

**AP14872003 “Improving the geological and economic assessment of mining and metallurgical enterprises in the context of their compliance with international trends and digital reform” – p.m. Issatayeva F.M.**

***Relevance***

The relevance of the research is driven by the increasing role of the fuel and energy complex in emerging markets for the decarbonization of the economy. In the context of this energy transition, the transformation of industrial enterprises in Kazakhstan through the application of digital technologies has become crucial, as they are an essential tool for enhancing efficiency amidst growing competition in the global mineral raw materials market. The authors' long-term research has identified the most significant factors that limit enterprise activities in this direction. External factors include increasing risks related to information security, preventing the leakage of geological and production data, and investment and innovation risks for sustainable development (competition level, technology and capital availability, legislative development, and economic uncertainty). Internal factors involve difficulties in changing internal production processes and a low technical production level, expressed in insufficient digital maturity of current processes, low levels of development in automated technological process control systems, challenges in integrating new technologies into internal production and organizational processes, low investment returns, and limited liquidity. There is a lack of new competencies in mastering digital technologies, managing innovative projects, building partnerships, and strengthening international positions. Despite the implementation of new technologies and security measures, geodynamic risks in mineral extraction continue to grow.

***Objective of the project***

Based on the factographic database of geological-economic indicators and characteristics of the deposits of LLP “Corporation Kazakhmys”, the objective is to develop an information-analytical system for the geological-economic assessment of the enterprise through the digitalization of key business processes. This system should enable the modeling of production situations, improve efficiency, and enhance management transparency.

***Expected and Achieved Results***

***For 2024***

The algorithms for the "Information and Analytical System" program have been systematized. The IAS for geological-economic assessment of LLP "Kazakhmys" can be used for collecting, storing, analyzing, and visualizing data related to geological resources and the economic activities of the company. A conceptual information and analytical system for the geological-economic assessment of LLP "Kazakhmys Corporation" has been developed. This can help the company make more informed decisions regarding exploration, extraction, processing of minerals, and data handling.

Work on the systematization and development of management decisions to strengthen the financial and economic condition and increase the investment attractiveness of LLP “Kazakhmys Corporation” is also ongoing. The use of a CRM system for managing customer relationships and the implementation of an ERP system for managing business processes is underway.

A number of management decisions aimed at strengthening the financial and economic condition and increasing the investment attractiveness of LLP “Kazakhmys Corporation” have been systematized and developed.

1. The algorithm for the “Information and Analytical System” program has been developed. Conceptual models for the information and analytical system of geological-economic assessment for LLP “Kazakhmys Corporation” have been developed.

2. A series of management decisions for strengthening the financial and economic position and boosting the investment attractiveness of LLP "Kazakhmys Corporation" has been developed.

In addition, as part of the implementation of this project, the main prerequisites for creating the information and analytical system have been substantiated. A system of indicators for the geological-economic assessment of the enterprise was developed in accordance with the KAZRC system and the international GRI standards. An assessment of the international competitiveness of LLP "Kazakhmys Corporation" was carried out using the cash cost calculation method.

In 2024, the results of the research were published in 2 articles indexed in Scopus with at least 50 (fifty) citations and 2 articles in CQASHE-recommended journals:

1. F. M. Issatayeva, G.M. Aubakirova, A.D. Maussymbayeva, L.I. Togaibayeva, V.V. Biryukov, E. Vechkinzova / Fuel and Energy Complex of Kazakhstan: Geological and Economic Assessment of Enterprises in the Context of Digital Transformation / Energies 16(16),6002, pp. 2-23) DOI 10.3390/en16166002. Percentile 82.
2. Issatayeva F.M., Aubakirova G.M., Maussymbayeva A.D., Yessendossova A.N. Mining sector transformation: the experience of emerging economies. "Eurasian Mining" 1-2024, pp. 40-45, Percentile 59; DOI: 10.17580/em.2024.01.10

One article has been submitted to Scopus with at least 50 (fifty) citations:

Issatayeva F.M., Umirova G.K., Zakaria M.K., Abdullina A.K. Complex geological interpretation of geophysical data based on 2.5D volumetric modeling. Eurasian Mining. 1-2025. (reference attached) (in print) Percentile 59 (in English).

- 2 articles CQASHE-recommended journals:

1. F.M. Issatayeva, G.M. Aubakirova, A.D. Mausymbaeva, R.K. Madysheva / Evaluation of the efficiency of digital solutions in the mining sector / "Proceedings of the NAS RK. Series of Geology and Technical Sciences", 2024, 2(464), pp. 91-113. DOI: 10.32014/2024.2518-170X.396.

DOI10.32014/2024.2518-170X.396. <http://www.geolog-technical.kz/assets/20242/91-113.pdf>.

2. G.M. Aubakirova, F.M. Issatayeva, S.K. Mazhitova, L.I. Togaibayeva "Decarbonization of the Mining and Metallurgical Sector: The Experience of Kazakhstan" // "Turan" University Bulletin Scientific Journal, 2023, No. 4(100), pp. 54-69. DOI: 10.46914/1562-2959-2023-1-4-54-69.

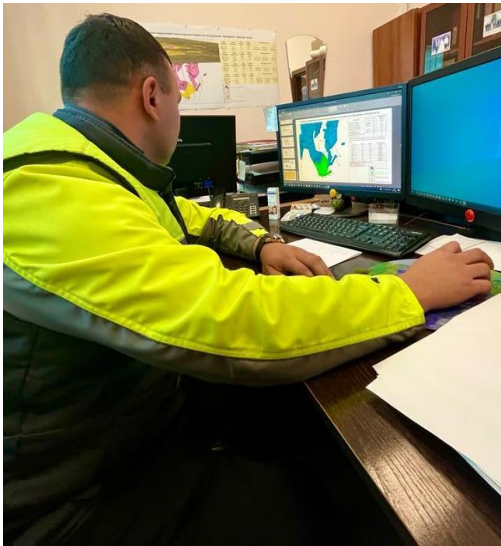
Journal, 2023, No. 4(100), pp. 54-69. DOI: 10.46914/1562-2959-2023-1-4-54-69.

1 monograph has been published: Issatayeva F., "Improving the Geological and Economic Assessment of Mining and Metallurgical Enterprises in Kazakhstan" Karaganda: Publ. House.

ISBN 978-601-355-190-6.

1 monograph has been published: Issatayeva F., "Improving the Geological and Economic Assessment of Mining and Metallurgical Enterprises in Kazakhstan" Karaganda: Publ. House NPJSC "Abylkas Saginov Karaganda Technical University", 2023, 121 p. ISBN 978-601-355-190-6.

1 thesis has been published in the International Conference: Aubakirova G.M., Issatayeva F.M. "Digitalization of the Mining and Metallurgical Sector in Kazakhstan, Current State of Economic Systems: Management, Development, Security" Collection of Scientific Papers of the IV International Scientific and Practical Conference, December 8–11, 2023, Tver, p. 12.



**Figure 1** – Research conducted by the faculty of the G&ME Department within the framework of the research project

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Hirsch Index- 4

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***Information for Potential Users:***

The research results will be applied in conducting geological-economic assessments considering Kazakhstan's transition to international reporting standards for mineral reserves (CRIRSCO). The developed algorithm for the "Information and Analytical System" program for

geological-economic assessment of enterprises will enhance the scientific and technical justification of the company's decarbonization strategies and accelerate the implementation of projects that align with ESG standards.

***Scope of application:***

The project is primarily aimed at creating and implementing an Information and Analytical System (IAS) for LLP "Kazakhmys Corporation," which will be used for collecting, storing, analyzing, and visualizing data related to the company's geological resources and economic activities. This will enable the company to make more informed decisions regarding exploration, extraction, and processing of mineral resources. Additionally, the results of the project will contribute to enhancing the scientific and technical justification of decarbonization strategies and accelerating the implementation of projects in line with ESG standards (Environmental, Social, and Corporate Governance). The system will also integrate digital technologies and innovations, improving management efficiency and transparency while strengthening the company's financial and economic condition and investment attractiveness.

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