Possibility of new mining project extracting in conditions of crisis

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This paper gives some information about investment in mining company, it specifies project of Strieborná Vein. The project uses instruments of financial management and it gives a lot of information about cost, taxes, return of investment, incomes and loan. That information is very important for application of project in Strieborná Vein and they support decision of investors. Strieborná Vein is an example of investment in period of crisis. Gold, silver, copper and iron extracting needs great investment but commodities are too interesting to invest to them.

***Key words**: investment, costs, financial analysis, net present value.*

Introduction

The investment environment connected with the mining industry is quite unique when compared with the environments of the other typical production industries. The main differences of the mining industry are intensity of capital, a long pre-production period, a high rate of risk, non-renewability of resources. It is important especially in period of crisis. But basic point in mining industry is always unreliability of all input data [6]. Investments into a daughter mining firm are different from investments into a parent company. Parent companies have already been established, and risks in the area of the firm development as well as financial risks are not so significant. Moreover, decisions regarding daughter companies are analysed through the historical experience of the parent firms. The dynamics of a daughter mining company depends mainly on the investment decisions. The success of investments in a daughter mining company depends mainly on the development of mining company, management, financial resources, marketing. The evaluation of investments into the property, project or operation in a mining venture requires the following:

- to define a category of type or kind of the investments, and define which group is represented by the investment (junior, senior),
- to identify its position in the mine's life cycle,
- to independently assess project advantages.

First of all, an investor invests in the management that runs the mining company. Namely, investment revenues come from the production managed by its management. Unfortunately, there are no quantitative criteria to define whether the management is good or bad. Its assessment is purely subjective. The management must be first of all honest and remain on the investor’s side.

Though honesty cannot be easily assessed:

- in case if a management creates a daughter company, which will own 100 % of the project shares,
- if it surprisingly dissolves private investments in the firm, the best thing from the investor’s perspective is to leave the project.

Often very good geologists and mining engineers are available, however they often focus not only on managing the mine to progress towards prosperity, but gradually on building their own firm, which will manage a mining venture. Making money for their share holders is for them only secondary. From the investor’s viewpoint the management is ideal, when the earned money is invested into the property, not into the venture overheads, employees´ wagesete [3], [7].

1. Analysis of investments in the mining industry

The task of analysing the investment and concrete project is to ensure reliable information connected with designing, mining method, production costs, recovery, consulting means (e.g. character of used bank systems, geostatistics and geographical information systems, etc.) and many other variable factors. One of the biggest

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(Review and revised version 1. 2. 2010)

is in present influence of crisis. In fact, it is necessary to use quantitative values for project variables based on technical analyses. Only in cases when variables are quantified, a study of the economic efficiency of the mining business can result in conclusions and a quality investment decision can be made.

The same approach applies not only to the decision to invest before starting production itself, such as with a new project, but also for the decision to invest into already ongoing projects, in cases of expanding production or the renewal of obsolete and worn-out technologies. Everyday operation requires an information analysis of the high quality project management in its technical as well as economic aspects. Thus the economic assessment of a mining project or setting the limit of the economic efficiency of a mining business requires a large amount of information that must be processed in one place using one system.

As an effect of the decision making process with regard to the above mentioned consequences analysis requires many alternatives, also the facts such as costs, profit, savings, project duration, taxes, increased inflation effects, project risk and others must be taken into consideration. At present there are several algorithms that can be successfully applied in the area of heavy industry and mainly in the mining industry. They include:

- development of a detailed economic study of the economic efficiency of business, along with defining the rate of opportunity acceleration (*screening*),
- comparison of relative advantages of all investment resources (*ranking*),
- assessment of supplier offers from many suppliers offering identical products or services,
- decision to buy or to lease,
- definition of values or prices for product purchase and sale,
- setting of costs for loan sources, both short-term and long-term from the payable sources,
- replacement of existing equipment or services,
- choice between interesting alternatives.

When assessing the economic efficiency of investments implemented by means of a project, with the effort to comprehend its internal consequences, it is necessary to proceed step by step, and gradually implement all variables affecting its result into the project assessment [7].

Strieborna Vein Silver Project

The Strieborná Project is an advanced exploration property centred on a silver-copper-antimony-bearing siderite-quartz vein, in which tetrahedrite in the main silver, copper and antimony mineral. The vein is situated in East part of Slovakia (fig. 1), within Mining License Rožňava III, which along with contiguous Mining License Rožňava I covering the historic Mária Mine, is held by Global Minerals Slovakia s.r.o. In geological terms, the area is situated in the Gemericum metallogenic province of the Inner Western Carpathians. This is a terrain underlain predominantly by Palaeozoic rocks deformed and metamorphosed in the upper greenschist facies during the Variscan deformation cycle in late Palaeozoic and reactivated during the Alpine deformation in Cretaceous to Tertiary. The Strieborná Vein and other veins in the Rožňava ore field are believed to have been derived through leaching of stratiform siderite bodies by metamorphic fluids and redeposition of siderite with quartz and sulphides in open structures. Eleven phases of deformation have been documented in the underground workings. The licenses allow holder to mine polymetallic ores, including iron, copper and silver ores. There is no time limit on the licenses, provided the holder complies with the Mining Law and annual filing / payment requirements. The new Slovak Mining Law requires mining to begin within the five years from the date a Mining License is granted [4], [8].

Study of a project

The analysis of probable project results is important from the viewpoint of identifying the most suitable variant for the implementation of the raw material exploitation. No single-shot economic evaluation can bring satisfactory results if made only on the basis of one calculation. The calculation variability ensures the possibility of the simulation of external and internal effects influencing the project, which may occur during the project implementation and also searching for the optimum variant of the project implementation with the purpose of maximizing its goals (fig. 3).

Tools of Economic Decision Making

The analysis of several alternatives for making an investment decision must consider factors such as costs, profit, savings, project duration, taxes, environmental limits, and effects of increased inflation, project risk and others (fig. 2). There are many simulations applicable in the area of heavy, mainly in the mining industry.

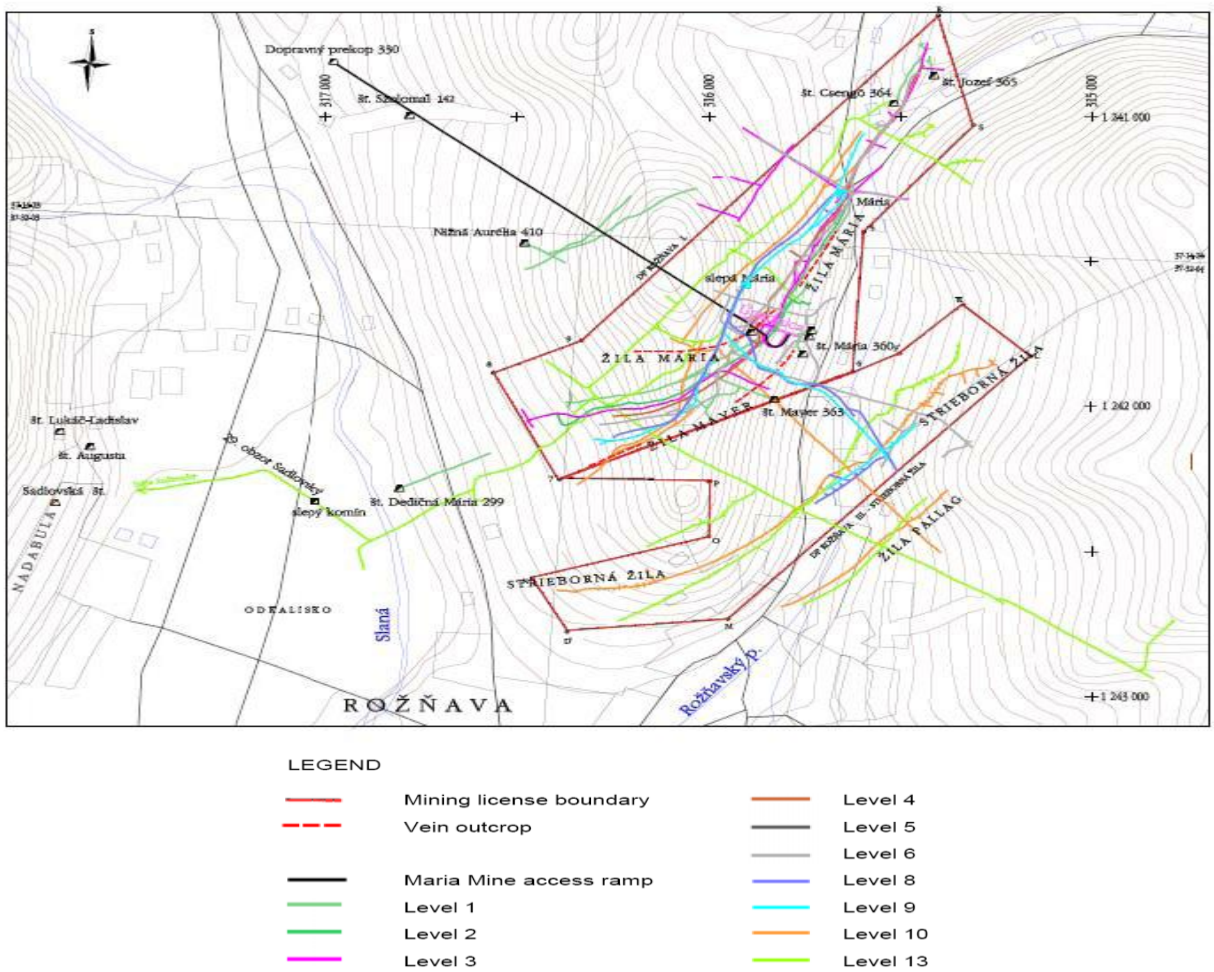

Fig. 1. Location of Mining Licenses Rožňava I and Rožňava III [8].

Cash – Flow (CF)

A flow of the spent and earned money can generally be called as the *cash-flow*. The *cash-flow* is a tool of financial analysis. The *cash-flow* represents extremely important data for each commercial unit. Each business or activity can go bankrupt, regardless of the fact of how profitable its accounting results seem to be, unless the company is able to pay invoices. Such success means the creation of a positive *cash-flow*.

Payback Period (pBp)

A payback period is the project duration from its beginning until when the cumulative *cash-flow* becomes positive. For some projects it is the risk measurement that indicates how long the investment of capital is endangered. Similarly to the previous case, when it is used as a single indicator, it does not have a complete assessment value, since it gives only information about a project during the payback period. Although in the case of some projects the assessment results based on the payback period may seem interesting, this indicator does not say anything about the project's future course from the viewpoint of its cash-flow development. This indicator does not specify in detail the cash-flow development until the payback period is reached, either.

Internal Rate of Return (IRR)

Internal rate of return, also called internal revenue rate, is a change of the update rate to the indicator of the economic assessment of the project. The IRR measures an effective rate of the investment return at which the investments return without producing other funds from the project, if the investments were gained from loan resources at a certain IRR interest rate. The IRR is an indicator, which considers the duration of the entire project [6].

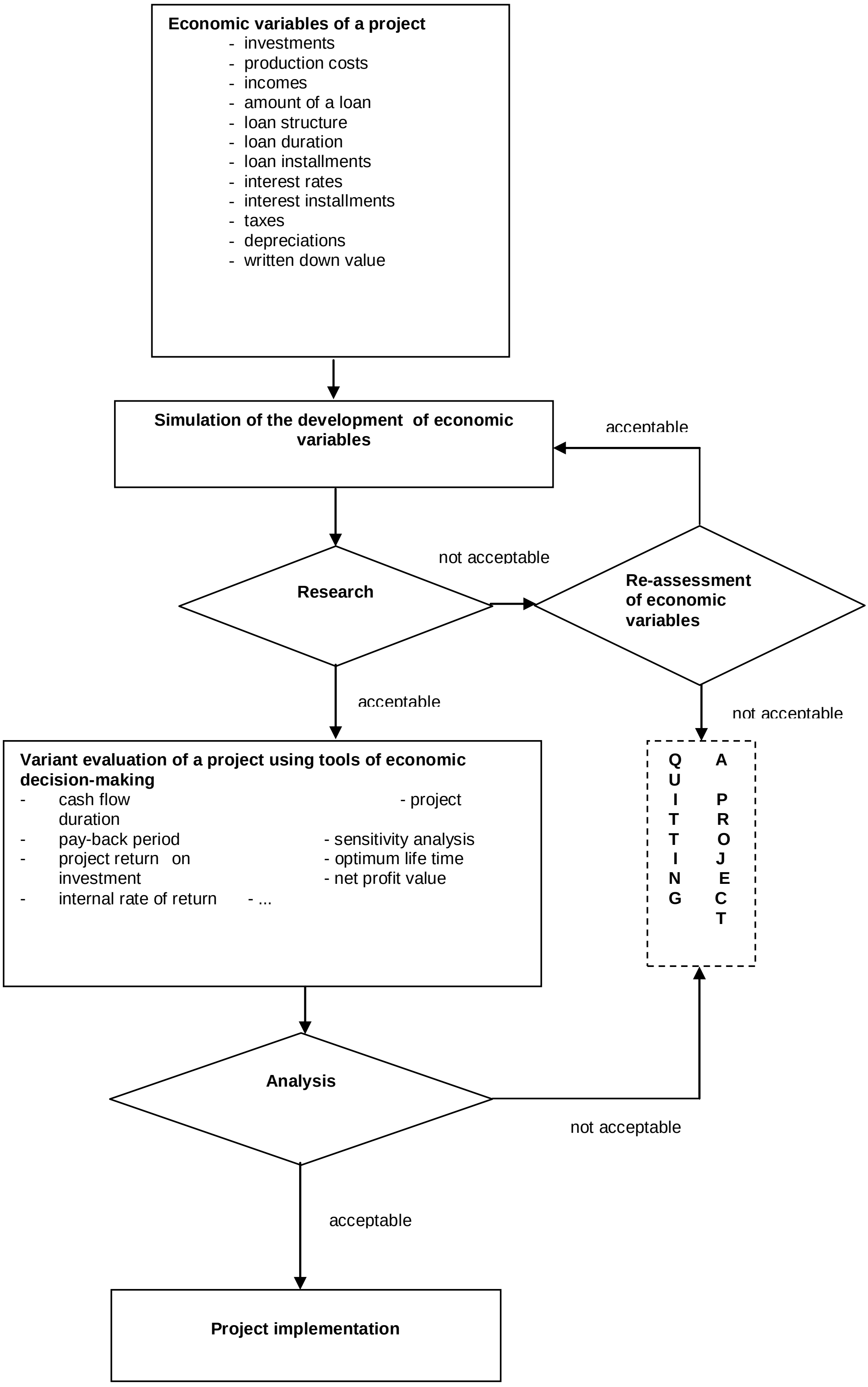

Fig .2. The study of the project [7].

Net Present Value (NPV)

On the basis of the above facts it can be stated that it is better to own one euro today than two euros tomorrow. Money that can be gained through the investing in a year is more secure than that, which can be gained in twenty years. This is one reason why it is worth assessing the project by means of the annual updated *cash-flow,* the sum of which, dependent on the project duration, is called the *Net Present Value* (NPV).

$$NPV = \sum_{i=1}^{n} \left[(-I + CF_i)(1+a)^{-i} \right], \tag{1}$$

where: NPV – net present value, I – investments, CF – cash-flow, a – update rate, i – current year, n – project duration.

This is the method of how to use the cash-flow and its certain rate of uncertainty expressed in the update factor (1 + a), exponentiated by the distance between present day and future data. The selection of „a“ depends on the interest rate at which investments can be obtained. It is also possible to select this value in accordance with the uncertainty of predicting the future. The more accurate the future and its impact on finances can be predicted, the lower the value of „a“. Thus a theoretical limit is „0“, when the update in fact lapses. And this is the current case.

The net present value can be expressed also in a more demonstrative way, as follows:

$$NPV = (R_0 - C_0) + \frac{R_1 - C_1}{1+a} + \frac{R_2 - C_2}{(1+a)^2} + ... + \frac{R_n - C_n}{(1+a)^n}, \tag{2}$$

where: R – incomes, C – costs.

Each member in this formula represents the annual updated cash-flow in general. The more distant the future, the higher the update rate, and this fact reduces the current value of future money.

When evaluating a mining project it is important to get a positive NPV value, because when it is positive, the project brings back both invested funds and a corresponding profit under conditions of a certain uncertainty in the future and with calculated the risk, which is expressed by means of the update. If the NPV value is negative, the project should be ceased. Money designed for such project should be invested somewhere else.

Another case of the NPV calculation can occur when there are not enough available funds for the project, and for the full investments budget it is also necessary to obtain other external sources. In such cases, when the part of the investments is formed by a loan with a certain interest rate, the NPV can be calculated as follows:

$$NPVCI = \sum_{i=1}^{n} \left[\left(-(I - L) + (CF_i - rep_i) \right)(1+a)^{-i} \right], \tag{3}$$

where: NPVCI – Net Present Value of own investments, L – loan, rep – interest instalments.

The NPVCI is a result of private investments only. In case of the assessment of the economic efficiency of a mining venture it is possible to make several studies, which will vary only in the ratio between loan and private investment funds. It enables the identification of their optimum ratio, not only from the viewpoint of their profit maximization, but also from the viewpoint of considering the project risk. In certain cases it may be more suitable to use loan resources to a larger extent and deposit private funds in the area of a relatively lower risk, for example in the bank. This is the way to gain higher revenues from the same source.

When calculating NPV and the cash-flow as positive each year, we can compare the NPV to the earnings that could be gained by depositing our private funds in the bank. The payback period of the Return on Investment ROI from the project is in this case identical with the interest rates provided by the bank. If they are equal, it is better to deposit funds to the bank and avoid business risk.

The first problem occurs in cases where the cash-flow is not always positive, and the calculation becomes very complicated, even impossible. The comparison can only be made in cases when each annual negative cash-flow is represented as the depositing of funds in the bank account in a corresponding year. Then the comparison is the same as in case of the constantly positive cash-flow.

Another problem occurs when two projects are compared and their NPV and ROI values show the opposite trends. The NPV of the 1st project is higher that the NPV of the 2nd project and vice versa - the ROI of the 1st project is smaller than the ROI of the 2nd project (NPV1 > NPV2; ROI1 < ROI2). In this case no exact mathematical formula defines which of the two projects is better. The investment volume and rate of project risks are likely to play the most significant role. The project evaluator’s intuition and experience as well as other arguments can affect investment decisions.

Note: As a rule, when granting loans banks prefer ROI, because as has been already mentioned, it is very similar to loan interest conditions.

On the basis of the NPV formula it is also possible to calculate the period of the ROI. ROI period can be calculated using the following equation:

$$\sum_{i=1}^{n} \left\{ I + CF_i / (1+a)^i \right\} = 0 \qquad (4)$$

or

$$\sum_{i=1}^{n} \left\{ (I - L) + (CF_i - rep_i) / (1+a)^i \right\} = 0 \qquad (5)$$

It means, when the project invested funds return [7].

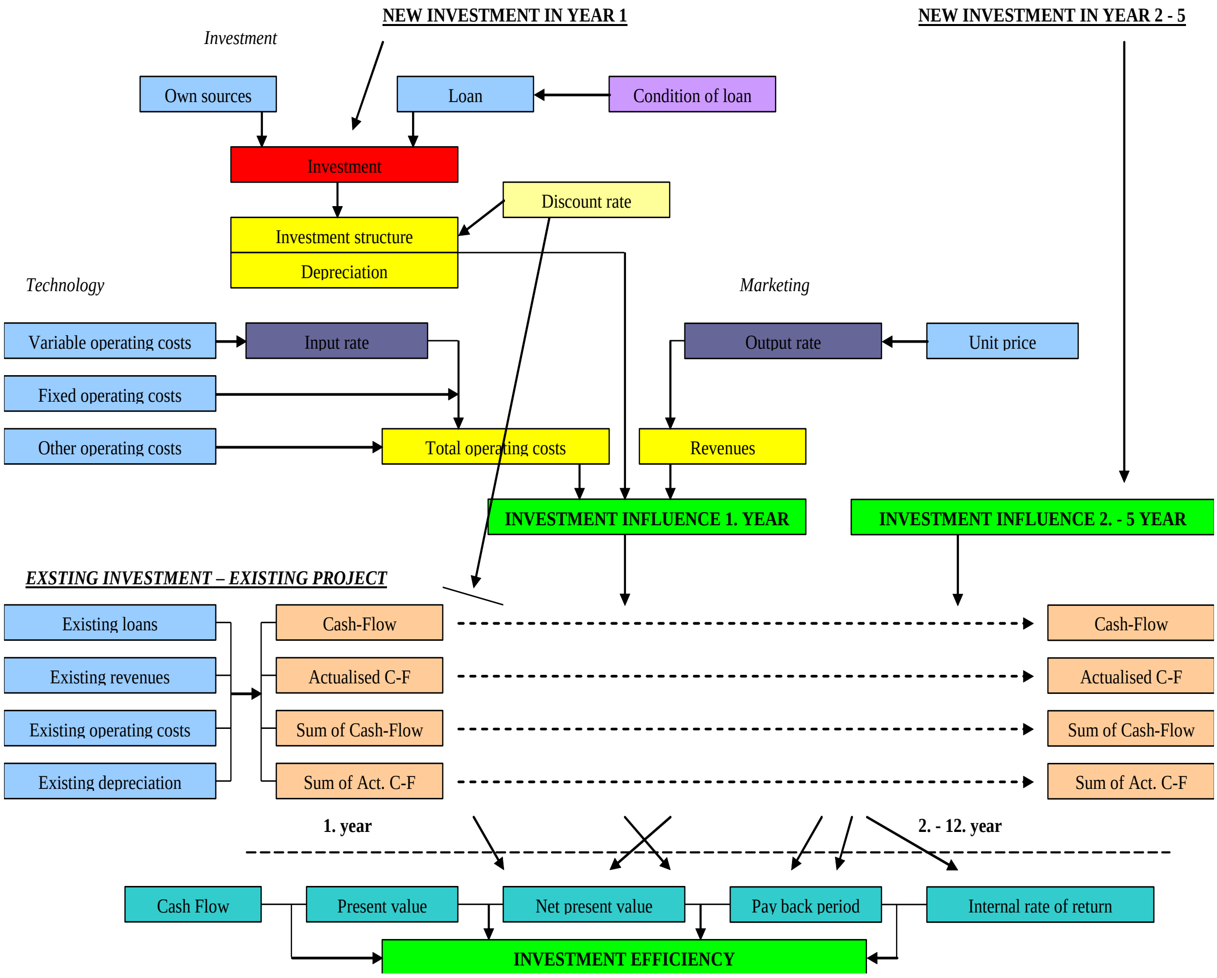

Fig. 3. Model of Mining Investment analyses.

Practical study of a project

For the practical study of a project it is necessary to know total amount of investment, structure of investment, source and properties of financing (tab. 1). All those parameters impact on result of investment as well. In heavy, and particularly mining industry, capital costs or capital investments mean the total volume of funds, which brings the whole project into activity [1].

Total capital costs consist of two basic parts: fixed investments and working capital. Fixed investments represent the financial volume, which is needed to prepare and construct the whole set of the project facilities, in a way to have the project ready for starting:

- acquisition of land, terrain work,
- preparation of extraction (displacement of a hanging wall,...),
- environmental studies and legislation proceedings,
- erection of an extraction facility (buildings, equipment,...),
- construction of a processing unit (buildings, equipment,...),
- supporting infrastructure (roads, railway, and connections to power supplies,...),

- project studies and engineering costs,
- other consequences.

Tab. 1. Structure of investment Strieborná Vein silver project.

Financing of the project						
Part of own financing		14	%	*Discount rate*	6	%
Credit 1	percentage of debt	0	%	*Income tax*	19	%
long	interest rate	8	%			
	year of repayment (2.to 12. year)	12	year (s)			
	beginning of repayment (2.to 4. year)	**2**	year	*Net profit*	0	€
Credit 2	percentage of debt	86	%	*Capital investment*		
middle	interest rate	8	%	Present capital costs	**55 297 845**	€
	year of repayment (2.to 12. year)	7	year (s)	Actualised capital costs	56 624 993	€
	beginning of repayment (2.to 4. year)	**4**	year	Actualised capital costs with calculated interest rate	62 986 106	€
Credit 3	percentage of debt	0	%			
short	interest rate	8	%			
	year of repayment (2.to 12. year)	1	year (s)			
	beginning of repayment (2.to 4. year)	**2**	year			

Production costs

Generally it applies that to estimate production costs is much more difficult than to estimate capital costs. The uniqueness of each mining venture and each mining operation is demonstrated by the peculiarity of conditions, technological equipment, characteristics of human resources, mining method, location, maintenance philosophy, etc. Based on the above mentioned it is evident that concerning the estimation of production costs situation in underground mining is significantly more complicated than in surface mining. Production costs, revenues and calculation of Cash-Flow and other indicators are tabled in charts (tab. 2, 3).

Production costs are generally expressed as a variable given in units $€.t^{-1}$. This data comprises all parts of costs and when analysing it more deeply we discover that the cost data expressed by this dimension is valid only for this particular production measure. At any production measure change the recalculation of production costs must be carried-out, which is very difficult mainly with feasibility studies, where variety and looking for optimal solutions is the basis of an economic analysis. To make it simpler and for the sake of better clarity the costs can be divided into three basic categories: direct, indirect and general (overhead) costs [2].

Market price of a deposit

The market price is a value determined in a public market through harmonization of seller and buyer requirements. The market price is defined by offer and demand as well as by sales conditions. However, the application of the market approach to mining results in serious practical problems. Let us mention at least the two most significant ones:

- mining properties are sold only to a limited extent, which results in a reduced availability of comparable data,

- each deposit is unique due to its qualitative properties, size, geographical position, range of mining operations and many other parameters. Hence any data on the value of a mining property is usable only very rarely. In order to enable the application of market data a similar property value in the same time must be considered, because market conditions change in time (extraction costs, sales price of a final product, level of information about a deposit, etc.) [3].

Tab. 2. Capital costs repayment and revenues calculation.

Financial analysis

Economic efficiency evaluation

Calculation of Cash - Flow

	Year	**1**	**2**	**3**	**4**	**5**	**6**
Capital costs	[€]	33 178 707	23 446 286	0			
Loan 1	[€]	0	0	0			
Repayment of loan 1	[€]	0	0	0	0	0	0
Interest of loan 1	[€]	0	0	0	0	0	0
Loan 2	[€]	28 533 688	20 163 806	0			
Repayment of loan 2	[€]	0	0	0	16 055 089	16 055 089	16 055 089
Interest of loan 2	[€]	0	0	0	0	3 853 221	2 877 072
Loan 3	[€]	0	0	0			
Repayment of loan 3	[€]	0	0	0	0	0	0
Interest of loan 3	[€]	0	0	0	0	0	0
Existing investment							
Other repayment of loans	[€]	0	0	0	0	0	0
Other interest of loans	[€]	0	0	0	0	0	0
Depreciation of assets	[€]	3 898 188	3 898 188	3 898 188	3 898 188	3 616 040	3 616 040
Year of depreciation activating (!!! 1to 4)	[year]	1					
Activated asset depreciation	[€]	3 898 188	3 898 188	3 898 188	3 898 188	3 616 040	3 616 040
Other depreciation - exist. Investment	[€]	0	0	0	0	0	0
Total depreciation	[€]	3 898 188	3 898 188	3 898 188	3 898 188	3 616 040	3 616 040
Production	**Years**	**1**	**2**	**3**	**4**	**5**	**6**
Annual sale I.	[t/year]	0	0	3 000	6 000	6 000	6 000
Annual sale II.	[t/year]	0	0	3 000	6 000	6 000	6 000
Annual sale III.	[t/year]	0	0	3 000	6 000	6 000	6 000
Annual sale IV.	[t/year]	0	0	850	1 759	1 759	1 759
Annual sale V.	[t/year]	0	0	500	1 079	1 079	1 079
Annual sale VI.	[t/year]	0	0	33 000	66 000	66 000	66 000
Annual sale VII.	[t/year]	0	0	0	0	0	0
Annual sale VIII.	[t/year]	0	0	0	0	0	0
Revenues I.	[€]	0	0	19 351 828	41 372 873	43 374 786	45 043 047
Revenues II.	[€]	0	0	35 078	74 995	78 624	81 648
Revenues III.	[€]	0	0	1 715 048	3 666 655	3 844 074	3 991 923
Revenues IV.	[€]	0	0	3 988 971	8 824 123	9 251 096	9 606 908
Revenues V.	[€]	0	0	213 312	492 075	515 885	535 727
Revenues VI.	[€]	0	0	149 675	319 994	335 478	348 381
Revenues VII.	[€]	0	0	0	0	0	0
Revenues VIII.	[€]	0	0	0	0	0	0
Revenue others - existing investment	[€]	0	0	0	0	0	0
Total revenues	[€]	0	0	25 453 913	54 750 715	57 399 943	59 607 634

Tab. 3. Operating costs repayment and economic parameters of project.

Financial analysis

Economic efficiency evaluation

	Years	**1**	**2**	**3**	**4**	**5**	6
Annual purchase I.	[t/year]	0	0	7 200	7 200	7 200	7 200
Annual purchase II.	[t/year]	0	0	7 200	7 200	7 200	7 200
Annual purchase III.	[t/year]	0	0	0	0	0	0
Annual purchase IV.	[t/year]	0	0	0	0	0	0
Annual purchase V.	[t/year]	0	0	0	0	0	0
Annual purchase VI.	[t/year]	0	0	0	0	0	0
Annual purchase VII.	[t/year]	0	0	0	0	0	0
Annual purchase VIII.	[t/year]	0	0	0	0	0	0
Production costs							
Production costs I.	[€]	1 422 869	1 494 013	8 870 939	13 480 689	14 090 535	14 637 769
Production costs II.	[€]	3 209 017	3 209 017	5 309 488	5 395 006	5 473 268	5 551 408
Production costs III.	[€]	0	0	343 010	733 331	768 815	798 385
Production costs IV.	[€]	0	0	797 794	1 764 825	1 850 219	1 921 382
Production costs V.	[€]	0	0	42 662	98 415	103 177	107 145
Production costs VI.	[€]	0	0	29 935	63 999	67 096	69 676
Production costs VII.	[€]	0	0	0	0	0	0
Production costs VIII.	[€]	0	0	0	0	0	0
Wages costs	[€]	1 253 571	1 303 714	1 353 856	1 403 999	1 454 142	1 504 285
Other costs - exist. Investment	[€]	736	736	736	736	736	736
Total production costs	[€]	5 886 193	6 007 480	16 748 420	22 941 000	23 807 987	24 590 785
Tax nondeductible item	[€]	0	0	0	0	0	0
Tax deductible item	[€]	0	0	0	0	0	0
Total items	[€]	0	0	0	0	0	0
Taxable income	[€]	-9 784 381	-9 905 668	4 807 305	27 911 527	26 122 695	28 523 736
Income tax	[€]	0	0	913 388	5 303 190	4 963 312	5 419 510
Loss	[€]	0	0	0	0	0	0
Fund I.	[€]	0	0	0	0	0	0
Fund II.	[€]	0	0	0	0	0	0
Fund III.	[€]	0	0	0	0	0	0
Fund IV.	[€]	0	0	0	0	0	0
Fund V.	[€]	0	0	0	0	0	0
Total funds	[€]	0	0	0	0	0	0
net profit	0 €						
		1	**2**	**3**	**4**	**5**	**6**
Cash - Flow	[€]	-10 531 212	-9 289 960	7 792 105	10 451 436	8 720 334	10 665 177
Sum. Cash - Flow	[€]	-10 531 212	-19 821 172	-12 029 067	-1 577 630	7 142 703	17 807 881
Actualised Cash - Flow	[€]	-10 531 212	-8 764 113	6 934 946	8 775 227	6 907 321	7 969 641
Sum. actualised Cash - Flow	[€]	-10 531 212	-19 295 325	-12 360 379	-3 585 152	3 322 169	11 291 810

Present value	**198 826 862 €**
Net present value (NPV)	**119 842 048 €**
Internal rate of return (IRR)	**43 %**
Payback period (PBP)	**4,5 years**

Exploration

Almost all exploration on the Strieborná Vein was conducted by the Geological Survey. It involved underground exploration by means of driving, raising and sampling crosscuts, either directly in the vein or in its footwall with sampling crosscuts at regular intervals to intersect the whole width of the vein. Diamond core drilling was also conducted by the Geological Survey, mainly underground, but was treated as a secondary exploration tool only to confirm the predicted locations of the vein between, above and below the underground workings. CMX (Capital Market Exchange) remapped about 60 % of all underground workings in the Strieborná Vein and resampled the sites of the previous Geological Survey channel sampling. In addition, CMX conducted a detailed structural analysis based on the examination of small structures and a mineralogical study focusing on the distribution and composition of tetrahedrite. The main purpose of the CMX programme was to verify results reported by the Geological Survey and to identify the productive sections of the Strieborná Vein. ŽELBA (former owner) developed the raise above Level 8 and the sublevel drives above Levels 8 and 9. This work was reportedly supervised by ŽELBA geologists but the Issuer has not been able to obtain any records indicating that these workings were mapped or systematically sampled. The raise from Level 8 was unsafe to enter and was not examined [7].

Conclusion

Price of the industrial mineral deposit especially in crisis can be determined on the basis of the deposit evaluation. From that point it is possible to say that price of the industrial mineral deposits is also equal to risk, which you will take when you will invest to the ore body. If you will think about evolution of prices at the crisis time, after that it is possible to understand the evaluation. The evaluation of mineral deposits is a specific problem, which is solved by classical methods of the evaluation of production enterprises. Principally two possibilities exist: to evaluate a deposit as land or to consider it as a production enterprise that creates profit by its activities. Then the deposit is evaluated as a mine, and is considered as means of money production. Hence its price is equal to the present value of future (assumed) net incomes from the extraction with regard to the time horizon, the cost of the invested capital, inflation and risk. Then the indicator of the industrial mineral deposit may be expressed by the *net present value* (NPV), *cumulative cash flow* (CCF), Morkill's formula, Hoskold's formula and others.

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