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## CONCEPTUAL APPROACHES TO FORMING A STRATEGY OF INNOVATION-BASED DEVELOPMENT OF THE COAL INDUSTRY\*

**Problem setting.** The innovation-based development is a strategic priority for the economic policy of Ukraine, and the scientific and technological development of industrial enterprises is considered as one of the major problems of the national economy. The accession to the WTO provides for a significant acceleration of innovation processes aimed at increasing production and sales of new competitive products, the expansion of production activities and access to the world markets.

The experience of developed foreign countries convinces that a sustainable socio-economic growth is achieved only on the basis of innovation through the active use of modern scientific research. Only under such conditions the plans on production of high-quality products, resource-saving intensification, increase of production efficiency, products competitiveness assurance on the domestic and global markets are implemented.

One of the determining factors of accelerated economic growth is the activation of innovative activities of enterprises and the transition of Ukraine to an innovative model of the economic development. And "... the dominant of the state policy in relation to the coal industry, as it is noted by the researchers of the Institute of Industrial Economics of NAS of Ukraine, is to enhance the efficiency of coal mining rather than the achievement of its predefined volume at any price" [1].

The proposals offered by the scientists to improve and stabilize the work of the coal industry include: accelerating the restructuring of the industry followed by putting of highly-unprofitable mines out of operation mostly through conservation and modernization of promising mines (the appropriate social protection for the workers released being provided); legal regulation of the state support system for coal mining companies giving it incentive character; establishment of the regulatory and methodological framework for attracting private investment in public sector of the industry through joint development of coal deposits by public and private enterprises; implementation of the anticipa-

tory strategy aimed at creating fundamentally new, innovative tools and technologies necessary for Ukrainian mines to extract the coal from thin problematic layers [1]. According to leading scientists, "Formation of the innovation economy supposes the creation of such an institutional environment where innovation is the main source of maximization of owner's individual incomes" [2, p. 19].

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Innovative economic model is based directly on obtaining new research results and their technological introduction in production, providing thus the GDP growth mainly due to the production and sale of high-tech products and services. Its main purpose is to improve the competitiveness of the national economy through the use of domestic and global scientific, technical and educational potential.

The problem of the development and use of the innovation potential is of special importance, what is explained by the need to address the strategic objectives at the micro and macro levels. At the same time, one can observe an organic entry of the Ukrainian economy into the world economy. Technological development is practically carried out in all industries and contributes to strengthening of the innovative nature of production activities and forming of a special sphere of innovation sphere with specificity and actors characteristic of it. A necessary condition for the formation of the innovation sphere is the determination of the mechanisms of innovation processes development. Now, the innovative activity is considered as one of the most important factors in improving the efficiency of industrial production. Intensification of innovation requires new approaches to the organization of the relationship between all participants of the innovation process, consolidation of certain functions for the relevant authorities.

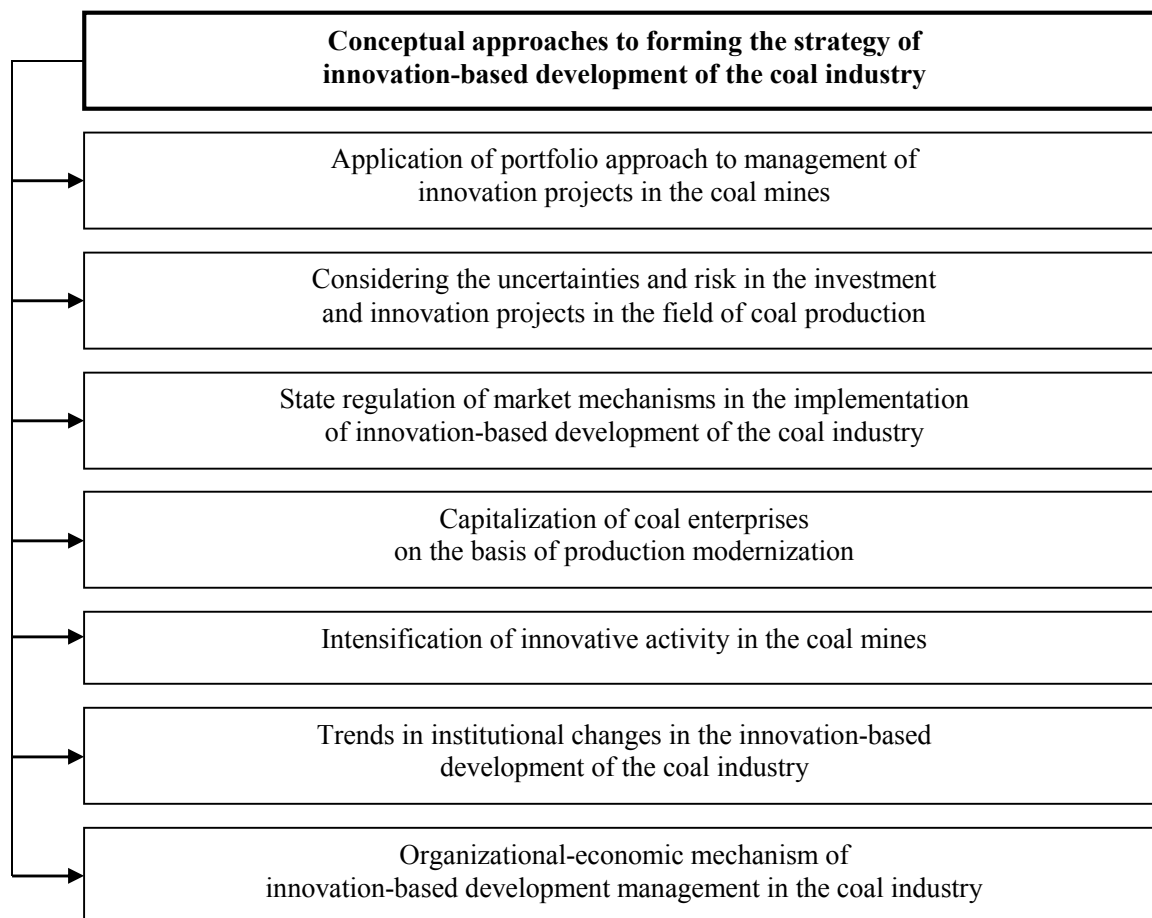
**Analysis of recent researches and publications.**

Problems of formation of the industrial innovation development strategy with consideration of sectoral specificity are studied by many scholars, including O. Amosha, I. Buleev, V. Vyshnevskiy, A. Voronkova, V. Heyets, V. Holyan, T. Grynko, V. Dementyev, A. Zemlyankin, A. Kabanov, T.M. Kachala, Yu. Kindzerskiy, Yu. Kovalenko, L. Kuzmenko, T. Melnyk, K. Pavlov, Yu. Petrunya, L. Rassuzhday, L. Starychenko, D. Cherevatskiy, A. Chukhno, N. Chukhray, L. Fedulova, N. Shchepkina and others. The researches of leading scientists are the scientific basis for the de-

velopment of further scientific-methodological positions, methodological and applied scientific recommendations on forming the strategy of innovation-based development of the coal industry.

**The task** of this study is to justify the conceptual approaches to the formation of the strategy of innovation-based development of the national coal industry.

**The main material of the study.** The study defines conceptual approaches to the formation of innovation-based development of the coal industry (Fig. 1). Let us consider each of these approaches.



**Fig. 1. Directions of forming a strategy for innovation-based development of the coal industry on the conceptual foundations**

The modern theory of portfolio investments was proposed by the American economist and Nobel laureate in economics Harry Markowitz [3], the basic concept of which is reduced to the following: the behavior of capital market players is determined not only by obtaining of the expected return on their investment, but on all the securities, according to the market of capital research in the U.S., which are traded on the market and which are in demand. In certain circumstances, low-income securities may seem more attractive for some investors than high-income ones. Thus, to determine the choice of security the investor is guid-

ed not only by the expected return, but also by a possible risk. The main problem facing the investor is to achieve the maximum level of expected return on investment under a given level of risk and to reduce a potential risk for the expected return. The aim of every investor – more income with less risk.

Basics of H. Markowitz's theory of optimal portfolio are:

indicators of measurement of risk level, proposed first. Earlier, the risk was measured intuitively. The risk is the degree of error in the prediction of income;

investment risk, which can be reduced by the diversification of investments through the increase of the number of components of the investment portfolio. In this case, those portfolio assets are chosen the revenues of which have different focuses and do not depend on the same factors. The relationship between incomes is measured by the correlation coefficient "r". The negative correlation reduces the risk, the positive increases it;

differences between the risk and income of one financial instrument and the risk and income portfolio, which consists of several financial instruments;

choice of assets by a rational investor that provide less risk under a given level of income, or providing a bigger income under a given level of risk.

Thus, a so-called efficient portfolio is formed. In the theory, the line that connects all effective investments is called the limit of effectiveness.

The modern theory and practice of investment management considers an innovation investment project as a set of interrelated activities designed to achieve predefined goals for a limited period of time and under the budget established (plan of cost). This project is an integrated system that requires certain resources for its implementation, i.e., requires the investment of capital, has a specific life cycle, is created and functions in the external environment under the influence of many factors. However, to predict precisely the extent and the nature of impact of each of the factors or their combination on the characteristics of the project is almost impossible, that is, keeping any project is closely connected with the concept of risk.

The need of risk management for the investment project is explained by the specific features inherent in real investment: the scale of investment in facilities that are the complex natural and industrial systems; high capital intensity and constant dependence on natural, technological and human impacts; complexity of the relationship between hazard (risks) and possible damage [4].

Thus, the problem of making investment decisions is reduced to the analysis of the adequacy of the plan of anticipated development of events and probable consequences of its impact on the expected outcome.

The higher the investor assesses the risk of the project, the greater his requirements for the profitability of the project. When making calculations, this is reflected by an increase in the discount rate due to the inclusion of the so-called "risk premium". Obviously, the increase in the discount rate reduces the estimated effectiveness of the investment project. This reduction should take into account possible losses associated with the risk events. Discount rate reflects the profitability of alternative investments, but the above alternative investments are also generally associated with risk. To avoid the double consideration of the risk, the calculations use as a rule risk-free alternative investments

(such as government bonds). Thus, the need to consider the risk in the discount rate generates a new concept – the discount rate that takes into account risk.

Analysis of uncertainty factors in the design, selection and implementation of investment projects is multifaceted and is provided [5]:

technically – by changing the requirements to the content and composition of project materials, as well as through the development of the organizational and economic mechanism that allows to adapt the project to changing conditions;

methodically – through the use of such models of functioning of investment facilities and methods of evaluating the effectiveness of investment projects (methods for calculating the indicators of expected effectiveness), which provide as complete and adequate account of uncertainties as possible;

organizationally – through the creation of new organizational structures, and / or involvement of new members in the project in order to reduce or redistribute the risk.

Based on the analysis of existing approaches of scientific schools and generalization of advanced international experience, the system is offered that includes the measures on the state regulation of innovation-based development of production under modernization, structural economic reforms and intensification of integration processes (Fig. 2).

The world experience shows that the coal industries of leading economies around the world connect their development with innovative modernization aimed at the development and implementation of technologies for complex processing of coal. At the same time, large-scale closure of mines leads to the loss of already disclosed industrial coal reserves and worsening of the social situation in the coal-mining regions. The problems facing the coal industry can be solved due to the mechanisms of companies' capitalization that are reflected in the new long-term coal policy [6; 7].

To give ground in favor of ways of improving the mechanisms of capitalization by increasing the value added in the chain of enterprises value increase on the basis of innovative modernization of the coal production the following is proposed [8]:

using the categories of production (enterprise) capitalization as applied to the development of coal mines;

conducting innovative modernization of coal production to form a chain of the economic value added by switching from goods production for a narrow energy use to getting products new for the industry, i.e., a complex coal processing.

Capitalization as the process involves an extended reproductive value. Capitalization is the first step towards the establishment of production activity, which enables the extended reproduction of all assets avail-



**Fig. 2. Measures of state regulation of market mechanisms in the implementation of innovation-based development of the coal industry**

able at the enterprise. It should be noted that to ensure that the assets are not destroyed, they have to earn the money at least on their own repair. In this sense, capitalization is a minimum condition that ensures a slow but progressive growth (development) of the company.

The indicator of capitalization is the value of (company's) asset – a single asset can be expensive but have a low market capitalization. To solve the problems of the industry capitalization, the factors of capitalization are divided into three levels (Fig. 3):

lower level – the level of the enterprise (micro-level) – a set of different resources, assets, including the ability of individual workers, each of which requires the capitalization of in order to develop;

average – sectoral (meso-level) – the state regulation of capitalization, which is reflected in the policy of the state development of the industry aimed at creating a favorable investment climate and possible getting of credit and other resources;

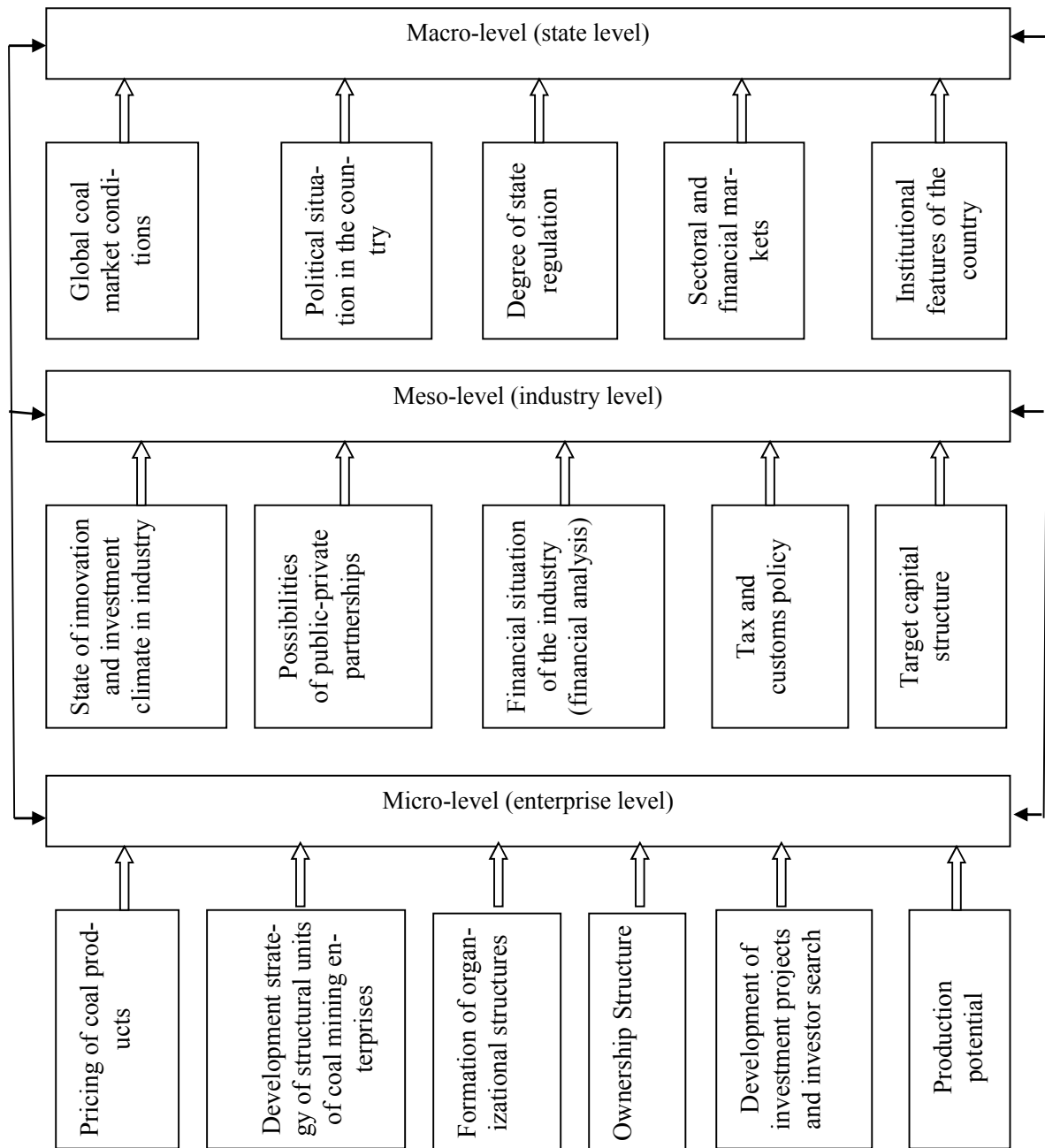
upper level – the integrated needs of the country, society's identity. Manageability of capitalization at enterprise level will depend on whether the society truly determined the integral value priorities of capitalization which are reflected in the level of GDP, government policy, regulatory and legislative framework. To do this, a draft standard of activities with capitalization is formed and given to companies, their resources and assets built in the chain of added value production.

The analysis of the scientific literature shows that despite the presence of a large number of publications on problems of capitalization there are no works dealing with management of capitalization in the coal in-

dustry, which is mainly explained by a high unprofitability of coal-mining enterprises. The solution to this problem lies in the innovative modernization of the industry. Innovation-based development of the coal industry is associated with the improvement of machinery and technology of coal mining, and borrowing of foreign technologies is offered as a source of development of this area. At the same time, the analysis of global trends in innovation-based development of the coal industry is associated with the development and implementation of technologies for complex processing of coal.

Management of the coal and energy sector takes into account the principles of social and economic programming which are characterized by: the need to take into account the nature of the coal-mining regions development caused by the closure of coal-mining enterprises; consideration of a city-forming factor of coal-mining enterprises in order to determine the conditions for operation of the mining areas after working out or cessation of the deposit exploitation; consideration of market conditions for the fuel and energy resources; consideration of investment made by participants of transformations when choosing measures of socio-economic development of the area; need to consider external and converting entities as a single economic complex areas taking into account the economic, social and environmental factors.

To introduce new innovative technologies for complex processing of coal and to create industrial clusters it is advisable to use the following tools:



**Fig. 3. Factors of coal-mining enterprises capitalization [8]**

granting benefits for income tax to the companies which implement technologies of integrated use of mineral resources. The benefit can be granted on a competitive basis and for the project's payback period;

abolition of duty on import of equipment and VAT on it in order to reduce capital expenditures for purchasing the equipment for complex processing of coal;

development of the credit mechanism for the companies which wish to introduce innovative technologies;

development of the organizational-economic mechanism of providing public money and government guarantees, creation of budgetary environmental funds,

where the implementation of these technologies will allow to obtain a significant environmental and economic effect.

Modernization of technological processes occurring at coal-mining companies on the basis of complex processing of coal will increase: the investment attractiveness of coal-mining companies because of the prospect for making profit in a shorter period; capital funds through the implementation of additional products; capitalization of coal-mining companies, coal companies due to obtaining of additional economic value and their inclusion in the chain of values.

The institutional environment is one of the main factors that determine the dynamics and nature of the



development of certain economic sectors, in particular the coal industry. The current strategy of rational use of mineral resources is not based only on market opportunities. Even in the developed countries, the market mechanism does not provide solution of the problem of strategic development of mineral resources use, environmental protection, sustainable economic security. So, the government regulation is necessary.

Institutional changes are considered on the basis of the total life cycle of any system. For example, in Ukraine, where there was a phase of liquidation, disappearance of old institutions the phase of the emergence of new institutions is determined, the stage of institutional designing. When creating new institutions, one can use both a government forced choice of a new institution through the mechanism of the political market and the voluntary adoption of new factors by coal-mining companies through the mechanism of market institutions, which should be created.

In Ukraine, there are still no large-scale institutional innovations that the state could carry out because the transition to the market means only price liberalization and the introduction of private ownership of production assets (means of production).

However, the real input of price liberalization occurred long before the adoption of the normative document that would formalize, allow punishment without a promise for the things which for a few years were a normal practice for coal-mining companies. They are a barter exchange, contract prices, and a black coal market, etc. As for the introduction of private ownership, in fact, the privatization is again becoming a formalization of property distribution that already took place in the pre-reform period [10].

It may be noted that in the country as a whole and in the coal industry, in particular, there is a market of different institutes of exchange that has been developed and operates, i.e., the market in the equilibrium stage:

a small proportion of the civilized market (with a government guarantor of property eligibility and their changes), while its predominant part is distributed between private clan agreements and nationalized clan agreements (with a government guarantor that acts selectively, i.e., not on the basis of the law but on the basis of individual decisions made by the executive).

At present, the codes and standards for mining operations which concern all aspects of coal mining are revised, including those from the exploration to closure of enterprises and settlement of issues in the further stage. However, there is a need to solve the problems concerning the issuance of licenses for mining with clear requirements for the provision of data and reporting by the entities, the assurance of full transparency in this and all subsequent stages of the coal companies operation.

In the coal sector, to some extent, the transformation of property relations is carried out on the basis

of privatization of state-owned enterprises, creation of integrated structures [11], but the institutional problems concerning the impact changes of the organizational methods on sectoral restructuring and socio-economic development of mining regions should be still solved, as well as the transition to market regulation on the basis of the principles of production efficiency, etc. [12, 13]. There are still unresolved issues concerning structural changes, namely: the technical upgrading of production, replacement of physically and morally obsolete fixed assets, ecologization of production, transition to advanced and resource-saving technologies, reduction of negative anthropogenic effects on the environment of coal enterprises, especially coal mines, which are in the stage of liquidation [14].

The institutional basis for functioning of the organizational and economic mechanism of enterprise's innovation-based management should provide funding, material and personnel support in the sphere of production, labor organization, marketing services [15, 16, 17].

The economic mechanisms of activation of the innovation processes of coal production include: the restructuring of payables to budgets and off-budget funds by increasing debt maturities; cancellation of penalties; reduction of interest by restructuring; partial or full reimbursement of interest paid on bank loans from the budget.

To stimulate the innovative activity the following tax instruments are used: a special tax regime for coal enterprises implementing innovation; exception of expenses for research and experimental developments related to primary production activities from the amount of taxable income; exemption from taxation of coal enterprise's funds invested in risky projects; providing investment tax credits to companies investing in their modernization and measures on rational use of energy; introduction of tax incentives for companies that conduct R & D: the introduction of tax privileges for the cost of patents; income tax reduction; writing-off R & D costs on the cost of coal products; tax credits for investment in research and development; tax credit to increase R & D expenditure; use of credit insurance system (guarantee a return to 50% of loans for 15–20 years); providing companies with subsidies for research and development of new products or technological processes (e.g., up to 40% of the cost for innovation); targeted free subsidies to the enterprises that are mastering new technology (for the purchase and installation of new technological equipment, implementation of improvements for up to three years, etc.); subsidies for small-sized industrial enterprises to purchase and lease of software and computer equipment (up to 25% of the cost).

The ways of personnel support proposed for the innovation-based development of the coal industry include: the renewal of the material and technical base

for the sectoral science and training of highly-qualified personnel on the basis of changes in the national legislation on the transfer of the cost from a taxable income; increase of public demand for postgraduate and doctoral studies of technical professions; ongoing training of staff in search of new ideas, research and new technologies.

In the time of the formation of the scientific and technical infrastructure in modern Ukraine it is expedient to:

create cluster structures the operation of which can accelerate the processes of the economic growth, boost the innovative activity and the level of region competitiveness; apply intersectoral cooperation of companies included in the cluster, which promotes job growth, the spread of advanced technologies and the flow of investments into the national economy;

establish the industrial and technological infrastructure (centers for collective use of high-tech equipment, technological clusters, innovation and technology centers and technological parks, innovation-industrial complexes);

introduce consulting activities (foreign economic consulting, technological, marketing consulting, technology transfer centers, consulting in the field of economics and finance);

create a financial infrastructure (guarantee structures and funds, budgetary and extra-budgetary funds for the technological development, venture funds);

form the infrastructure for personnel training (experts in the field of technology management, personnel in innovation);

develop an information infrastructure (regional information networks, resource agencies to support small business, the state system of scientific and technical information).

One of the ways of organizing the form of managing the scientific work in the coal industry is an integrated scientific and technical center "Vuhleinnovatsiya", the implementation of which requires coordinated actions of managers of existing research institutions and their labor groups. Creation of the Center is the first step towards reforming the management of a sectoral science with involvement of research and design institutions.

The effectiveness of the organizational and economic mechanism for managing the innovation-based development of an industrial enterprise is based on: the consistency; involvement of all levels of enterprise's management cycle in the innovation processes; integrity and unity of the management system; formation of long-term fundamentals of innovation policy at the enterprise; introduction of standards system with application of adequate economic sanctions for non-compliance of established requirements; responsibility of enterprise's services for achieving the end result of innovation-based development, increasing interest of

the employees in proactive and strict performance of their duties; adequacy and efficiency of reflection of the mechanism functioning and accounting a maximum number of factors of impact which form the quantitative values of interim and final economic indicators of enterprise's innovation-based development.

The defined directions of innovation-based development of the coal industry will promote the formation of innovation infrastructure, enhancement of the economic, financial incentives and public funding of priority measures to boost innovative activities, creation of an information environment; improve the scientific and regulatory support to the innovation sector of the industry.

**Conclusions.** Strategy of innovative activities of any industry is a coordinated set of innovative solutions that initially affect the activities of the company (country, industry) and have a long and sometimes difficult to reversible effects. Innovations are of great importance for the country because they determine its potential for a long term development. As a result, these innovations become a strategic driver of the economic growth both of business and the country. In Ukraine, where the coal industry is unprofitable and is characterized by severe and extremely difficult geological conditions of work, the creation of the efficient mechanism to stimulate innovation with the optimal combination of 'automatic' market and direct state regulators is of great importance. In this relation, a considerable work is carried to upgrade and develop the regulatory framework and methodological for achieving a scientific and technological progress in market conditions, taking into account specifics of the industry.

Analysis of the literature shows that there is a two-way relationship between the economic growth and improvement of institutions. In the process of structural economic modernization the institutional changes should be taken into account. If the institutional trajectory is consistent with the resources, technological and institutional constraints, has the mechanisms that provide changes in institutions and prevent the emergence of institutional traps – it will be socially perspective.

The main objectives of the strategy of innovation-based development of the domestic coal industry can be the increase of coal production, enhancement of productivity and safety, improvement of coal quality and reduction of its cost. Proceeding from these objectives, the strategy of innovation-based development of the coal industry should be based on the implementation of the following priority directions:

technical re-equipment of coal production, including the development of technologies for underground mining with a preferential use of mechanized complexes of a new technical level in the stopes, the industrial utilization of coal mine methane;

implementation of measures to enhance the potential and role of the sectoral science according to scientific-technological, design and experimental directions; renewal of the material and technical base of the sectoral science and training highly-qualified scientific personnel.

Conceptual approaches to forming a strategy of innovation-based development of the national coal industry are contained in the current concepts of the development and reform of the industry. The problem is to establish an effective mechanism of their implementation. The use of the above organizational and economic mechanism will provide a comprehensive solution of problems concerning the innovation-based development of the coal industry.

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### **Драчук Ю. З., Рассуждай Л. М., Трушкіна Н. В. Концептуальні підходи до формування стратегії інноваційного розвитку вугільної промисловості**

У статті обґрунтовано концептуальні підходи до формування стратегії інноваційного розвитку національної вугільної промисловості, які полягають у визначенні основ застосування портфельного підходу до управління інноваційними проектами на підприємстві; врахуванні чинників невизначеності й ризику при оцінці інноваційних проектів; державному регулюванні ринкових механізмів у здійсненні інноваційного розвитку вугільної галузі; доведенні доцільності капіталізації вугледобувних підприємств за рахунок модернізації виробництва; активізації інноваційної діяльності на вугільних



підприємствах; тенденціях інституціональних змін в інноваційному розвитку вугільної промисловості; удосконаленні організаційно-економічного механізму управління інноваційним розвитком вугільної промисловості.

Визначено, що стратегія інноваційного розвитку вугільної галузі має базуватися на реалізації таких пріоритетних напрямів: технічне переоснащення вугледобувного виробництва, включаючи забезпечення розвитку технології підземного видобування з переважним використанням у очисних вибоях механізованих комплексів нового технічного рівня, промислову утилізацію шахтного метану; здійснення заходів з підвищення потенціалу та посиленні ролі галузевої науки за науково-технологічними, проектно-конструкторськими і дослідно-експериментальними цілями; відновлення матеріально-технічної бази галузевої науки та підготовка наукових кадрів вищої кваліфікації.

*Ключові слова:* концептуальні підходи, стратегії, інноваційний розвиток, вугільна промисловість.

**Драчук Ю. С., Рассуждай Л. Н., Трушкина Н. В. Концептуальные подходы к формированию стратегии инновационного развития угольной промышленности**

В статье обоснованы концептуальные подходы к формированию стратегии инновационного развития национальной угольной промышленности, которые состоят в определении основ применения портфельного подхода к управлению инновационными проектами на предприятии; учете факторов неопределенности и риска при оценке инновационных проектов; государственном регулировании рыночных механизмов при осуществлении инновационного развития угольной отрасли; доведении целесообразности капитализации угледобывающих предприятий за счет модернизации производства; активизации инновационной деятельности на угольных предприятиях; тенденциях институциональных изменений в инновационном развитии угольной промышленности; совершенствовании организационно-экономического механизма управления инновационным развитием угольной промышленности.

Определено, что стратегия инновационного развития угольной отрасли должна базироваться на реализации таких приоритетных направлений: техническое переоснащение угледобывающего производства, включая обеспечение развития технологии

подземной добычи с преимущественным использованием в очистных забоях механизированных комплексов нового технического уровня, промышленную утилизацию шахтного метана; осуществление мероприятий по повышению потенциала и усилению роли отраслевой науки по научно-технологическим, проектно-конструкторским и опытно-экспериментальным целям; обновление материально-технической базы отраслевой науки и подготовка научных кадров высшей квалификации.

*Ключевые слова:* концептуальные подходы, стратегии, инновационное развитие, угольная промышленность.

**Drachuk Yu. Z., Rassuzhday L. M., Trushkina N. V. Conceptual Approaches to Forming a Strategy of Innovation-Based Development of the Coal Industry**

The paper substantiates conceptual approaches to forming a strategy of innovation-based development of the national coal industry, which consist in defining the basis for using a portfolio approach to the management of innovation projects at the enterprise; consideration of uncertainty and risk factors when evaluating innovation projects; government regulation of market mechanisms in the implementation of innovation-based development of the coal industry; prove of coal-mining enterprises' capitalization by production modernization; boosting innovative activities in the coal mines; institutional changes in the innovation-based development of the coal industry; improvement of the organizational and economic mechanism for managing the innovation-based development of the coal industry.

It was determined that the strategy of innovation-based development of the coal industry should be based on the implementation of the following priority directions: technical re-equipment of coal production, including the development of underground mining technologies with preferential use of mechanized complexes of a new technological level in the stopes, the industrial utilization of coal mine methane; implementation of measures to enhance the role of the sectoral science for scientific and technological, academic and experimental purposes; renewal of the material and technical base of the sectoral science and training highly-qualified scientific personnel.

*Keywords:* conceptual approaches, strategy, innovation-based development, coal industry.

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