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DIGITAL SOLUTIONS IN THE MINING AND METALLURGICAL SECTOR OF KAZAKHSTAN

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Abstract. *The relevance of the study is dictated by the increasing role of mining metallurgical sector of Kazakhstan in the energy transition. The authors substantiate the feasibility digitalization mountain-metallurgical sector to improve the assessment of the importance of enterprises in the decarbonization of the economy of Kazakhstan. On the example of Azimut Geology LLP It shows how the process of strategic mapping can be organized using digital solutions. It is substantiated that the development of high-tech technologies by mining and metallurgical enterprises will expand the methodological apparatus of analysis mining deposits and will strengthen the international positions of enterprises.*

Key words: *digitalization, Kazakhstan, mining and metallurgy sector, strategic mapping*

Introduction.

Among countries highly dependent on mineral resources, Kazakhstan is at a transitional stage from effective development to innovative development: the country is implementing a new industrial policy and creating an industrial ecosystem aimed at diversifying the economy and reforming the institutional environment [1-3].

The development of the mining and metallurgical complex, which contributes 8% to the country's GDP, requires increased flexibility, adaptability, and the ability to respond promptly to changes in a stochastic external environment.

A key feature of Kazakhstan's economy, which aims to become a digital hub in the Eurasian region, is the high level of technological heterogeneity. Therefore, the new industrialization seeks to eliminate the technological lag of the mining and metallurgical complex, create new points of digital growth, and prevent the continuation of a catching-up development strategy, which implies borrowing both current technological solutions and digital management models [4-6]. In the context

of the transition to a low-carbon economy and overcoming technological dependence, the importance of transferring digital and environmentally friendly technologies is increasing, as well as the need to combine investments in human capital and fixed assets with the use of digital technologies, the introduction of process innovations, and growth in R&D expenditures.

This study is devoted to the highly relevant issue of innovation adoption by mining and metallurgical enterprises in Kazakhstan. Considering that being part of the value chain does not promote active product innovation adoption by mining and metallurgical enterprises, the focus largely shifts to process innovations, particularly non-technological innovations that contribute to marketing and organizational changes in business activities.

The objective of the study is, based on the analysis of the current state of Kazakhstan's mining and metallurgical enterprises, to evaluate the possibilities of using the strategic mapping process with the help of digital solutions.

The research object is LLP "Azimut Geology," a multi-disciplinary enterprise that solves the full cycle of geological tasks, from exploration and prospecting of promising ore occurrences, their assessment, to volumetric modeling, resource estimation, and addressing issues related to the subsequent development of mining facilities.

To achieve the set objective, software products such as "1C: Enterprise," "1C: Enterprise 8. Management of Our Firm for Kazakhstan. Basic Version"; Statistica software, CASE technologies, and Expost forecasting were used.

Main text

In light of the above, we propose using the scenario planning method combined with the application of the balanced scorecard (BSC) system [7-10] to evaluate the activities of the studied entity.

The opportunities offered by the use of scenario planning include:

• formulating forecasts for the short- and medium-term periods, taking into account both the dynamics of geopolitical events and the continuously increasing volume, complexity, and uncertainty of geological and economic information;

• utilizing the enterprise's internal production resources by comparing technical and economic indicators and assessing operational costs;

• justifying the chosen strategy for subsequent development;

• responding promptly to changes in the internal and external environment to successfully achieve the stated goals.

The greatest challenge lies in accounting for and evaluating operational goals introduced into the strategic map (the process of strategic mapping), on which the ultimate achievement of strategic objectives depends, both in terms of timing and the qualitative characteristics of all aspects of the enterprise's activities.

When constructing the strategic map and calculating key indicators for the forecast period according to the relevant scenarios, LLP "Azimut Geology" used a system of evaluation indicators covering key success factors and performance metrics (both absolute and relative) (Table 1).

Table 1 - Key performance indicators of Azimut Geology LLC for the forecast period

Indicators	Scenarios	Year		
		2027	2028	2029
Finance				
Return on sales, %	1	6 ,4 3	1 0 , 85	1 2 , 46
	2	7 , 47	5 , 10	8 , 37
	3	6 , 35	6 , 10	5 , 24
Accounts receivable turnover, days	1	2 0 , 14	1 4 , 27	1 7 , 25
	2	2 0 , 34	2 2 , 27	15 , 36
	3	2 6 , 11	2 2 , 54	23 , 67
Consumers				
The share of services provided to regular customers, %	1	0.76	0.81	0.86
	2	0.76	0.80	0.85
	3	0.74	0.72	0.70
Return rate, %	1	1.50	1.40	1.30
	2	1.70	1.60	1.50
	3	1.70	1.80	1.90
Advertising costs, thousand tenge	1	472.56	605,50	788,00
	2	393.80	519,00	689,50
	3	196.90	259.50	344.75
Internal production business processes				
rate, %	1	1.80	1.70	1.60
	2	2.00	1.90	1.80
	3	2.50	2.70	3.00

Execution of the plan according to the provided services, %	1	94	97	100
	2	88	91	94
	3	90	86	82
Sales Volume / volume of services, %	1	89,00	93,00	97,00
	2	85,00	89,00	94,00
	3	90,00	87,00	85,00
Wear of process equipment, %	1	5 2 ,0 2	4 6 ,0 2	36 , 12
	2	6 1 ,00	5 6 , 12	5 3 , 16
	3	58,0 2	65, 13	7 6 , 17
Personnel policy				
productivity, %	1	10 1 ,0 1	11 0 ,32	1 12 ,9 1
	2	100,00	1 12 ,39	12 4 , 0 6
	3	100, 25	10 3 , 18	10 1 ,9 5
Staff turnover, %	1	1, 3	1, 3	1 3 5
	2	1, 1	1 ,1	1, 1
	3	1 ,0	1 ,0	1 ,0

According to research, when selecting KPIs, preference should be given to indicators that are as independent from each other as possible. This is because, in such cases, their combined use provides the most accurate and objective picture of the analyzed system.

Conclusions.

In summary, we emphasize the following. According to the conducted study, a methodological approach that identifies the strengths and weaknesses of the entity should be a key component in evaluating the performance of mining and metallurgical enterprises in Kazakhstan [11-13]. Today, as Kazakhstan fulfills its obligations under the Extractive Industries Transparency Initiative and strives to comply with the international GRI standards and ESG principles, mining and metallurgical enterprises face the tasks of structuring geological and economic calculations and taking into account changes depending on the specifics of the deposit, as well as the content of primary geological-technological and ecological-economic data, which may vary and require adjustments during use [14].

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