

**PROVIDING SUSTAINABLE DEVELOPMENT TO MINING  
ENTERPRISES THROUGH THE VALUE MANAGEMENT****Csikosova A., Zuzik J., Culkova K., Janoskova M., Weiss E.\***

**Abstract:** In the present economic crisis caused by the pandemic and political situation, the theme of the enterprise evaluation has become an actual and important one. The contribution of the present study aims to present a tool for managing the enterprises' value, acting in the mining sector in Slovakia conditions. The evaluation is made by predicting future cash flow and creating the company's financial plan. During the creation of the financial plan, the probability distribution of individual factors is used. Probability distribution had been determined according to the development of annual changes of chosen indicators. According to the evaluation of the chosen company, a process of individual steps for model creation is suggested. The process results present the evaluation of chosen company by various revenue methods. Individual results are compared with the market capitalization of the chosen company, and in this way, the results could serve to manage the competitiveness of the companies in other industrial sectors.

**Key words:** management of the enterprise value, mining company, sustainability, Slovakia.

DOI: 10.17512/pjms.2022.25.2.07

*Article history:*

*Received* January 12, 2022; *Revised* March 21, 2022; *Accepted* March 28, 2022

**Introduction**

Presently there is a number of studies and publications connected with enterprise evaluation. Recently, many researchers have used discounted cash flow methods but not revenue methods (Chen and Teng, 2015). Over recent years, practices using economic forecasting have changed (Elliott and Timmermann, 2016). The latest research is orientated to probabilistic cash flow forecasting (van den Boomen et al., 2020). Becker (2020) offered a solution for the consistent valuation of cash flows with a limited lifetime and debt financing. Vayas-Ortega et al. (2020) found cash flow forecasting is not coherent with market expectations or sector conditions. Dec (2020) mentioned that it is an adjusted discounted cash-flow valuation for final users or investors. Mahata and Mahata (2020) used discounted cash flow analysis to provide the highest present value of all future cash flows. Khanzadi et al. (2017) found inadequate cash flow is the main cause of bankruptcy of the industrial companies. Chizmar et al. (2020) modeled cash flow for the agriculture sector, and Purani and Jeesha (2020) prepared methods for the broadcasting industry. However,

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the evaluation of mining enterprises is not very known in the literature. The study aims to find out special conditions for the mining enterprises evaluation, such as changes in prices of certain commodities as a product of mining enterprises (Damodaran, 2010).

Mining enterprises are characterized by high volatility of revenues and cash flow (Koller et al., 2000; Jacks et al., 2011) and high fixed costs for repeated renovation of the operation (Kernot, 2006). Mining companies demand vast initial investments to start the operation, which leads to the use of debt financing to many mining companies (Damodaran, 2010). In case when mining companies are looking for other possibilities for their expansion, they use mostly debts (Kernot, 2006). Mining industry faces many financial problems. One of them is to determine the proper performance funding structure. Turek and Michalak (2011) created new models of funding performance in mining enterprises and proposed examining the influence of separate models on the effectiveness of financial management in mining enterprises. According to Mingaleva et al. (2019), the value of the mining enterprise can also be improved through cluster forming, which contributes to obtaining a high positive effect from the cluster for urban and municipal development at the origin of the mining enterprise. The results of studies show that social responsibility positively influences corporate value (Xu et al., 2020; Csikosova et al., 2020). Such findings reveal the transmission mechanism of social responsibility on corporate value and provide policy suggestions for coal enterprises to promote sustainable development, which is beneficial for the national energy security and strategy. The stable market position of the enterprise is given by financial stability (Panova, 2020; Valaskova et al., 2021) when the company's share of its own and foreign resources affects the company's financial stability. A high share of own resources makes the company stable and independent. The financial situation of the enterprise can be improved by logistics tools use (Teplická and Szalay, 2021). This indicates the necessity to include financial indexes in value management. However, also soft-skills in enterprise value management play an important task. This area examines the influences and relations between local and foreign employees and/or managers (Gallo et al., 2021a). Especially for companies with a labor force from diverse countries and cultures, disputes often arise in communication, contributing to increased enterprise value.

### **Research Methodology**

The contribution is orientated to the chosen mining enterprises acting in Slovakia. The research process consists of collecting input data from mining organizations in Slovakia. 22 chosen mining organizations were analyzed during the research in 5 years' horizon. The analyzed indexes are probable development of the mining company property, capital, revenues, costs and cash flow for the probability distribution. The indexes were further applied to create financial plans in the concrete organization (Evalent 4.0 is used). Individual indexes were evaluated by the program Crystal Ball from Oracle to obtain probability distribution of the individual indexes

development, used for the enterprise value development by Evalent 4.0. Simulated values had been placed on the plans of the enterprise by methods demanding knowledge of the enterprise plan; consequently, simulation by Monte Carlo had been used and suggested process for evaluation of the enterprises. The object of searching is chosen to mine, a joint-stock company with the main activity of dolomite mining. The company is chosen due to the real business with its capital market shares, which provide publicly available information and reports.

During the research, we used the method of enterprise evaluation based on discounted cash flow (Chen et al., 2015; Dec, 2020) since it presents the most used method in Slovakia to determine enterprises' value. The base calculation is as follows:

$$V_{(0)} = \sum_{t=1}^{t=N} \frac{E(CF)}{(1+r)^t} \quad (1)$$

Where: E(CF) - free future cash flow;

r - discount rate, reflecting the risk of future cash flow;

N - assumed life cycle of assets.

The evaluation is supported by models based on Economic value added (EVA), which belong to relatively new models of enterprise evaluation (Sabol and Sverer, 2017; Behera, 2020). Weighted average costs of capital (WACC) are considered in the model as a discount rate.

$$EVA = NOPAT - WACC \times NOA \quad (1)$$

Where: NOPAT - operational economic result,

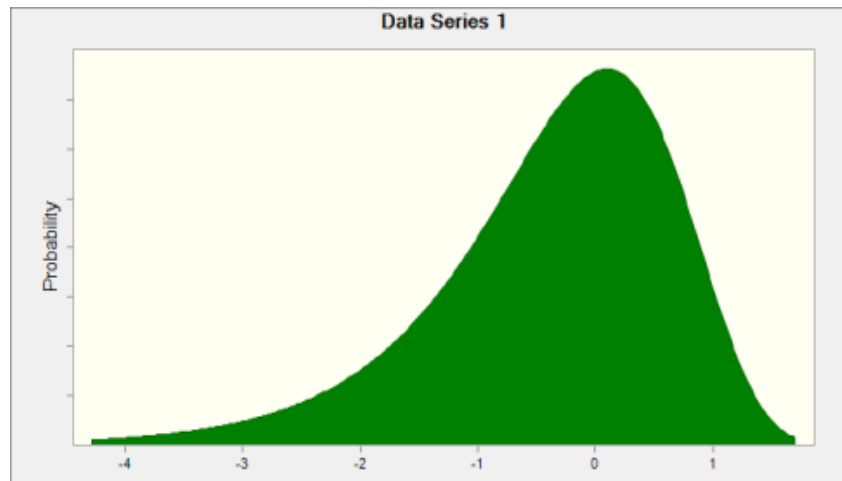
WAC – weighted average costs of capital,

NOA – net operation assets – (invested capital).

The value of the enterprise is also calculated through the method of capitalized net revenues, offering a possibility to calculate the value of the enterprise as the value of its equity, derived from the so-called permanently sustainable level of profit.

## Research Results

The first step in the value process of the mining company is creating a benchmark group of enterprises. The analyzed company is Slovakian mining enterprise extracting the dolomite. Therefore, to the benchmark group, 22 compared enterprises were given. Data were obtained from financial reports of the individual companies in the last 5 years. According to obtained and collected historical data, the individual indexes development created a probability distribution. Data entering to the calculation during the individual methods are presented below. Probability distribution of the operation results in changes in individual mining enterprises in Slovakia is presented in Crystal Ball. Figure 1 illustrates operation results change in individual mining organizations in Slovakia.



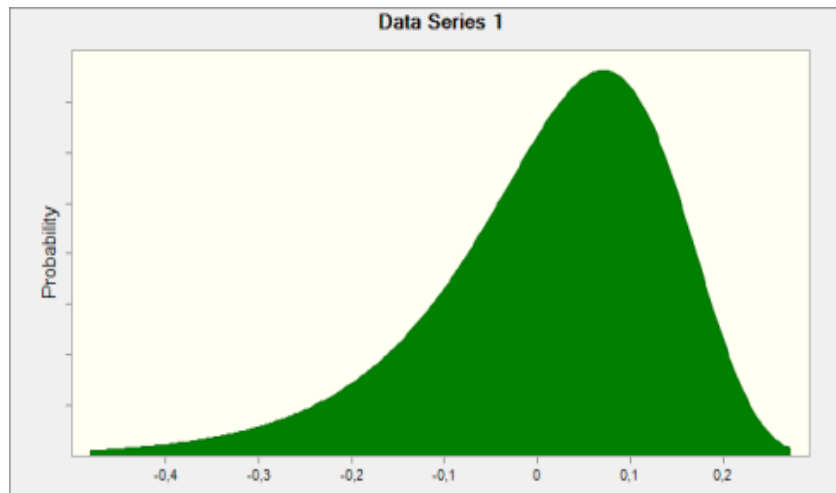
**Figure 1: Probability distribution of the operation results changes.**

Table 1 mentions description characteristics of the probability distribution from Figure 1. The most probable is a 10% growth in economic results. The average change of economic result is -0,38, which means that during 5 years, mining organizations registered an average decrease in economic results – in this case, a loss of 38%. The index values are considerably variable, which is also confirmed by the level of standard deviation (106%). Half of the annual changes in economic results are over a 20% decrease.

**Table 1. Description characteristics of the changes in economic results.**

Type of distribution	Minimum Extreme distribution
Likeliest	0.1
Scale	0.83
Mean	-0.38
Median	-0.2
Std. Dev.	1.06

Figure 2 illustrates the probability distribution of sales changes in the mining industry in Slovakia.



**Figure 2: Probability distribution of annual changes in sales.**

Description characteristics are mentioned in Table 2. The most probable is a yearly growth of 7%. The average annual growth of sales is at the level of 1%. The median is at the level of 3%. The standard deviation is 13%, which means that individual data are less variable compared to other indexes.

**Table 2. Description characteristics of the annual sales distribution.**

Type of distribution	Minimum Extreme distribution
Likeliest	0.07
Scale	0.1
Mean	0.01
Median	0.03
Std. Dev.	0.13

The next important index in the frame of mining industry is the volume of amortization. Probability distribution of annual changes in amortization is illustrated in Figure 3.

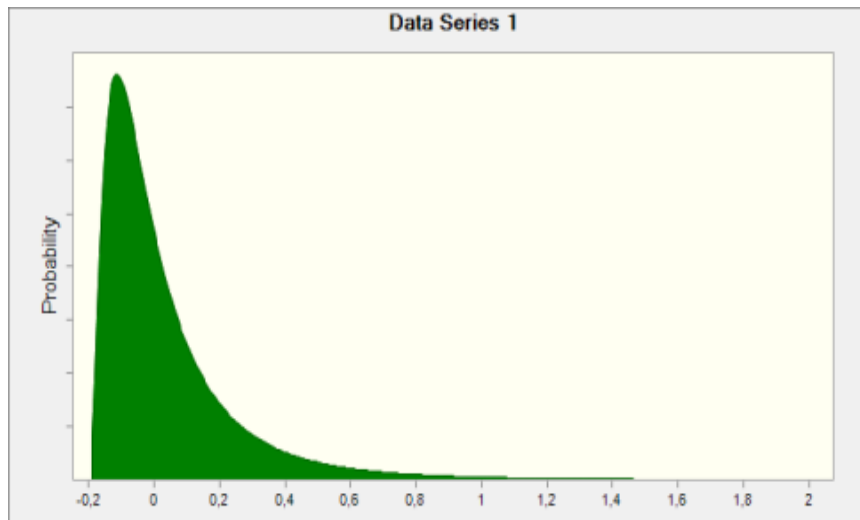


Figure 3: Probability distribution of annual changes in amortization.

Description characteristics are mentioned in Table 3. Half of the annual changes in the frame of analyzed mining organizations registered annually more than 3% decrease of the property amortization. Averagely during the analyzed period, the annual change of amortization is 3%. The standard deviation during the probability distribution of the index is 24%.

Table 3. Description characteristics of the annual amortization.

Type of distribution	Lognormal distribution with parameters
Location	-0.21
Mean	0.04
Median	-0.03
Std. Dev.	0.24

The trend of total value of individual companies is illustrated in Figure 4.

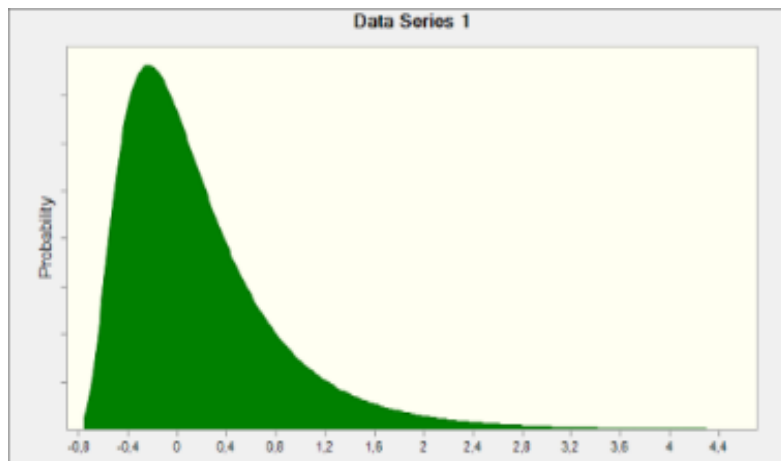


Figure 4: Probability distribution of annual changes of mining organization.

Parameters of volume changes are mentioned in Table 4. Analyzed mining organizations increased annually by 19% on average, but more than a half of the changes were lower than -3%. The standard deviation is at the level of 24%.

Table 4. Description characteristics in a volume change of enterprises.

Type of distribution	Lognormal distribution with parameters
Location	- 0.9
Mean	0.19
Median	-0.03
Std. Dev.	0.24

The resulting values of individual indexes are used during the creation of financial plan of the company. Input data necessary for the determination of the chosen company value had been obtained from the company's financial reports. Except for the data mentioned in the balance sheet, loss and profit report, and cash flow, the authors obtained supplementary data. They are illustrated in Table 5.

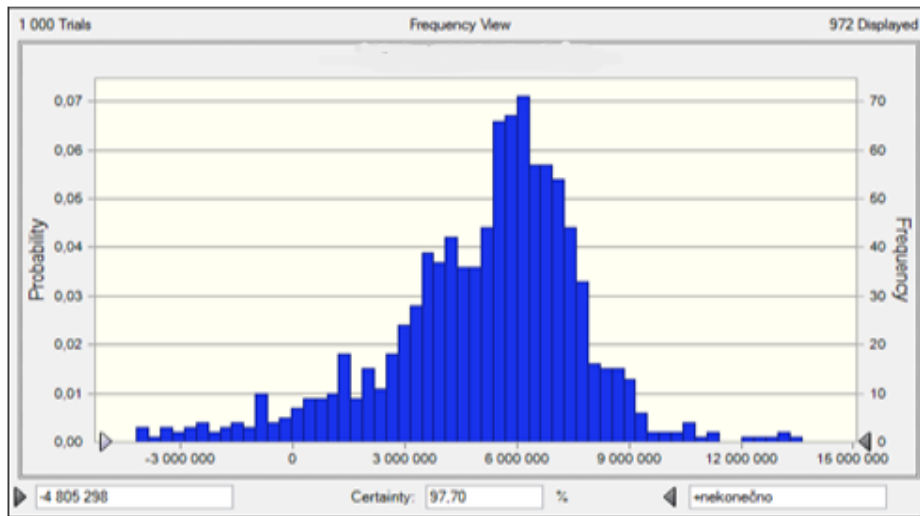
**Table 5. Supplementary input data for the company's value determination.**

Index	2011	2012	2013	2014	2015	2016	2017	2018	2019
Paid dividend per share in EUR	0	0	0	0	0	0	0	0	0
Number of issued shares	28	28	28	28	28	28	28	28	28
Nominal price of the share(EUR)	253	253	253	253	253	253	253	253	253
Market price of the share (EUR)	33	33	33	33	33	33	33	33	33
Income tax rate (%)	95	56	96	136	75	140	150	150	150
ERIBOR interest rate (%)	19.0	19.0	19.0	19.0	23.0	22.0	22.0	22.0	22.0
Number of employees	39	32	35	35	34	30	30	30	30
ERIBOR interest rate (%)	1.42	1.38	1.89	1.18	0.54	0.48	0.48	0.48	0.43

Table 5 illustrates historical data and data for financial plan creation. The company was evaluated on 31st December 2019. Table 5 presents the last five years' financial plan creation. During the analyzed period, the mining company did not pay dividend. The number of issued shares and the nominal price of the share are obtained from the company's annual reports. The market price of the share is obtained at the end of the year when financial reports are constructed. Income tax rate during the analyzed period fluctuated around 19-24%. EURIBOR during the analyzed period had almost always decreasing tendency. According to the obtained data, financial rate indexes are calculated (indebtedness, liquidity, activity, profitability, Altman index), and they are necessary for the financial plan creation.

After creating a financial plan and calculating individual indexes, the mining company is evaluated. Since the financial plan does not consist of absolute values but the probability distribution of individual indexes, the resulting value is also by way of the probability distribution. The resulting value is determined first of all by discounted cash flow together with Monte Carlo simulation. Results of simulation from statistical program Crystal Ball, and also probability distribution of total value of the mining company is given in Figure 5.





**Figure 5: Probability distribution of resulting value – DCF.**

Statistical data are illustrated in Table 6. During the simulation, 1000 repetitions were done. The average value of the mining company is at the level of 4 883 353 EUR, and the median is 5 574 246 EUR. Standard deviation is at level 3 460 232 EUR, and minimal value of probability distribution is -17 800 470 EUR, maximal value is at the level 29 420 694 EUR.

**Table 6. Description statistics of the distribution of company value – DCF.**

Forecast: Resulting value of the mining company	
Statistic	Forecast values
Trials	1 000
Base Case	5 069 451
Mean	4 883 353
Median	5 574 246
Mode	-
Standard Deviation	3 460 232
Variance	11 973 207 668 738
Skewness	-1.13
Kurtosis	11.41
Coefficient of Variation	0.7086
Minimum	-17 800 470
Maximum	29 420 694
Mean Std. Error	109 422

Results of the sensibility analysis showed that during discounted cash flow evaluation, the resulting method is more sensitive to the costs of sales and sales of

own products and services. During the calculation of the mining company by EVA, similar input data have been considered as during DCF.

Description statistics by EVA evaluation are given in Table 7. Simulation is done by 1000 attempts. The average resulting value of the company is 5 104 507 EUR, and the median is at the level of 5 818 320 EUR.

**Table 7. Description characteristics of the distribution of EVA evaluation.**

<b>Forecast: resulting value of the mining company</b>	
Statistic	Forecast values
Trials	1 000
Base Case	5 427 643
Mean	5 104 507
Median	5 818 320
Mode	-
Standard Deviation	3 958 738
Variance	15 671 607 999 608
Skewness	-2.15
Kurtosis	16.37
Coefficient of Variation	0.7755
Minimum	-30 400 966
Maximum	24 646 064
Mean Std. Error	125 186

Results of sensibility analysis showed that the resulting value of the mining company is most sensitive to the change in services and sales of its products and services. Description statistics by capitalized net revenues are mentioned in Table 8, where we can see the median at the level 2 013 378 EUR and the average value at the level 2 103 877 EUR.

**Table 8. Description characteristics of the distribution of the mining company value - capitalized net revenues.**

<b>Forecast: resulting value of the mining company</b>	
Statistic	Forecast values
Trials	1 000
Base Case	0
Mean	2 103 877
Median	2 013 378
Mode	-
Standard Deviation	46 518
Variance	2 163 943 745
Skewness	0.1593
Kurtosis	2.99
Coefficient of Variation	0.0221

Minimum	1 966 144
Maximum	2 251 303
Mean Std. Error	1 471

Results of the sensibility analysis show the value of the company is most sensitive to the level of a discount rate. A comparison of the individual methods is summarized in Table 9. The highest average values were calculated for the EVA method (as in the case of median and averages). During the EVA method, the resulting probability distribution had the highest standard deviation, according to which we can state the method is for using of suggested process less exact in comparing with other chosen methods. The most exact method is capitalized net revenues. In the case of this method, the average value compared with the average values of other methods is the least.

**Table 9. Comparing of characteristics of the company value distribution.**

<b>Forecast: resulting value of the mining company</b>	<b>DCF</b>	<b>EVA</b>	<b>Capitalized net revenues</b>
Statistic	Forecast values	Forecast values	Forecast values
Trials	1 000	1 000	1 000
Base Case	5 069 451	5 427 643	0
Mean	4 883 353	5 104 507	2 103 877
Median	5 574 246	5 818 320	2 103 378
Mode	-	-	-
Standard Deviation	3 460 232	3 958 738	46 518
Variance	11 973 207 668 738	15 671 607 999 608	2 163 943 745
Skewness	-1.13	-2.15	0.1593
Kurtosis	11.41	16.37	2.99
Coefficient of Variation	0.7086	0.7755	0.0221
Minimum	-17 800 470	-30 400 966	1 966 144
Maximum	29 420 694	24 646 064	2 251 303
Mean Std. Error	109 422	125 186	1 471

According to the chosen methods, determining the value had to be done by the end of 2019. During this period, the company's share price is 150 EUR. With the total number of 28 253 issued shares of the company, the company's market capitalisation was 4 237 950 EUR. According to the mentioned, it can be stated that the closest to the market value of the company is the value of the company, determined by discounted cash flow.

## Discussion

The selection of the method resulted from the demand to know the financial plan, which is constructed by the probability distribution of annual changes. There is necessary to mention that planning during the evaluation is connected with a certain measure of risk and uncertainty. Therefore, the suggested financial plan does not include absolute values, only probability distribution. According to the input data from the financial plan, the evaluation of mining company is done by discount cash flow, EVA and capitalized net revenues. The evaluation results by three methods are compared by probability distribution comparison when description characteristics have also been compared between each other and with the company's market capitalisation at the time of its evaluation. The highest average values had been achieved for the method based on economic value added. Market capitalization of the company at the time of the evaluation presented 4 237 950 EUR. The closest to this method is the value of the company, determined according to the discounted cash flow method. Through the research, it is found that the analyzed methods are proper for evaluating mining organizations.

Similar research is made by Dec (2020), reviewing the development and practice of discounted cash flow method in value management that may be used for a broad group of users without the necessity of point valuations. Chen et al. (2015) showed that the organizations should use discounted cash flow on revenue and other costs. This contributes to the competitive market position of the enterprises, decreasing trade credit. There is a noticeable increase in the enterprise value specially managed by financial indicators; however, modern methods show the growing significance of non-financial indicators. (Gallo et al., 2021b).

## Conclusion

The reasons for determining the value of the enterprise are various. The enterprise value is important during purchase or sale of the company, during entering of new investors, mergers and acquisitions, etc. In any case, there is necessary to determine clearly the reason for the evaluation. The presented contribution provides the process of the evaluation of mining companies in concrete conditions. However, the contribution has a limitation when methods without plan knowledge have been not considered due to the unknown elements of the analyzed enterprises. Also, assumptions must be considered for methods calculation, especially for DCF calculation. In practice, not all assumptions can be met to 100%, but DCF model can be used in a simplified form. Moreover, the planning process includes a certain measure of risk and uncertainty. Therefore, the suggested financial plan does not consist of absolute values but probable distribution. In spite of mentioned limitations, the evaluation process of mining organizations is useful for the managerial aims of organizations and helpful to the mining industry in any country. The results of the paper could serve financial managers, who are challenged in valuing companies that are difficult to value by conventional methodologies using

due to the risky business. The high value of the company will create confidence in the firm's current performance and illustrate the company's prospects in the future.

### Acknowledgement

This research was supported by project No. 1/0363/20, financed by the Scientific Grant of the Ministry of Education of Slovak Republic.

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## ZAPEWNIANIE ZRÓWNOWAŻONEGO ROZWOJU PRZEDSIĘBIORSTW GÓRNICZYCH POPRAZ ZARZĄDZANIE WARTOŚCIĄ

**Streszczenie:** W obecnym kryzysie gospodarczym wywołanym pandemią i sytuacją polityczną temat oceny przedsiębiorstw stał się aktualny i ważny. Wkład niniejszego opracowania ma na celu przedstawienie narzędzia do zarządzania wartością przedsiębiorstw działających w sektorze wydobywczym w warunkach słowackich. Oceny dokonuje się poprzez przewidywanie przyszłych przepływów pieniężnych i tworzenie planu finansowego firmy. Podczas tworzenia planu finansowego wykorzystuje się rozkład prawdopodobieństwa poszczególnych czynników. Rozkład prawdopodobieństwa wyznaczono na podstawie rozwoju rocznych zmian wybranych wskaźników. Zgodnie z oceną wybranej firmy sugerowany jest proces poszczególnych kroków tworzenia modelu. Wyniki procesu przedstawiają ocenę wybranej firmy różnymi metodami przychodów. Poszczególne wyniki są porównywane z kapitalizacją rynkową wybranej firmy i w ten sposób wyniki mogą służyć do zarządzania konkurencyjnością firm w innych sektorach przemysłu.

**Słowa kluczowe:** zarządzanie wartością przedsiębiorstwa, spółka górnicza, zrównoważony rozwój, Słowacja.

### 通过价值管理为矿业企业提供可持续发展

**摘要:** 在当前疫情和政局引发的经济危机中，企业评价的主题已成为现实且重要的主题。本研究的贡献旨在提供一种管理企业价值的工具，在斯洛伐克的采矿业中发挥作用。评估是通过预测未来现金流和制定公司的财务计划来进行的。在创建财务计划期间，使用了各个因素的概率分布。概率分布是根据所选指标年度变化的发展情况确定的。根据对所选公司的评估，建议了用于创建模型的各个步骤的过程。过程结果显示了通过各种收入方法对所选公司的评估。将个别结果与所选公司的市值进行比较，通过这种方式，结果可以用于管理公司在其他行业部门的竞争力。

**关键词:** 企业价值管理, 矿业公司, 可持续性, 斯洛伐克