

Economic Evaluation of Small Deposits in the Applicable Function of Business Decision in Mineral Economy

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ABSTRACT: *Contemporary production of various mineral raw materials in the domestic mineral economy of Serbia faces problems and limitations of different types. Economic demands of the market economy, together with reduced investment funds and a short economic cycle of crafts, make small deposits of mineral raw materials especially attractive as objects of geological exploration, exploitation and valorization of mineral raw materials. Determining and defining the economic importance of small deposits have particular specificities in relation to medium and large deposits. The economic evaluation of small deposits is crucial in considering the justification and cost-effectiveness of investments in their productive activation. This economic evaluation is particularly important in business decision-making in the current transitional, economic and reform conditions of the mineral economy of Serbia and the upcoming European integration.*

KEYWORDS: *economic evaluation, small deposits, mineral economy, business decision making.*

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I. INTRODUCTION

Different intensity and volume of production of certain mineral raw materials in the world mineral economy is characterized by production mining capacities of different sizes. Economically observable large capacities and mass production are characterized by high total costs, but given the volume of production, there are low individual costs per unit of reserves of the mined raw material. This geological-economic approach, given the large total production capacities, enables economically profitable use of poor deposits too. A characteristic example is the economically cost-effective exploitation of copper-based porcelain deposits with content even below 0.1% Cu, while the same contents in hydrothermal massive sulphide deposits represent tailings [1]. In addition to the large deposits in the structure of the mineral-raw material base of certain mineral raw materials, small deposits are also important, i.e. small scale mining. Their significance can be analyzed from the aspect of: (a) Genetic conditions for the formation of deposits and (b) Economies of productive activation and utilization of deposits.

The genetic aspect relates to the fact that through different genetic processes, in geologically different terrain, a relatively small number of unique and large deposits has emerged, with a significantly larger number of small deposits. The economic aspect refers to the economic viability of their productive activation and exploitation, which, among other things, is based on: (a) Relatively short time of exploration and geological-economic definition; (b) Small investment for productive activation; (c) Relatively small environmental impacts; (d) Attractiveness for small and medium-sized entrepreneurs; and (e) Possibilities of providing certain quantities of quality mineral raw materials from relatively small spaces in a relatively short time.

A part of the national mineral economy in a organized way and successfully exploits the small deposits of various mineral raw materials, which significantly influence the provision of necessary mineral raw materials for different industries. Their importance is especially growing in specific circumstances, among which the following conditions can especially be distinguished [2]: (a) Economic blockades; (b) Transition Period; (c) Concession; and (d) Attracting investments in the mineral economy.

So far, geological exploration in Serbia has revealed a large number of small deposits of various, mainly metallic and non-metallic mineral raw materials [3]. Among the metallic mineral raw materials, the following are small deposits: iron, nickel, tin, copper, antimony, gold, lead and zinc, tungsten, etc. Among non-metallic mineral raw materials, these are small deposits: magnesite, dolomite, bentonite, fluorite, quartz raw materials, distene, feldspat and especially various types of technical building and architectural-building (decorative) stone as well as brick raw materials. Some of these deposits have been exploited or are still exploited, but a large number of explored deposits have not been activated due to certain unfavorable natural, value or synthetic indicators of economic evaluation [4].

Consideration of the problem of economic evaluation of small deposits is of particular importance for further planned, economic activities in the country's mineral economy and making of appropriate decisions. The

analysis of the current importance is based on the basic settings of the economic evaluation of the deposits of mineral raw materials and the economic conditions of operations in the country's mineral economy [5-15]. The main goal of this paper is the general review of the current applicative position, the importance and role of the economic evaluation of small deposits in the current stabilization, reform and concession moment of the development of the mineral sector and the adoption of appropriate decisions for the improvement of the state of the Serbian economy.

II. METHODS OF ECONOMIC EVALUATION OF DEPOSITS

The evaluation of mineral deposits, that is, mineral reserves, in contemporary scientific and professional literature, is indicated by different terms. The following are used as valid terms for assessment: (a) Potential assessment; (b) Prognosis assessment; (c) Forecast of geological-economic assessment; (d) Geological assessment; (e) Economic (value) evaluation; (f) Industrial evaluation; (g) Technical-economic evaluation; (h) Technological assessment; (i) Socio-economic assessment; (j) Expert evaluation; (k) Geocological assessment; (l) Geocological and economic evaluation; and (m) Geological and economic evaluation. Prefeasibility and feasibility analysis are also an appropriate form of mineral resource evaluation, although they have a wider significance and are also used in evaluating various investment and other projects [5].

Based on the previous theoretical studies and rich practical experience from the domestic so-called Belgrade School of Economic Geology [1], and partly of the foreign practice of economic geology, it has been proved that the most acceptable hybrid integral term, which also includes the geological and economic aspect of the evaluation, that is, the term geological-economic evaluation of the deposit. More precisely, it is an economic evaluation of ore anomalies, phenomena (mineralization), ore bodies, deposits and other major metalogenetic units. The application of such a geological-economic evaluation has come to life in the domestic decades-long practice of economic evaluation of deposits in the mineral economy of Serbia. The scientific, expert and methodological observation of the geological and economic evaluation has been developed in the Faculty of Mining and Geology of the University of Belgrade at the Belgrade School of Economic Geology at the Department of Economic Geology. As the objects of this evaluation, there are both geogenic and technical deposits, regardless of the aggregate state of the mineral resource. This estimate is not only related to investment projects and the economic importance of reserves, but is much wider at all stages of the exploration, including the evaluation of the potentialities of the area, post-exploitation studies and appropriate decision-making on the basis of such an evaluation.

The geological-economic evaluation of the deposit as such has practically two basic components or more picturesque it has two poles: geological and economic pole. Between them are law-legal, technical-exploitation, technological, geocological and other relevant factors, which primarily depend on natural geological conditions and economic requirements, and they must be adapted with a certain exception to geocological factors. From the market point of view the essence of the geological-economic evaluation is contained in the economic, ie value evaluation of deposits, as the ultimate expression of the value of the reserves on the market of mineral raw materials.

Practice longer than one century unambiguously shows that the methods of estimation of phenomena and deposits are continuously improved and changed, depending on a series of social, economic, and other factors, as well as new scientific-professional achievements and knowledge. Long-standing practice has shown that the optimal results of the evaluation of the deposits can be obtained if at least two methods are combined - for example, NPV and IRR, which in modern conditions is the most common case. Furthermore, there is no doubt that in today's conditions discount methods (DCF) have an advantage over other methods. However, in order to obtain a more complex, more accurate and complete evaluation, DCF methods should be combined with methods that do not take into account the time dimension of money (PB method, etc.), which is often not the case with US sources [6]. As a simplified and orientated evaluation, an economic evaluation is used without taking a time factor into account, which has a static character, unlike NPV and IRR, which are dynamic methods.

III. ECONOMIC EVALUATION OF SMALL DEPOSITS IN THE PRACTICE OF MINERAL ECONOMY

At the level of the world's mineral economy today, a large number of small deposits of solid mineral raw materials are exploited, whose share in the world's global production, depending on the type of mineral raw material, varies between 10 and 15% [6]. Therefore, these deposits and their exploitation are very interesting for many reasons, especially from the economic point of view. In the professional geological, mining and economic circles, there is still no precise and universally accepted and adopted definition of the term "small deposit" and "small scale mining", and the prospect that such a situation in the foreseeable future will be substantially changed are slim, primarily due to the complexity of the definition. Scientific-professional literature deals with different criteria and their combinations, when determining the geological-economic concept of small deposits.

The most commonly used criteria for their definition and separation are as follows [7]: (a) Quantity of produced or prepared (concentrated) mineral raw materials - capacity of mines and plants for the preparation of mineral raw materials; (b) Number of employees employed and other staff; (c) The size of the mine concession; (d) The size of the share capital; (e) Total annual revenue from the sale of mineral raw materials; (f) Annual profit from the sale of mineral raw materials, etc.

Different countries apply different criteria for allocation of small deposits. According to the views of the relevant United Nations bodies, small mines are those that provide less than 50,000 t of ores a year. In Peru, the Mining Act provides that installations for the preparation of mineral raw materials on small mines have an average capacity of 200 tons of ore per day; In the same country, the lower limit for the medium-sized mining capacities is 200 t ore per day, 100 employees, the value of the fixed capital of US \$ 5 million. In the Philippines, small mines are considered to be those with less than 25 employees. It should also be noted that "Mining Journal Exploration Services" advocates that on the basis of these international standards, all mines with production of less than 150,000 t of ore per year belong to a group of small ones.

There are no established international statistics on the number of small deposits - small capacities in the world in exploitation. From the available data of individual countries it can be concluded that their total number exceeds 300,000. In previously published works, it is reported that there are 2,000-3,500 small mines in Bolivia that produce antimony, lead, tin, tungsten and gold. The number of small mines in Peru ranges from 2,000-3,000 (antimony, tungsten, lead, gold and zinc). In Brazil, about 4,000 small deposits produce semi-precious stones, beryl, gold and tin, and in Mexico about 2,500 small mining capacities produce pirochlor, mercury, fluorite, tin, silver and opal. In Thailand, about 1,000 small mines produce tin, antimony and tungsten, and in Malaya from 200 small mines, they receive ilmenite, monazite and cassiterite. Indonesia has around 500 small deposits of cassiterites and gold [8].

The approach of Chinese economic geologists is interesting, within the new geological-philosophical discipline - the philosophy of prospecting and exploration, in comparison to small deposits, to provide the necessary mineral raw materials. In China, after the Second World War, 163 kinds of mineral resources were found, reserves for 149 of them were found, 15,000 deposits were found. In China in 1990, there were 237,424 small deposits, of which 115,315 were cooperative and 122,109 privately owned. In the same year, the production of mineral resources in China amounted to about 5 billion tons, of which 2,675 billion tons or 53.48% of them originated from small deposits [9].

The economic evaluation of small deposits is followed by a series of specificities in the scope and structure of the necessary data for the processing of the necessary factors, natural, value and synthetic indicators. The exploration of small deposits through all five stages, as envisaged by the respective regulations, as provided by the applicable by-law, followed by a geological-economic evaluation, is not rational, and in that sense, it is necessary to make appropriate simplifications and harmonization. They are primarily related to reducing the number of exploration stages to practically two, without the need for detailed exploration in most cases. In the geological and economical evaluation of small deposits, basically the usual factors and indicators are analyzed, but in the shortened scope. Since a large number of small deposits in domestic conditions have already been practically explored, and they also have reserves of high categories (proven and measured) although they were not or are occasionally exploited, it is advisable to apply expert economic evaluation in accordance with its content, structure, methods, goals and tasks [6, 10].

In the world scale, the exploitation of small deposits, in most cases, is characterized by the following features: (a) Relatively low level of deposit exploration and quality knowledge ("early" start of exploitation); (b) Non-systematic exploitation due to, often, inadequate data on the deposit, its morphostructural characteristics, conditions of spatial location, spatial distribution of useful minerals and useful components (improvised production without plan and program); (c) Low capital investments because of, most often, large share of living labor; (d) Relatively low exploitation in exploitation and large dilution (in some underdeveloped countries there is the so-called "harvesting" of deposits); (e) Inadequate working conditions, especially in underground mining operations; (f) Inadequate social care and general insufficient security of employees (small daily allowances, insufficient security and hygiene measures, pension insecurity, etc.); small sources of tax revenues for the state, etc.

There are several positive characteristics, that is, the advantages of small-scale mining / capacity mining, which include: (a) A short period of exploration and investment of relatively small financial assets; (b) Possibility of rapid construction of mining capacities, application of mobile plants for preparation, with low investment and relatively low energy consumption; (c) Equipment, in particular for preparation, is often lightweight, simple and mobile so that it can be transferred from one deposit to another (deposits of gold, tin, precious and semi-precious stones, etc.); Such equipment can also be partly produced by domestic companies; Using "modular plants" with a capacity of 10-50,000 t of ore / year; (d) The ability to hire local unskilled workers positively reflects the reduction of the number of unemployed people in underdeveloped areas, where there is often no other alternative or there is a workforce left out of work; (e) Smaller quantities of the necessary

deficient mineral resources can be relatively quickly provided, which is very important in the context of the lack of foreign exchange assets and extraordinary circumstances (economic blockade, war situation, immediate recovery period, etc.); (f) the possibility of additional foreign exchange assets being provided by export; (g) Mineral raw materials from small deposits are often of higher quality, which improves the raw material base of individual resources and economic sectors, as well as the country as a whole; (h) In the exploitation and preparation of mineral raw materials of small deposits, as a rule, there are relatively less negative consequences for the environment in relation to the medium and large-capacity mines (smaller excavations, less total surface disturbances, smaller areas for recultivation, etc.), but it is sometimes the other way round [6].

IV. ECONOMIC EVALUATION OF SMALL DEPOSITS AND BUSINESS DECISION IN SMALL ENTERPRISES

The economic evaluation is the basis for defining the conditions and manner of doing business on small deposits, as well as decision making, organization and implementation of management, with which it is directly functionally connected [4]. The theory and practice of management clearly distinguish between the management of small, medium and large enterprises. Here too, it starts from certain criteria on the basis of which the enterprise is classified into one of the above groups. These criteria are most commonly: total income, number of employees (maximum 300-500), realized realization, additional value, etc.

In the case of small enterprises we most often speak of the so-called "small business". Contrary to widespread opinion, it should be pointed out that small deposits and mining capacities require, as well as the so-called "big business", good and organized management and quality decision making. This primarily means that small capacities of mineral resource production have management exclusively highly professionally organized and in line with specific business conditions, avoiding major professional services and unnecessary improvements in business tasks. Regardless of the lifespan of the exploitation, even in small capacities, i.e., small deposits, there should be a certain strategy, even in terms of strategic guidelines for dealing with the subject matter of the deposit in question.

One of the very important assumptions of a successful small business is the definition and organization of top-management tasks and accompanying decision-making. The top management team in most small businesses should be one full-time top manager and at least one part time worker engaged in performing certain top-management tasks assigned as a direct and primary responsibility. In other cases, instead of a team, managerial activities will be performed by only one person in the function of a top-manager, who in addition to these tasks will perform some important functional and operational tasks. But even then, in such small enterprises, the top management tasks should be determined decisively, as experience shows that what has not been established, i.e. what is unknown or insufficiently known, in practice, is performed with difficulty or not performed at all [11].

For the functioning of small enterprises it is very important to use the data of the economic evaluation of small deposits in a significant business segment, which refers to the decision-making process, i.e. preparation, adoption and implementation of various types of business and operational decisions. The business domain of the decision-making on the basis of the economic evaluation refers primarily to the overall economic elements and profitability of operations, then decisions on planning and realization of investments, but also general monitoring of different costs and their impact on the economic viability of reserves. In the area of operational activities, the economic evaluation serves as the basis for decisions in the planning and economic monitoring of individual stages of the production process on small deposits, which include geological exploration, exploitation, preparation and processing of mineral raw materials into the final product, which will be the subject of buying and selling on the market. Therefore, in the further activities in the mineral sector of Serbia, special attention has to be paid to the economic evaluation of small deposits, in order to be realized in accordance with market conditions, economic environment, decision making principles and managerial principles of efficiency and effectiveness of operations in the mineral economy.

V. CONCLUSION

The size and intensity of the production of various mineral resources in the world's mineral economy is characterized by large production mining capacities, but in modern economic and economic conditions small deposits (small-scale mining) play a significant role. Their significance can be analyzed from the aspect of: (i) the genetic conditions of origin and (ii) the conquest and exploitation economy. A part of national mineral economies achieves the exploitation of small deposits of various mineral raw materials, whose importance is particularly increasing in specific circumstances, such as: (i) Economic blockade; (ii) Transition Period; (iii) Concessions; and (iv) Attracting investments in the minerals sector.

The economic evaluation of small deposits is followed by a series of specificities in the scope and structure of the necessary data for the processing of the necessary factors, natural, value and synthetic indicators, which are analyzed, processed and displayed in a shortened scope. The economic evaluation is the basis for

defining the conditions and manner of doing business on small deposits, as well as decision making, organization and implementation of management, predominantly in the category of small enterprises. For the functioning of small enterprises, the use of data on the economic evaluation of small deposits is particularly important in the segment of the decision-making process, i.e. the preparation, adoption and implementation of various types of business and operational decisions, in order to achieve economic positive business with a shorter period of turnover and higher profits.

Consideration and improvement of the problems of economic evaluation of small deposits has a special importance for further planned, economic activities in the mineral sector of Serbia. Therefore, in further activities, special attention should be paid to the economic evaluation of small deposits, in order to realize them in accordance with market conditions, economic environment, decision making principles and managerial principles of efficiency and effectiveness of operations in the Serbian miner economy, especially in the context of the upcoming European integration.

REFERENCES

- [1] Tošović R., Actual Economic Importance of Evaluation of Small Deposits in Economic Activity of Mineral Sector, Proceeding of 18th International Conference Dependability and Quality Management ICDQM-2015, Belgrade, Serbia, 27-28 June, Research Center of Dependability and Quality Management DQM, pp. 495-503, Belgrade, 2015.
- [2] Tosovic R., Economic evaluation of mineral resources from the standpoint of business and social profitability, International Journal of Research - Granthaalayah, Vol. 4, No. 10, pp. 46 – 52, 2016.
- [3] Tošović R., Management of Business Investment, Investment Decision-Making in the Company and Economic Evaluation of Mineral Deposits, 5th International Conference COAL 2011, pp. 393-405, Zlatibor, 2011.
- [4] Tošović R., Management in Modern Conditions of Serbian Mineral Economy, MISKO 10, pp. 411-434, Belgrade, 2010.
- [5] Tošović R., Milovanović D., Relacije geološko-ekonomske ocene ležišta mineralnih sirovina i prifizibiliti i fizibiliti studije pri oceni mineralnih resursa Srbije, Zbornik savetovanja IMES'03, Komitet za površinsku eksploataciju, pp. 252-260, Arandelovac, 2003.
- [6] Milovanović D., Tošović R., Geološko-ekonomski aspekti održivog razvoja u mineralno-sirovinskom kompleksu, Ecologica, Pos. Izdanje br. 14, Godina XIV, pp. 19-26, Beograd, 2007.
- [7] Milovanović D., Zakonodavno-pravni faktori i njihov uticaj na ocenu prirodnog faktora, Zbornik radova savetovanja Kamen 97, Površinska eksploatacija kamena, pp. 12-29, Beograd, 1997.
- [8] Gocht W.R., Zantop H. & Eggert R.G., International Mineral Economics, Springer-Verlag, 271 p., Berlin-New-York, 1988.
- [9] Žu Sjun, Osnovy poiskovoj filosofii, Naučnaja Tehnika, 303 pp., Benczin, 1996.
- [10] Tošović R., Expert Economic Evaluation of Mineral Resources in Modern Conditions of Transition and Management, Proceeding of 14th ICDQM-2011, pp. 624-634, Belgrade, 2011.
- [11] Babić M. & Stavrić B., Menadžment - Struktura i funkcije, II izm. i dop. izd. - MB Centar, 325 pp., Beograd, 1998.
- [12] Rundge I., Mining Economics and Strategy, Society for Mining Metallurgy & Exploration, 1 edition, 316 pp., Littleton, Colorado, 1998.
- [13] Torries F.T., Evaluating Mineral Projects: Applications and Misconceptions, Society for Mining Metallurgy & Exploration, 172 pp., Littleton, Colorado, 1998.
- [14] Tošović R., Geološko-ekonomsko modeliranje polimetaličnog ležišta Rudnik, Katedra ekonomske geologije RGF-a, Pos. izd. br. 8, 226 pp., Beograd, 2006.
- [15] Tošović R., Economic Evaluation of Small Deposits in the Function of Successful Designing, XX International Symposium on Project Management, YUPMA 2016, pp. 61-65, Beograd, 2016.

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