Financial evaluation of the minerals industry based on the software support

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Currently, there are many different analytical tools and assumptions that are applicable depending on the environment, the desired result or limit possibilities for the organization in accordance with the use of available tools - an operational software, information technology, databases, analogies, etc...

Presented article describes one of the multifunctional analytical tools for assessing the economic aspects, risk factors, transparent mineral resources using projects analysis analogy processing, which is a program MINVEST.

1 INTRODUCTION

The issue of mineral deposits valuation is currently topical as in the business so in the public sector.

The economic evaluation of mineral deposits and their profitability for the businesses in the terms of Slovakia are made by using the most modern information systems that support the administrative decisions of the involved subjects on the issues of financing their business projects of minerals mining and quarrying.

Given the multilateral nature of the mineral resources financial evaluation problem it is essential for this activity to use such information systems and computer models, which integrates multi-quantitative set of the analytical and evaluation tools aimed on the increasing of the business subjects prosperity and reducing the potential risks in this area.

2 VALUATION AND ECONOMIC EVALUATION OF THE MINERAL RESOURCES IN THE TERM OF SR

The owner of the exclusive mineral deposits, under the provisions of the art.4 of the Slovak Republic Constitution, is the state. However it does not result in the clear obligation for him to all registered restricted mineral deposits economically evaluate. [5]

Mineral industry and mineral resources processing in the Slovak Republic is fully privatized and the state, as owner of the exclusive mineral deposits, is in accordance with the applicable law creating a space and conditions for business subjects in their use. The principle of freedom of enterprise, following established rules, also applies in the sphere of mineral resources use.

The recommended classification of the UN mineral resources reserves, created by the European Economic Commission, is based on the mineral deposits market assessment under the given economic conditions of their use and extracted raw materials recovery in a liberalized market. While the geological evaluation of mineral deposits and their occurrence is in the competence of organizations under the provisions of the Act No. 313/1999 of the Code of law (Geological Act), evaluating the mineral resources use business plan feasibility and economic profitability (the "Feasibility Study") is realized by specific business subjects which intend to exploit mineral deposits under the given economic conditions and after taking into account the level of the business risk. The result is a necessity of a differentiated approach in the mineral resources evaluation, with the focus on the deposits, which on the base of geological survey results, quantitative and qualitative parameters of raw material and others, can be effectively used by the specific business subjects in the given market environment.

In the process of preparing the deposit rent to the business object realization corporate state authorities for their decision provide its economic evaluation in the current economic conditions. [3,4,9]

The aim of any organization, not only in the extractive industries is to increase competitiveness, and elimination of the risk factors related to the

economic aspects by increasing production and reducing risk factors through the risk management. To achieve an optimal state elementary statistical methods and technically-based analysis must be used.

In the terms of productivity raising, process control and appropriate analysis application it is essential in the planning of a particular mineral resource exploitation to use the various computer models, which contain information of the geodetic, geological, mining, processing, economic and environmental character which for the business object determine the successful mining planning and its control. An appropriate computer model should reflect the work queue progress within the time, but also quick database changes, which take into account the development of knowledge about the deposit obtained during the extraction procedure, the distribution of the useful and harmful components in the deposit. An important condition is the possibility of taking into account the opening, preparation and work queue status during the time of deposit modeling. The computer modeling of a particular mineral resource deposit currently use the most modern computer systems enabling the valuation of projects through a computer modular deposit model and a mining simulation for the planned time periods of 10, 20 and more years, O `Hara model for the surface mining, processing and determination of the production costs, Linear model and Dowd's model (last two are integrated in the software MINVEST) and others. [1,2,7]

2.1 MINVEST PROGRAM

Effective assessment of the mineral resources exploitation business project and its economic profitability allows the software (SW) MINVEST. The main skeleton of the MINVEST program is the financial analysis of the processes productivity in the area of the mining industries. Economic factors are closely linked with the risk factors which directly or indirectly threaten the economic aspects of the industrial production. It is therefore necessary to use the basic statistical methods and spreadsheets for a better simulation of the potential aspects that can significantly help in the detection of the critical points of the mineral industry business projects and then take the necessary measures for the risk reduction. MINVEST program, which is the resultant product of the University of Leeds under the lead of Professor P.A.Dowd meets the requirements for the interconnection of statistics, risk management, spreadsheets and by its multifunctional range, simple design and integrity with the Windows operating system it is commercially and flexibly usable with minimum hardware and software requirements. [1]

2.2 MINVEST PROGRAM – MAIN MENU

As mentioned above, the MINVEST program bearing skeleton is the project financial analysis, with the support of the spreadsheets use and studied parameters graphical representation. The MINVEST program menu is defined on the master menu bar, consisting of the File menu, Settings, Edit, Data, Analysis, Risk Analysis, Schedule, View, Window, Help. Individual choices contain a subgroup of operations that program allows. For a better view are some of the basic program elements illustrated by visuals. [1]

Defining the MINVEST program main menu

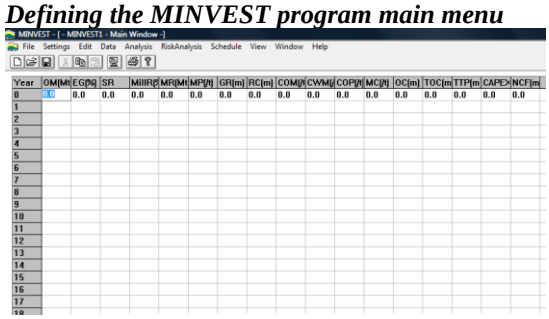


Fig. 1: MINVEST program master menu bar interface: consisting of the predefined zero attributes starting any new project.

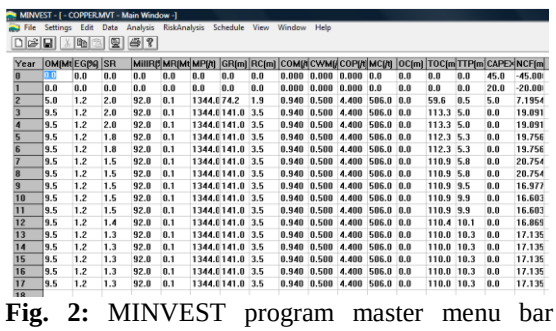


Fig. 2: MINVEST program master menu bar

interface: program predefined case study

Commands provided in the **FILE** menu [1]:

- Open new MINVEST project
- Open MINVEST project data file
- Forms of the MINVEST project Save
- Print
- Exit

Commands provided in the **SETTINGS** menu [1]:

- Basic settings – allows adjustment of the basic program interface
- Royalty charge – allows application updates and MINVEST program using
- Tax allowance options
- Taxation policy
- Choose minerals – commodities choice option

Commands provided in the **EDIT** menu offers basic options of the graphs and tables adapt under the Windows operational system interface [1]:

- Undo
- Cut
- Copy
- Paste
- Clear
- Column display format
- Copy graph to clipboard
- Open new text recorder window

Commands provided in the **DATA** menu [1]:

- Multi-minerals data window
- Show taxation schedule
- Yearly operational graph
- Chart selected data

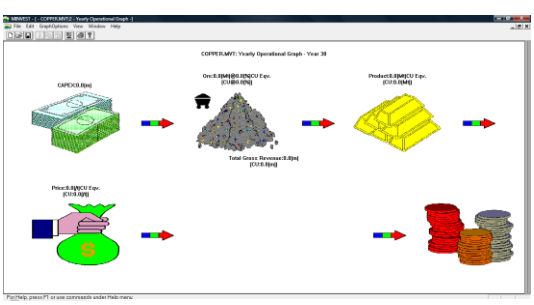


Fig.3: Case study - Annual operation (output) graph

ANALYSIS menu is categorized into two basic categories – first are the **financial evaluation** options [1]:

- Undiscounted payback period
- Discounted payback period
- Net present value
- Internal rate of return
- Wealth growth rate
- Growth rate of return
- Optimal life

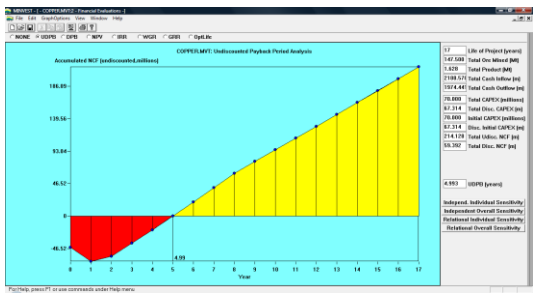


Fig.4: *Case study – Undiscounted payback period*

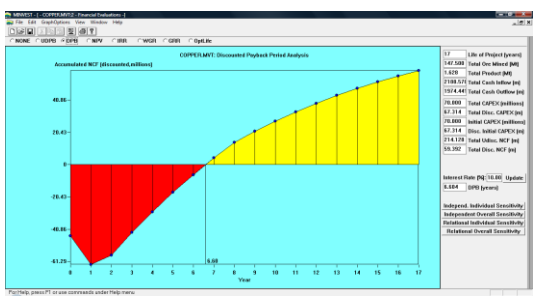


Fig.5: *Case study – Discounted payback period*

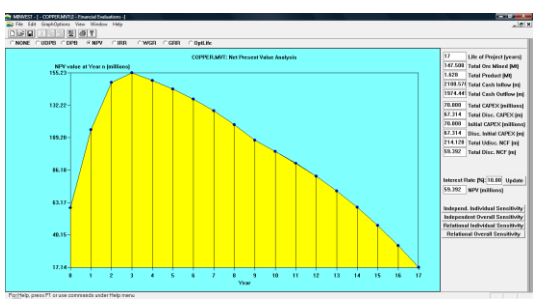


Fig.6: *Case study – Net present value*

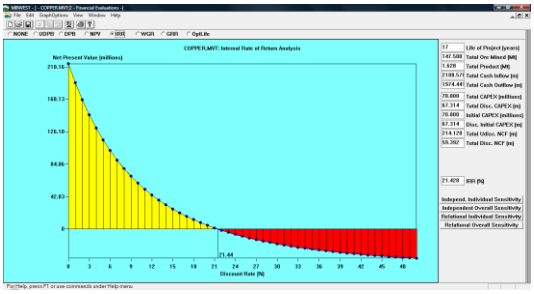


Fig.7: *Case study* – Internal rate of return

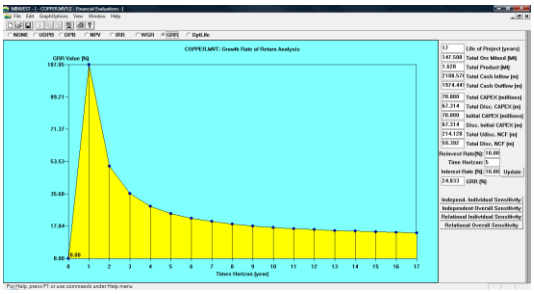


Fig.8: *Case study* – Growth rate of return

Second category of the **Analysis** is the **Sensitivity analyze** with its options [1]:

- Evaluation results
- Independent individual sensitivity analysis
- Independent overall sensitivity analysis
- Relational individual sensitivity analysis
- Relational overall sensitivity analysis

Risk Analysis menu continues the financial analysis menu offer and on the similar platform provides the following options for financial specifications defining [1]:

- Undiscounted payback period
- Discounted payback period
- Net present value
- Internal rate of return
- Wealth growth rate
- Growth rate of return
- Optimal life

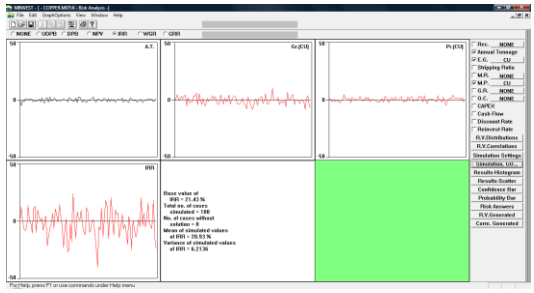


Fig.9: *Simulated situation risk analysis case study graphic presentation*

Scheduling menu offers an option to choose the planning methodology into two basic groups [1]:

- Lane´s method
- Dowd's method

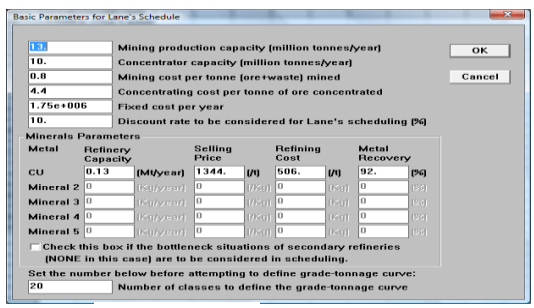


Fig.10: Lane´s method

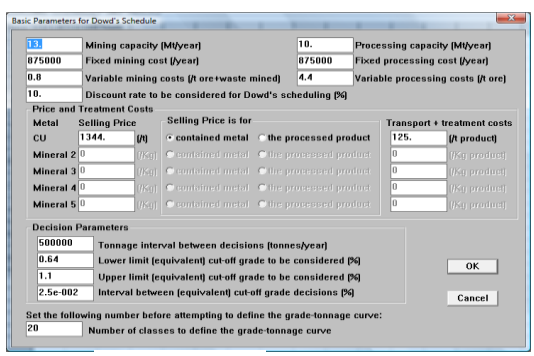
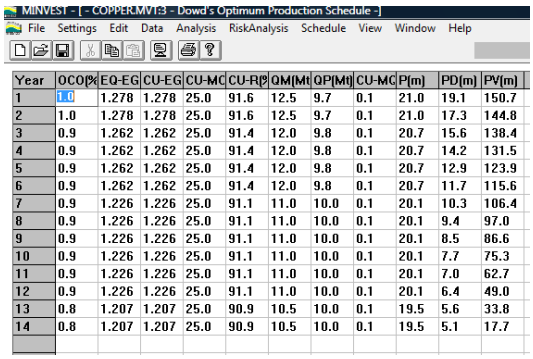


Fig.11: Dowd's method

- Optimal production program - provides production program optimalization analysis for the process productivity increase and risk factors elimination


MINVEST - [- COPPER.MVT:3 - Dowd's Optimum Production Schedule -]

File Settings Edit Data Analysis RiskAnalysis Schedule View Window Help

Year	OCO[%]	EQ-EG	CU-EG	CU-MC	CU-RP	QM[Mt]	QP[Mt]	CU-MC	P(m)	PD(m)	PV(m)
1	1.0	1.278	1.278	25.0	91.6	12.5	9.7	0.1	21.0	19.1	150.7
2	1.0	1.278	1.278	25.0	91.6	12.5	9.7	0.1	21.0	17.3	144.8
3	0.9	1.262	1.262	25.0	91.4	12.0	9.8	0.1	20.7	15.6	138.4
4	0.9	1.262	1.262	25.0	91.4	12.0	9.8	0.1	20.7	14.2	131.5
5	0.9	1.262	1.262	25.0	91.4	12.0	9.8	0.1	20.7	12.9	123.9
6	0.9	1.262	1.262	25.0	91.4	12.0	9.8	0.1	20.7	11.7	115.6
7	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	10.3	106.4
8	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	9.4	97.0
9	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	8.5	86.6
10	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	7.7	75.3
11	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	7.0	62.7
12	0.9	1.226	1.226	25.0	91.1	11.0	10.0	0.1	20.1	6.4	49.0
13	0.8	1.207	1.207	25.0	90.9	10.5	10.0	0.1	19.5	5.6	33.8
14	0.8	1.207	1.207	25.0	90.9	10.5	10.0	0.1	19.5	5.1	17.7

Fig.12: Production program optimalization analysis for the process productivity increase and risk factors elimination

2.3 MEANING OF TOOLS FOR ECONOMIC ANALYSES

After the changes to the economic systems in many European countries the criteria of assessment and evaluation of mineral deposits have changed significantly, and authors of these „recomputations and calculations“ use various, often unsuitable methods, mainly because they have never had an opportunity of becoming acquainted with modern and comprehensive methods of mineral deposit evaluation. It results that this book might be a contribution also for experts from practice. [3]

- The purchase and sale of a company,
- The increase of fixed assets,
- The entry and exit of partners,
- Inheritance procedures and donations,
- The merger and splitting of companies, changes (establishment of a joint-venture, purchase of a company by its employees, privatisation),
- The taking or increase of a loan, backing the loan,
- The identification of the financial status of suppliers or customers,
- The conclusion of insurance contracts,
- Entry into the stock market,
- The detection of excessive indebtedness limits,
- The assessment of a company by its management,
- Maintenance measures, liquidation,
- Tax purposes (property tax),
- Requirements of state administration bodies (defining economic and raw material policy, solving various conflicts of interests, statistic data in the area of national accounts).

However, the above list does not include all the reasons that may exist world-wide.

With regard to the various understanding of notions - *sources of mineral raw materials, deposits and mineral raw material reserves, mines, quarries*, etc., it is worth defining the basic notions used in the deposit geology, mining and economy of mineral raw materials, i.e. in specializations that support the evaluation of mineral raw material resources.

Earth resources are abiotic resources from the lithosphere, hydrosphere and atmosphere that can be excavated or obtained by means of existing and available technologies with the aim of meeting the needs of human beings. Earth resources are also a reflection of the human approach as well as the development of civilization and technologies. The development of inventions, technologies, trade, business, market requirements, investments, social and political events and institutions that control world trade as well as social relations within or between states may form a world-wide need that creates a required earth resource e.g. from a raw material that either has not been used so far at all or has been used only locally.

A Mineral raw material (primary mineral raw material) is a mineral natural substance, which was, is or will be (under defined conditions) used in production or consumption processes due to the content of its industrial components.

A Source of mineral raw material is, at present (or under precisely defined conditions), an extractable part of a retrieved or explored deposit as well as a deposit reasonably anticipated on the basis of geological conditions. Sources of mineral raw materials also include the earth's atmosphere, seas, oceans and mineral water springs.

An Ore is a mineral raw material with a metal being its industrial component.

Other mineral raw materials belong to non-metallic raw materials or fossil kaustobiolites.

A Deposit of mineral raw materials is such an association of mineral bodies in the earth's crust, which, based on its position, quality and quantity of mineral raw materials, meets the condition of immediate industrial exploitability both from the technical and economic viewpoint. The term "deposit of mineral raw materials" is also used for each natural occurrence, which was exploited for production purposes in the past.

Occurrence (prospect) of mineral raw materials is a mineral raw material resource which has not been exploited so far, and the reserves of which could be verified by its further exploration. Thus the occurrence can become a deposit. This assumption is based on the physical presence of mineral raw materials verified by geological prospecting (in boreholes or exposures).

Reserves of mineral raw materials are parts of currently mineable mineral raw material resources, the quantity and quality of which has been calculated in their original state, "in the earth".

Calculation of mineral deposit reserves – it is a calculation (estimation) of the quantity and quality of reserves in a deposit or the estimation of quantity and quality of resources (prognosis resources) serving for the evaluation of mineral raw material deposits.

When calculating reserves it is extremely important to quantify an error (of both quantity and quality), which affects not only a category of reserves, but mainly the accuracy of subsequent technical and economic assessments. If output economic and financial information is required to maintain ± 5 - 10 % accuracy for a detailed feasibility study, also the accuracy of reserve calculation (both quantity and quality) must meet these requirements.

Another important requirement for the modern and comprehensive evaluation of mineral deposits is the implementation of alternative calculations of reserves for several (4 - 10) cut off grades that cover the whole range interval of deposit quality parameters. The aim of alternative calculations of reserves is to define graphical and mathematical dependencies between reserves [Z], the average quality [x] and limit value [x_0], which subsequently enable alternative technical and economic assessments of reserves and an exact definition of optimum cut off grades [x_0] for non-balancing [x_{0N}] and balancing [x_{0B}] reserves, and for the maximum deposit price [$x_{0max.}$]. [3,8]

3 CONCLUSION

MINVEST program on the base of using the elementary statistical methods and technically-based analysis, its commercial availability and the minimum installation requirements will help the organization to detect critical spots (hotspots), take necessary measures for risk reduction and elimination of the risk factors what will increase its competitiveness and production.

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