

REVIEW

of the domestic scientific supervisor to dissertation work by Zhai Xuan, having the title "Current state and prospects of cooperation between Kazakhstan and China in the natural gas sector", presented for the Degree of Doctor of Philosophy in the educational program 8D04101 – World Economy

Relevance of the research.

The relevance of the research is due to the increasing role of energy cooperation between Kazakhstan and China in the context of global energy transformation.

Natural gas is an important resource necessary for the economic development of Kazakhstan and China, which makes gas trade an important form of cooperation for long-term sustainable development. Currently, Kazakhstan's unique geographical advantages and its rich energy resources contribute to deepening cooperation with China in the field of natural gas and contribute to the efficient and sustainable development of the regional economy. Kazakhstan needs to take full advantage of Chinese investments to expand its own gas infrastructure in order to increase gas exports and achieve rapid economic growth. For China, which is one of the largest importers of natural gas in Asia, the increased demand for natural gas is dictated by population growth. The international cooperation mechanism provides a new platform for promoting cooperation in the field of natural gas, as well as increasing the level of investment. Therefore, gas cooperation between the two countries has formed an integrated industry chain consisting of production, pipeline transportation and processing, which demonstrates good prospects for further expansion of cooperation in the gas sector.

The topic of the dissertation is directly related to the implementation of priority state strategies and programs, such as the Strategy "Kazakhstan-2050", the Concept of transition to a "green economy", as well as the National project to attract investment and develop export potential. It is consistent with the priorities of scientific and technological development aimed at improving energy efficiency, integration into the global economy and the development of international cooperation. The practical significance of this dissertation lies in the formation of scientifically based recommendations for strengthening the energy partnership between Kazakhstan and China within the framework of sustainable development and regional integration.

Considering the above, it should be concluded that the presented scientific research is very relevant, has undoubted practical and theoretical significance for the development of fundamental economics and sustainable economic development of Kazakhstan.

Main scientific results.

The scientific novelty of the dissertation is illustrated by the conceptualization, modeling and practical solution of a number of empirical problems related to cooperation between Kazakhstan and China in the natural gas sector.

The dissertation presents the following scientifically based practical and theoretical results, the combination of which is of fundamental importance for the development of economic science:

1. Diversification and clarification of the interrelationships between economic development and energy structure in Kazakhstan and China, which helps determine the importance of cooperation that considers the economic environment, industrial integration, and sustainable development.

2. It has been determined that economic growth in Kazakhstan and China, population growth, and increased energy consumption in China have a significant positive impact on the level of natural gas trade, which is revealed by regression analysis and determines the potential for gas cooperation between Kazakhstan and China.

3. Based on a structural analysis of cooperation projects between Kazakhstan and China in the natural gas sector, the main problems in gas cooperation were identified, including the similarity of projects, insufficient investment support, and inadequate natural gas infrastructure.

4. Models of the natural gas supply chain from Kazakhstan to China were evaluated, including the Stackelberg game model and the Cournot competition model. Based on game theory, a number of mathematical models for natural gas transportation were developed, and opportunities for increasing Kazakhstan's competitiveness were identified.

5. Practical recommendations were proposed to stimulate the effectiveness of Kazakhstan-China cooperation in the natural gas sector, including investment assessment, localization of operations, and a communication platform. The introduction of low-carbon technologies, the use of coalbed methane, and the gas chemical industry were proposed as possible areas of cooperation in the gas sector.

The candidate conducted comparative analyses of the current development of the gas industry in Kazakhstan and China using quantitative methods (production, consumption, infrastructure distribution); assessed China's import potential and Kazakhstan's export potential.

The proposed practical recommendations and organizational and economic model are being implemented at international scientific conferences, confirming their scientific and practical validity.

Theoretical and practical significance of the research.

The dissertation research is logically structured, has internal unity and scientific novelty. Zhai Xuan used formal logic methods competently and correctly to substantiate the results, conclusions, and recommendations. The conclusions of the dissertation are consistent with the main content of the research and the results presented in the economic literature.

The analysis of the content of the dissertation shows that the proposed scientific positions, results, key findings and conclusions are justified, reasoned and reliable. They are confirmed by the solution of the tasks set in the research, based on the analysis of fundamental theoretical, methodological and applied scientific works of Kazakhstani and foreign scientists engaged in research; extensive use of legislative acts, government strategies and programs collected in

the course of the research; the use of various economic and statistical methods of data processing; approbation of the conclusions and results of the research at international and national conferences, publication of the main provisions of the research in the open access.

The main results of the research are reflected in 20 scientific publications prepared both in collaboration and individually, including 6 articles in the journal included in the international citation database Scopus, 4 articles in publications recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan and others.

The publications fully reflect the content of the thesis, including theoretical provisions, methodological approaches, modeling results and analytical conclusions, as well as practical recommendations proposed by the author. Therefore, the PhD student's publication activity ensures sufficient openness, verifiability, and recognition of the scientific results obtained.

In the course of her dissertation research, Zhai Xuan demonstrated a high level of independence, analytical thinking and scientific argumentation. Her personal contribution to the development of the problem under study related to cooperation between Kazakhstan and China in the natural gas sector.

The PhD student conducted a deep theoretical analysis and systematization of the existing concepts of integration cooperation and economic and mathematical analysis, developed an author's interpretation of its essence, principles and factors based on economic and mathematical models. An important contribution was the comparative analysis of cooperation between Kazakhstan and China in the natural gas sector.

A key element of the scientific contribution is the development of an organizational and economic mechanism to stimulate investment cooperation between Kazakhstan and China in the natural gas sector, including government regulatory instruments, financial and credit support measures and institutional initiatives.

Within the framework of the empirical part of the research, the PhD student conducted a detailed comparative analysis of the current development of the gas industry in Kazakhstan and China using a quantitative method (production, consumption, distribution of infrastructures); China's import potential and Kazakhstan's export potential were assessed.

The clarity of the PhD student's scientific position is expressed in the logical validity of the formulated conclusions, strict adherence to the research methodology and consistent justification of the proposed recommendations. All the results obtained are substantiated on the basis of qualitative and quantitative analysis, which is confirmed by the extensive use of statistical methods, the regulatory framework and the approbation of materials in various scientific forums.

In conclusion, the dissertation of Zhai Xuan is a scientifically based, practice-oriented study in which the PhD student demonstrated independence, a high degree of mastery of economic tools and a clear understanding of the problem under study, which indicates the author's formed scientific position. While

completing this dissertation, the author proved herself to be a responsible, purposeful and hardworking researcher.

In the process of study, Zhai Xuan acquired deep knowledge in the field of economic analysis and strategic planning, developed critical thinking skills and scientific justification of decisions. The applicant has successfully mastered and applied a wide range of modern methods of economic research, including economic and statistical analysis, comparative analysis of foreign experience, modeling methods, as well as factor analysis. An important achievement is the application of a systematic approach methodology in cooperation between Kazakhstan and China in the natural gas sector.

The scope of the research covers a detailed analysis of natural gas transportation and identified opportunities to increase the competitiveness of Kazakhstan. Proposals were developed to improve the efficiency of cooperation between Kazakhstan and China in the natural gas sector, including increased investment and innovative management approaches; coalbed gas extraction and the gas chemical industry were proposed as mutually beneficial cooperation.

This dissertation is the result of a deep and comprehensive study of the mechanisms of economic incentives for investment cooperation. The results obtained and the proposed recommendations not only make a significant contribution to the scientific understanding of this problem, but also have practical value for the formation of an effective state policy to support the effectiveness of cooperation between Kazakhstan and China in the natural gas sector.

The dissertation research is a scientific work having an internal unity. The content of the dissertation corresponds to the logic of the presentation and fully reveals the research topic, the structural elements of the dissertation do not raise objections. The work is designed in accordance with the requirements for the preparation of dissertations. The results obtained during the research are reliable and well-founded. The reliability and validity of the research results are determined by a critical understanding of existing economic concepts, the use of official statistics, methods of scientific analysis and research. The results are presented in graphical and tabular form, which greatly facilitates their perception and confirms their reliability and accuracy. In this regard, the validity of the research methodology and its relevance to the problem raised are undoubted.

The completed dissertation "Current state and prospects of cooperation between Kazakhstan and China in the natural gas sector" by Zhai Xuan is a completed study, fully meets the qualification requirements for PhD dissertation, and is recommended for public defense for the degree of Doctor of Philosophy (PhD) on the specialty 8D04101 – "World Economy".

Scientific supervisor,

**Honored Worker of Kazakhstan, Honorary
Academician of the National Academy of Sciences of
the Republic of Kazakhstan,**

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