce the effectiveness of the unit: first of all, it is necessary to pay attention to the "soft" elements and identify the possibility of change towards compliance with the "hard" and core values of the company; if this is not possible, it is worth making changes in the "hard" elements; the last and emergency variant of changes is the company values. Once all the elements are in balance and the change plan is in place, all that remains is for the company to control the process and evolve in the direction it wants to go.

Of course, for each stage of strategic management there are different tools to analyze the situation. But the ability to undertake universal analysis and use one model across all stages of management will allow the dynamics of change to be considered

and control to be introduced at each stage. The 7s model was taken as the basis for such a task and modified with the Life Balance Wheel model.

The Life Balance Wheel is one of the time management techniques for personality and personal growth that can be used to understand what needs to be changed in life to achieve a goal or the best quality of life. The creator of the "Wheel of Life" or "Success Gene" Paul J. Mayer is still a recognized authority on motivation, time management and goal setting [20]. One of the main benefits of the wheel of life balance is the visualization effect. It has been proven that 70% of people perceive information best with their eyes. Thus, in the life balance wheel a person can quickly understand how satisfied he is with his life, how it is in balance with his life goals and thoughts. The algorithm for the balance wheel is as simple as possible and consists of several steps:

- Define the areas (categories) for further assessment.

- score each area (category) on a 10-point scale; the score is a measure of satisfaction with the criteria.

- to analyze the situation, identify gaps (imbalance) and its causes for each criterion (answer the questions: which areas are imbalanced, which areas are leaders, how to improve the assessment, what actions to take to stabilize/improve, how should the picture look in 1 month, a year and 5 years in your opinion)

- Make an action plan to change the situation, i.e., for each area, make 3-5 concrete actions that will lead to an increase in the grades.

Such a tool is not only used to analyze the situation-now, but also to assess progress.

Returning to strategic management in the mineral sector, it is possible to say that the "wheel of life" can also be applied in this sector. The only thing that would be different from the human life balance wheel option would be the areas/ criteria against which the assessment is made.

Thus, by combining the two tools: the 7s model and the wheel of balance, we obtain a modified 7S model, which has the following form (Figure 3).

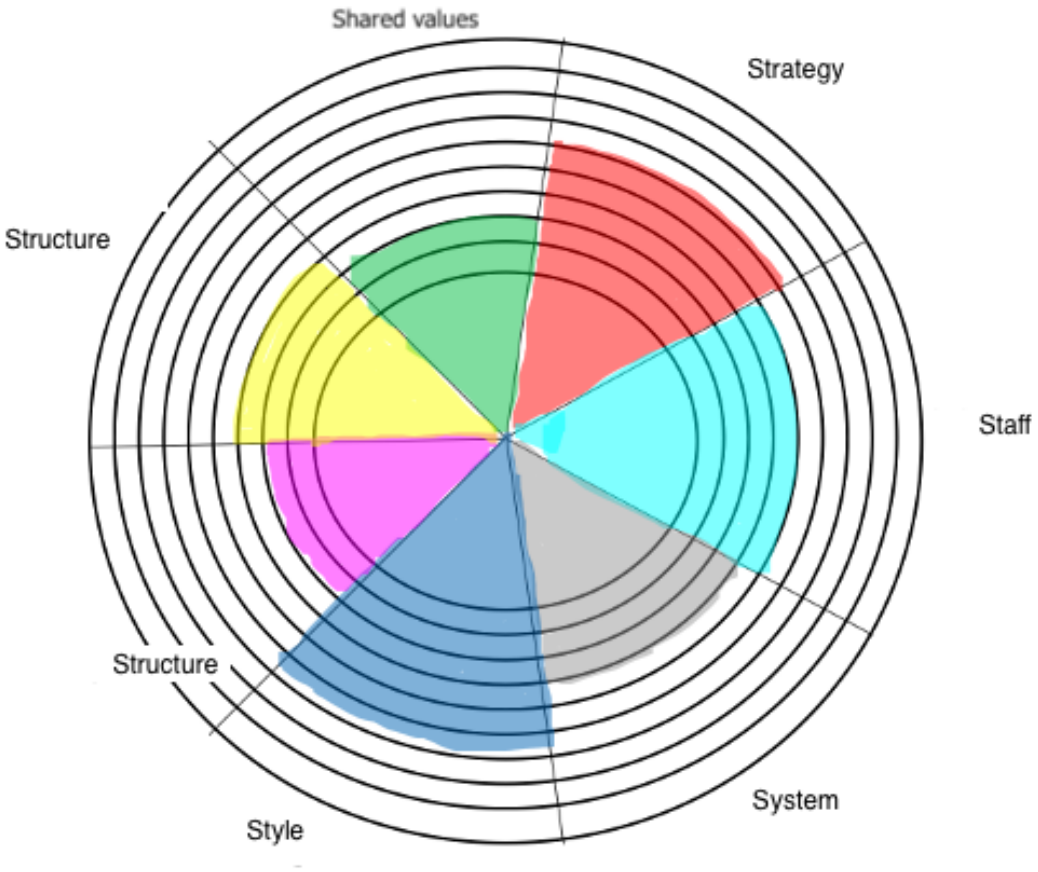

Figure 3: modified 7S model

Figure 3 shows the 7 areas for which an industry/company/business unit can be analyzed. The segments for evaluation have been shaded for clarity of use. The wheel is in imbalance and cannot 'roll', signaling that the industry or company cannot function correctly and efficiently. It is evaluated on a scale of 1 to 10, which in fact corresponds to a percentage scale of 10% to 100%. This model can be used at each stage of strategic planning as an express model in identifying the dynamics of change and readiness, the need for new management, financial and structural innovation solutions. A feature of the model is that each element must be described briefly and clearly, using concise facts to save time.

3.3 Assessing the effectiveness of strategic management of innovation

An important stage in the conduct of innovation activities in the enterprise is the assessment of its expected effectiveness, which gives an understanding to both company managers and investors, whether the work process is going in the right direction or whether the effect of the "project" does not satisfy the interests of both parties and adjustments to innovation activities are inevitable.

The effectiveness of an organizations' innovative development is determined by the ratio of the effect to the resources spent on it. The effect for innovation development is the result of scientific and technological activities (STA). The result of innovative development can be:

- technical effect (this is the emergence of completely new production technologies, rationalization solutions and know-how);

- economic effect (lower employee turnover, higher labor productivity, lower production costs, higher profits)

- resource effect (resource release at the enterprise).

- social effect (increase in the material standard of living of citizens, satisfaction of needs, prevention of imbalance of supply and demand, improvement of workplace conditions and its safety) [26].

Innovative development of the industry/enterprise is closely connected with huge investments. Investment cash flows in this case are aimed at bringing R&D works to the stage of implementation and introduction, as well as the purchase of ready-made technology, which has not previously been used in the enterprise, to achieve a certain planned effect. The size of the investment depends on the industry in which the enterprise is operating, as well as on the complexity of the objective set for the innovation activity of the organization.

To assess the effectiveness of innovation activities, the focus and specificity of the sector/organization should be considered, based on which a list of criteria for assessing the effectiveness of innovation activities is generated. When generating items for evaluation, it is worth relying on specific objectives and based on them, making a choice regarding one or another criterion for assessing effectiveness [26].

The basic set of criteria is divided into several categories. The first category is the organization’s purpose, strategy, and policy. This category is responsible for analyzing the consistency and coherence of innovation activities with the main goals and objectives of the organization, the sustainability of the organization’s position with the changes introduced into it. The second category is external and environmental criteria. This category is responsible for assessing the impact of production on the environment before and after the implementation of the innovation process. The third category is the production criteria category, which shows the magnitude of production costs, the need for additional production capacity, and the need for technological innovation to reduce different types of gaps in the organization. Financial criteria are no less important in assessing the effectiveness of innovation activities; they are the amount of investment made, the initial cost of the innovation project, the payback period, financial risk, and the project's compliance with the criteria of economic efficiency of investment [10].

As it is known, innovation activities spend a large amount of both financial and non-financial resources, such as time, depending on the desired effect. To assess the economic efficiency of innovation activities there are various methods of assessment, often used are the method of assessing the investment attractiveness of the project and statistical methods of efficiency assessment (not using the discounting method).

Statistical methods of efficiency evaluation are divided into absolute and comparative efficiency methods. The first boils down to calculating the ratio of the base period and the current period, while the second is calculated as the difference between the periods, showing the cumulative effect of implementations.

The method for assessing investment attractiveness in innovation differs in that it contains discounting, i.e., bringing future cash flows to the current period. This method contains the following set of indicators, which are necessary to assess the effectiveness of innovative activity of the enterprise:

The net present value (NPV) method, the use of which gives management and investors an indication of the feasibility of a particular innovative implementation; in fact, it is the sum of all cash flows of the project for the current period, if positive - the project is accepted.

- Payback period, which determines the period when the investment made in a project generates a return equal to or greater than its value.

- Profitability index. This is the ratio of the present value of cash income to the present value of cash expenditure at the start of the project8 if the value is greater than or equal to 1 - the project is considered successful, and its implementation is cost-effective.

- Annuity method. Applies when all payments and receipts have the same value over the entire economic period of the investment.

This method of investment appraisal is used when a project of innovation activity has a long-term perspective for implementation and development. In this case, the effect should only be evaluated by using the discounting method, i.e., the reduction of the project value to the current time. The main fact of substantiation of effectiveness is not the introduction of technology itself, but its result after a month, a quarter, a year. That is, the economic effect of creating an innovation is the result of assessing the modernization of the production method for the same unit of production in the base period.

4 Direction for improving the strategic management of innovation in the coal sector

4.1 Assessing the effectiveness of strategic management of innovation

Russia occupies one of the leading positions in the global energy turnover system and is actively involved in global energy trade and international cooperation in this area. The country's position on the global hydrocarbon market is particularly significant. Coal's value in the energy sector is high, and it is one of the main sources of electricity and heat production. It is the large-scale reserves of hard coal that make Russia a promising country for supplying this type of raw material around the world.

Energy security is one of the most important components of a country's national security. Threats are determined by external (geopolitical, macroeconomic, and conjunctural) factors, as well as by the state and functioning of the country's energy sector.

As of 01.01.2021, 179 coal mines in the Russian Federation, including 58 coal mines and 121 surface mines were producing coal [16].

The main strategic document of the mineral resource sector of the Russian Federation is the draft energy strategy of the Russian Federation, which is the development of the most important goals and long-term qualitative guidelines for the transition of the country's economy to an innovative path of development in the field of energy resources.

The baseline forecast field is used to identify priorities and guidelines for the prospective development of the energy sector in all the directions presented in this Strategy.

Using a strategic management tool such as gap analysis and the information provided in the strategic framework, the following is a gap analysis of the coal sector. The analysis is based on key current and projected coal sector indicators to identify strategic gaps. It is necessary to note, that the forecast indicators reflect the program of energy strategy till 2035 and are presented in 2 variants, conservative (provides stagnation of coal consumption in electric power industry of Russia and minimum level of forecast prices in the external market) and optimistic (provides growth of coal consumption in electric power industry of Russia according to the General scheme of location of electric power industry facilities and average level of forecast prices for coal in the external market). The analysis will highlight several strategically important indicators, in our opinion, that most accurately reflect the dynamics of industry development.

Extraction	Year									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	336,7	354,9	352	359	374	385,7	411,2	439,3	441,4	402,1
including coking coal	62,1	72,4	77,3	79,7	83,2	84,6	85	94,2	98,5	88,7
steam coal	274,6	282,5	274,7	279,3	290,8	301,1	326,2	345,1	342,9	313,4
Open pit	236	248,9	250,8	253,7	270,4	282,6	305,5	331	334,1	298,7
Underground	100,7	105,7	101,3	105,3	103,6	104,3	105,4	108,3	107,3	103,4

Table 2: Coal production (actual)

According to Table 2, there was a positive trend in coal production in the Russian Federation until 2020, with production declining by 9% in 2020. To be sure, the coal industry was experiencing some difficulties even before the pandemic due to low fuel prices and partial refusals to import such energy raw materials in a number of European countries. In the context of the coronary pandemic, the situation deteriorated throughout the country's mineral sector and the coal industry was no exception, so in this paper the 2020 figures will be taken as anomalous and bear a minimal impact on the overall analysis of the industry, if the figures have a steep downward trend.

Extraction	Forecast									
	Conservative (minimum)					Optimistic (maximum)				
	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
Total	358	435	459	476	485	358	466	593	659	668
including coking coal	104,4	102	120	136	140	80,2	107	145	149	150
steam coal	250,6	333	339	341	345	209,8	359	449	510	518
Open pit	234	328	346	359	366	186,7	351	447	497	503
Underground	121	107	113	117	120	103,3	115	146	162	165

Table 3: Coal production (forecast)

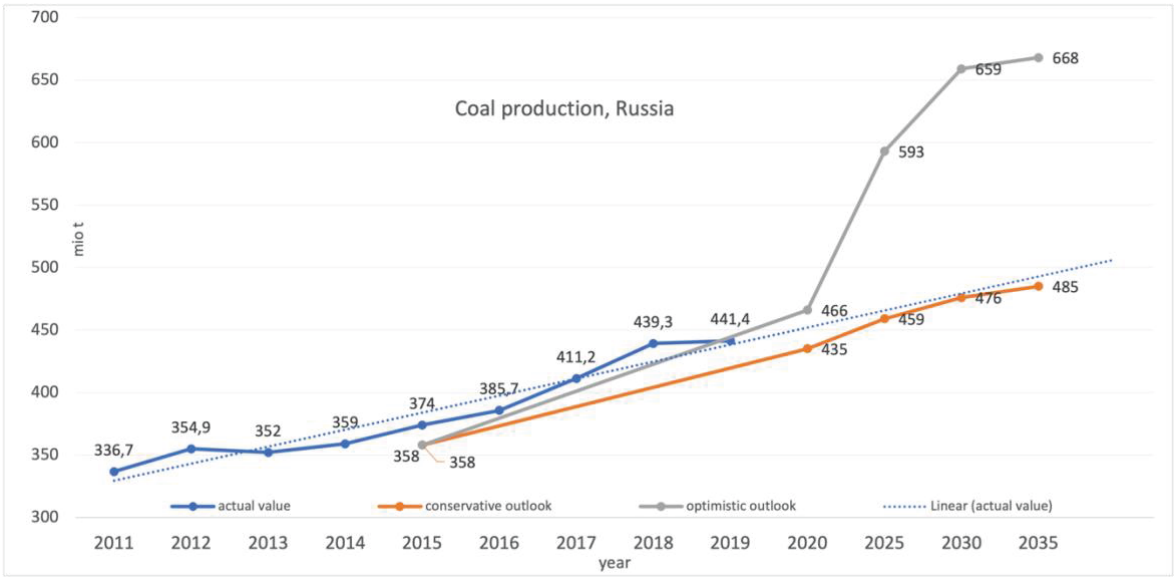

Figure 4: coal production

In Figure 4, a trend line ("linear (actual)") has been plotted for the actual figures to schematically represent the actual amount of coal produced in the future.

Analyzing Figure 4, there are no gaps between the actual figures and the forecast (conservative). Moreover, by 2035 coal production could reach a figure of about 500 million tons per year. There is a positive trend.

At the same time, there is a second scenario (optimistic forecast) in the program where there is a clear gap starting from 2020. Until then, there is no gap; moreover, the optimistic forecast line lies on the line of actual coal production in Russia.

The next indicator is the capacity of enterprises. It characterizes the maximum possible annual (daily, shift) output (or the volume of raw materials processing) in the nomenclature and assortment under the condition of the most complete use of

equipment and production space, application of advanced technology and organization of production [6].

Capacity	Year									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	492,1	405,9	407	407,5	412,4	435	453,7	500	508	505

Table 4: Production capacity (actual)

Capacity	Forecast									
	Conservative (minimum)					Optimistic (maximum)				
	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
	430	495	505	494	536	430	513	615	728	748

Table 5: Production capacity (forecast)

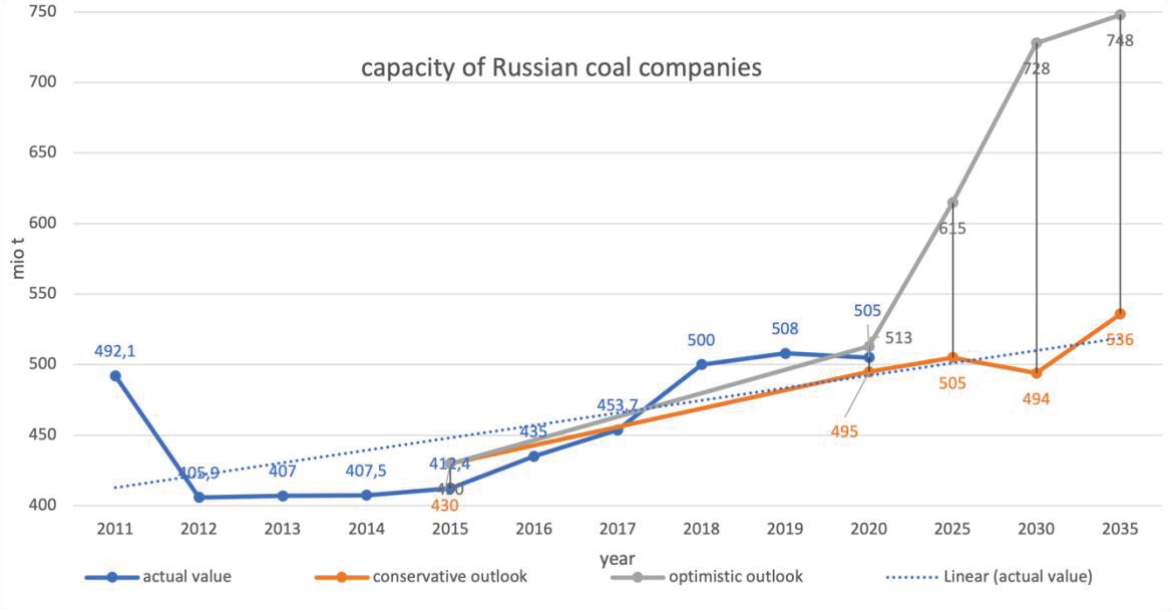

Figure 5: capacity of Russian coal companies

Analyzing Figure 5, it can be said that a strategic capacity gap in coal plants existed from 2015 to 2017. Between 2018 and 2019, the gap did not exist, and the capacity of coal enterprises was higher even than the optimistic energy strategy plan 2035. The gap was due to the inability of the enterprises to purchase new technical equipment to increase the capacity of the enterprises. The plotted trend line for actual capacity until 2035 has a clear gap with the optimistic plan and the conservative one from 2032 to 2035.

The export orientation of the coal business is a key factor in the development of Russia's coal industry.

Coal exports 2020 have increased by 20 million tons to 210 million tons, making the Russian Federation the third largest coal exporter in the world (after Australia and Indonesia) for three years with a 16% share in international coal trade.

Export	Year									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	111	131,3	140	154,8	156	171,4	190,1	210,3	205,4	212,2
East direction	74,1	82,2	81,5	85,3	84	85,4	97,4	99,4	96,4	92,3
Western direction	36,9	49,1	58,5	69,5	72	86	92,7	110,9	109	119,9

Table 6: Actual Russian coal exports

	Forecast									
	Conservative (minimum)					Conservative (minimum)				
	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
Total	145	206	230	242	259	150	226,5	319	379	392
East direction	65	114	151	166	190	70	117,5	207	253	261
Western direction	80	92	79	76	69	80	109	112	126	131

Table 7: Forecast of Russian coal exports

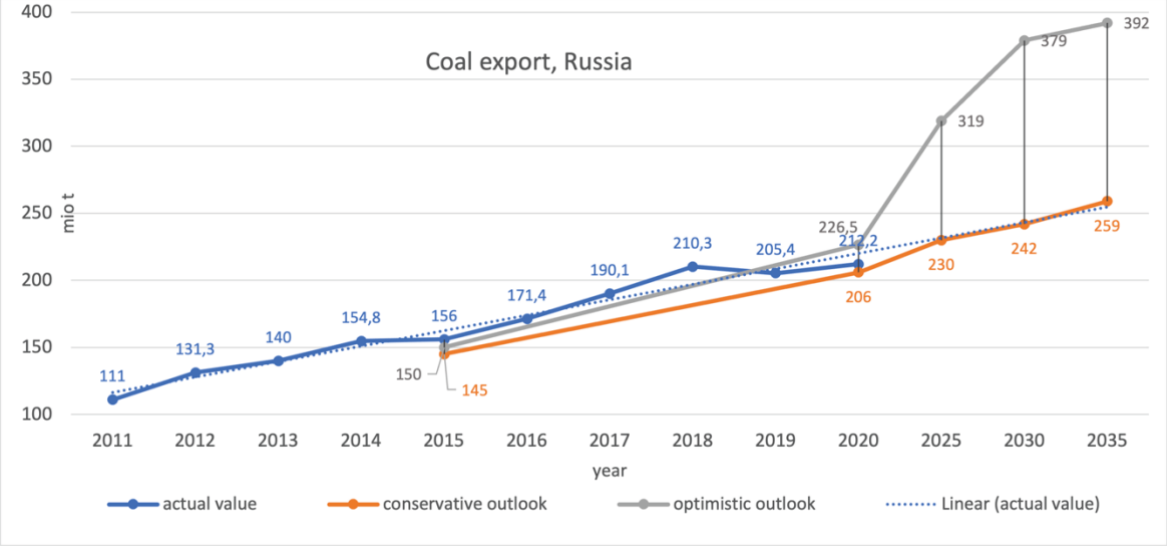

Figure 6: Russian coal exports

From 2015 to 2019, a positive gap can be seen, the actual performance is above the two strategic program scenarios. The export results for 2019 and 2020 are below the optimistic plan, but still above the conservative plan, the trend line indicates that the export figure will gradually increase in the future until 2035, reaching at least the values of the conservative plan. Accordingly, by increasing the share of exports to the Asia-Pacific region, Russian coal exports will increase slightly, but remain at a high global level.

Domestic coal consumption in the country is declining due to the large-scale gasification project, but coal exports are increasing, especially to Asia-Pacific countries. Under the strategic program, eastern supply will increase to 151 million tons of coal by 2025, an increase of 60% over the 2020 results. Demand for coal is expected to increase due to the build-up of production capacity in Indian Ocean countries, which includes India, Vietnam, Malaysia, and Indonesia. Exports may decrease in the western direction, as countries in Europe are increasingly adopting a "CO2-neutral" energy policy.

The direct economic impact of coal mining is not only a cost increase, but also a relief for the transport infrastructure that carries the finished product. The main goal today is to develop a profitable freight structure and innovative environmental and logistics solutions.

Today, the Russian coal industry is predominantly represented by private companies, making investment in the development and expansion of production, processing, and transportation of the energy resource more timely, objective, and large.

It is thanks to the entry of private companies into the coal industry that production levels have increased by 30% in the last 10 years, and production capacity has reached 505 million tons versus 200 million tons. New coal companies are equipped with modern machinery, and mines and surface mines are using the latest technology as much as possible. Table 8 shows the ranking of the main Russian coal companies.

	Coal production, million tons									Market share for 2020
Company	2012	2013	2014	2015	2016	2017	2018	2019	2020	
1. JSC SUEK	97,5	96,5	98,9	97,8	105,5	107,8	110	106,2	101,2	25,2 %
2. Kuzbassrazrezugol	45,2	43,9	43,5	50	44,5	46,3	48,4	47	43,2	10,7%
3. SDS-Ugol	25,2	25,9	28,5	30,0	28,6	27,6	26,8	26,1	29,2	7,3%
4. EVRAZ	17,8	20.3	21	20.5	21.7	23,3	24,2	26,1	20,65	5,13%
5. Mechel	27,8	25,1	22,6	23,2	22,7	20,6	18,8	18,9	16	4 %
Total industry	354,9	352	359	374	385,7	411,2	439,3	441,4	402,1	100%

Table 8: the ranking of the main Russian coal companies

Table 8 shows that SUEK has a leading position in the industry with a 25% share. It is also worth noting that the trends occurring in the coal industry persist for SUEK. That is, this company directly affects the overall performance of the coal industry.

Therefore, further directions of improvement of strategic management of the coal industry innovation activities will be generated on the example of the largest coal company of Russia, SUEK JSC, as a company directly and significantly affecting the coal industry of the Russian Federation.

4.2 Strategic analysis of SUEK JSC

Siberian Coal Energy Company (SUEK) today is Russia's leading fuel and energy company, the country's largest and one of the world's leading coal suppliers. SUEK's open-pit and underground coal mining facilities are in seven regions of Siberia and the Far East. Such tools as SWOT analysis, Porter's five competitive forces, and a modified 7s model (Chapter 2) were used in the strategic analysis of the company.

	Opportunities (O)	**Threats (T)**
	1. Increasing opportunities to raise finance from international capital markets 2. Growing demand from Asia-Pacific countries and India 3. Increased production from already proven coal reserves in the field 4. Government support (strategic programs for coal industry development) 5. Introduction of world technologies and innovations 6. New opportunities for the use of coal	1. Increase in sales of substitute goods (gas/oil) 2. Volatility of world coal prices 3. Tightening of global and national CO2 emission requirements 4. Downsizing of workers in the industry 5. Mine closure
Strengths (S) 1. Advantageous geographical location 2. Flexible sales geography 3. efficient distribution network 4. High industry profitability 5. Strong competitive position 6. Own logistics company - National Transport Company	**S1,2,3- O2** Increase in coal shipments to Asia-Pacific countries **S5-O5** Increase in innovation potential **S4-O4** Use of coal as a resource for windmill production in Russia	**S5-T3** Introduction of new technologies, CO2 control methods **S2-T1** Occupy markets where demand for coal is higher than for alternative energy source
Weaknesses (W) 1.Dependence of profits on world prices 2. High research and development costs 3. Slow expansion of customer base 4 Limited range of products 5. Due to the coronavirus pandemic, there has been a decline in coal production 6. Availability of downtime in the mines. 7. Ventilation problems during drilling and blasting operations	**W6-O5** Increase productive capacity **W2-O4** Cost sharing for greenfield research between the state and a private company **W7- O5** Solving the ventilation problem	**W3-T1** Modern technology for low-emission coal production and use **W6-T5** Reduced downtime through technological innovation

Table 9: SWOT-analysis of SUEK JSC

Table 9 provides a swot analysis of the company, highlighting the company's strengths and weaknesses, as well as its threats and opportunities. As a result, the factors have been compared to each other and the central quadrants of the table suggest possible strategic directions for the company's development and the elimination of existing threats and disadvantages.

Porter's competitive forces analysis serves to analyze the competition in the industry and to elaborate further strategy. The main advantage of using this analysis is a parallel risk assessment, namely the identification of factors that can threaten the development of the business. This method of assessment allows making rational decisions in the field of business development, creating a new strategic direction.

The company's competitive advantages can be identified as follows: a vertically integrated business model with extensive reserves of high-quality coal, profitable mining assets and modern coal preparation plants with a quality control system, highly efficient power plants and an extensive distribution network, a wide range of coal with low Sulphur and nitrogen content, and advantageous geographical location and representation in all key markets. The key recommendations of the analysis were to promote the product to target and interested markets, to increase supply to such markets, and to introduce innovative technologies to maintain leadership in the industry.

4.3 Develop a proposal for a set of actions aimed at the innovative development of the coal industry

To carry out effective innovation activities, an innovation development strategy has been selected, aimed at securing market positions and competitive advantages in the current economy.

Based on the analysis of the coal industry and the strategic analysis of the coal industry leader SUEK JSC, coal export was highlighted as a priority for strategic development in the medium term. Moreover, export of Russian coal is one of the indicators corresponding to the planned indicators of the Coal Industry Development Strategy. Therefore, we have formed the following strategic direction for the development of innovation and improvement of its efficiency:

- Transformation of the logistics segment: large-scale use of innovative wagons for transportation. Transition to the innovative 4-axle self-unloading half wagon with unloading hatches.

Application of innovative wagons for transport

Since the end of 2018, innovative open wagons have been available on the railway. Now, they are mostly used for the transport of sand, crushed stone, cars, steel, and copper ore. In the strategic direction of development of innovative activities, it is proposed to use a 4-axle self-dumping innovative open wagon for carriage of coal on a large scale.

These open wagons have improved technical and operational characteristics (Table 10).

Characteristics	Innovative half wagon	Universal half wagon
Cost, $	48 000	53 000
Lifetime, years	32	22
Body volume, m3	94	88
Lifting capacity, tons	75	69,5
Axle load, tons	25	23,5

Table 10: Comparative characteristics of innovative and universal wagons

Figure 7: Innovative wagon
(Source: [27,28])

The design of the wagon body allows efficient heating for unloading frozen cargo. Ten unloading hatches per section allow the cargo to be unloaded quickly. There is also the option of unloading on tandem wagon tippers installed at the sites of major Russian ports.

Sending heavy trains provides a good opportunity to speed up cargo delivery, reduce wagon downtime, while improving wagon turnover, as well as reducing transport costs and atmospheric emissions.

4.4 Assessing the effectiveness of implementing innovation

At the current stage of the economy, the efficiency of coal industry development depends on the successful operation of the industry's major energy extraction, processing, and transportation enterprises. The contribution of the raw materials sector accounts for about 65% of the Russian economy's total exports. It is known that with an increase in delivery distance of 1000 km, the costs of fuel delivery tend to exceed the costs of their extraction. In this regard, the comparison of the costs of energy resources delivery by different modes of transport is of great importance in the formation of energy tariffs in the energy system [4].

The main reserves of such energy resource as coal are in Siberia, and the main importers of Russian coal are the countries of the Far East. Under these conditions, it is necessary to deliver energy resources from their sources to the end consumers through a wide network of transportation systems. Among the types of transport systems used, pipeline, rail and road are predominant.

The main advantage of the railway method of cargo delivery is the ability to move large and heavy loads over long distances, as well as the stability of operation in almost all-weather conditions. The disadvantages include inaccessibility in some areas, both for the sender and the recipient of the cargo.

Today, the bulk of coal transportation is carried by rail and accounts for about 75% of the rest.

The evaluation of efficiency of introduction of 4-axle self-discharging innovative gondola cars for coal transportation is calculated based on SUEK JSC reporting data as a leader in the coal industry. To assess efficiency, we took the Kuzbass-Vanino coal transportation railway line.

Parameter (using multi-purpose open wagons)	**2020**
Rail shipments from Kuzbass to Port Vanino, mln tons	18,3
Rail freight costs to Port Vanino,	217,14
Depreciation and amortisation, mln $	65,1
Repairs and maintenance	7,98

Table 11: SUEK's open data for calculating the effectiveness of innovative implementation

Also, according to open data, the maximum number of wagons per train for heavy transport in the Far East is 90 wagons, as there is huge free space for the construction of any long receiving and sending tracks there.

Thus, if we use our own universal wagons, we have the following:

The load-carrying capacity of a train of universal wagons:

69.5 tons*90 wagons= 6255 tons in one train or 0.006255 million tons

Number of trains for 2020: 18.3/0.006255=2926 departures per year

Cost per wagon with a capacity of 69.5 tons: $217.14m/tons the cost per wagon with a capacity of 69.5 tons: 217.14 million$/2926 departures/90 wagons=824.9$/ wagon

Then the cost per ton of coal in universal wagons = USD 824.9/ wagon US$/ wagon/69.5 tons= 11.8 $

At linear depreciation of universal wagon has a lifetime of 22 years:

Depreciation per year= $5,268/22= 2,394$/year

When introducing 4-axle self-unloading innovative wagons:

Carrying capacity of a train of innovative open wagons:

75 tons*90 wagons= 6,750 tons in one train or 0.00675 million tons

Number of trains in 2020: 18.3/0.00675= 2,711 items per year

If the cost per wagon remains unchanged at USD 824.9/ wagon

Then the cost of one ton of coal in an innovative wagon= 824.9$/ wagon /75 ton= 10.9 $

At linear depreciation of an innovative wagon with lifetime of 32 years we get:

Depreciation per year= 48510/32= 1515$/year.

Parameter	Innovative half wagon (1)	Universal half wagon (2)	%, (2/1)
Cargo-carrying capacity of the train, tons	6750	6255	+7%
Number of departures per year	2711	2926	-7,9%
Volume of transportation at 2926 departures per year, million tons	19,8	18,3	+8,2%
Cost of transportation of 1 ton of coal, $ per ton	11,8	10,9	-7,6%
Annual depreciation charges per 1 car, $	2394	1515	-36%

Table 12: Comparative table of open wagons for the transport of coal

Thus, when introducing a 4-axle self-dumping innovative half wagon for coal transportation, the consignor (SUEK JSC):

- Increases the capacity of the train by 605 tons for each consignment in the Kuzbass-Vanino direction, which amounts to an increase of 7%.

- When the innovative gondola cars are dispatched 2926 per year, the total freight volume is 19.8 million tons of coal, while the volume of universal gondola cars is 18.3 million tons.

- The heavyweight trains sent to Vanino will increase the carrying capacity at the Komsomolsk-Vanino limiting section and will allow the company to increase the loading volume in the Vanino direction by 1.4 million tons per year.

- The cost of transportation of 1 ton of coal by the innovative open wagon is almost 8% lower.

- The annual depreciation charge is reduced by 36%.

- Synergistic effect of economic, technical, environmental efficiency.

Due to the increased loading capacity and volume of the body the innovative wagon generates more profit during transportation: with the increase of freight traffic by 1.5 million tons a year and the average price of steam coal at 50$/t, it generates +75 million tons a year. The increase in freight traffic of 1.5 million tons a year and an average price of 50$/t for steam coal will result in a +75 million $. The company assumes that exports of coal will increase by 20 million $ per year.

The company assumes that export prices of coal in the Asian market will increase by an average of 9% in 2021 compared to 2020 and will increase by an average of 1% in

2022-2025. This means that the assumed price in 2021 will be 54.5$/t for steam coal. The price in 2021 is expected to be 54.5$/t of steam coal and in 2025 56.7$/t of steam coal. In 2025 it will be 56.7$/t of steam coal.

In fact, in 2020 Russia exported 119 million tons of coal in the Eastern direction (Chapter 4), with Kuzbass-Vanino transporting 18.3 million tons of coal for export, representing 15.3% of total exports in the Eastern direction. By 2025, according to the conservative plan of the Russian Federation Energy Strategy Project till 2035, exports of 151 million tons of coal to Asia-Pacific countries via the Eastern direction is expected, where SUEK's share in physical units is 23.103 million tons.

2025		
Parameter	Universal half wagon	Innovative half wagon
Price per ton of coal, $/t (including company expectations)	56,7	
Transportation volume, mln tons	23,1	
Revenue from transportation, mln $	1309,9	
Cost of transportation of 1 ton of coal, $/t (considering inflation rate for cargo transportation category)	13,6	12,6
Cost of cargo transportation, mln $	314,2	291,1
Number of shipments per year (train =90 wagons)	3693	3422

Table 13: Forecast calculating the cost of transport

Thus, when forecasting the cost of coal transportation by two alternative methods (universal and innovative half wagons) in the direction of Kuzbass - Vanino, it was revealed:

- The cost of transportation by innovative open wagons is 23.1 mln $. The cost of transportation by innovative open wagons is 23.1 mln $ more profitable than the alternative option

- The number of shipments is 271 fewer if the innovative wagon is selected, which significantly reduces railway track congestion and minimizes the environmental impact.

The large-scale implementation of innovative 4-axle self-dumping open wagons has the following advantages: leadership in productivity, increased transport volume through

increased wagon load capacity while reducing the number of train departures, minimized environmental impact, and efficient and timely deliveries.

5 Conclusion

In modern economy one of the most important indicators of coal industry development is competitiveness, which in turn depends on the level of innovative development of production and management.

This research allowed studying basic theoretical and practical aspects of strategic management of coal industry innovation activity based on works of foreign and domestic scientists, besides, it was possible to offer own sequence of actions at strategic management of innovation activity and possible direction of innovation development of coal industry.

As part of the conducted dissertation research, the analysis of existing research on the topic was carried out, the experience of strategic management was studied, based on which the author proposed a system of strategic management of innovation activity, which consists of 6 stages. The dissertation study also revealed the degree of intensification of innovation activity in the Russian coal industry.

To consider, the peculiarities and problems of the coal industry, an analysis of strategic gaps was conducted, as well as a strategic analysis of the industry leader SUEK JSC, directly affecting the coal industry. Based on the analysis, the thesis research proposed a direction for improvement of coal industry innovation activities - transformation of the logistics segment (large-scale application of innovative 4-axle self-unloading wagons for coal transportation). The aim of the direction was to increase the competitiveness of the industry in the global market by increasing the export share of such energy resource as coal.

During work the effectiveness of implementation of the proposed direction was assessed. According to the results of implementation it is possible: to reduce the cost of transportation up to 10%, to reduce congestion on the railways by 7.3%, to minimize the impact on the environment. Thus, we can conclude on the effectiveness of the implementation of the proposed direction to improve the innovation activity of the coal industry.

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5 List of Figures

6 List of Tables