Prediction of Extraction Companies' Development

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ARTICLE INFO

ABSTRACT

A crisis is a general part of a company's life cycle. It presents the result of unfavorable developments and represents a serious threat to the life of the company. Therefore, if the company wants to survive, it must take corrective measures to avert negative developments. Especially mining and extraction companies belong to the industry, which has a significant position in the national economy due to the providing of the raw materials for other industries. However, dealing with a high risk of negative development. In the present global crisis, there is necessity to provide financial health of this sector, when financial health demands to achieve sufficient profit, as well as long-term liquidity to avoid possible bankruptcy. This means a situation when a given organization does not have the possibility to overcome bad financial health. Mainly, extraction companies from post-communist countries, as it is in a case of Slovakia, fight for their survival. For prediction of chosen extraction company development, we used multi-dimensional discrimination analysis, by a file of various financial and economic indexes, with aim to make a prognosis of financial situation through achieved results and with correspondent reliability to rank the company among prospering or non-prospering companies. Results of the prognosis of the development in Extraction Company show negative impacts of the crisis to the firm's economy during the evaluated period and they become important assumption during elaboration of suggestions and recommendations for the firm´s recovering. Such recommendations can be very timely in present changing economic environment and they can be very important for decreasing of negative impact of the economic crisis in any extraction company. By avoiding the bankruptcy of single companies, the whole industry can develop.

INTRODUCTION

Financial health presents an ability of the company to hold balance against changing conditions of the environment in relation to everyone participating in the business. Financial healthy company is able to evaluate invested capital to the measure demanded by shareholders. Results of financial analysis are different in companies from various sectors, since companies have different property and financial structure and different structure of economic result. Financial health demands achievement of sufficient profit and long-term liquidity. Bankruptcy means a situation when a given organization cannot overcome bad financial health. During the evaluation of financial health and prediction of financial problems of the companies, various indexes served as input for the creation of various models. The main disadvantage of such approach, based on chosen statistic methods, is its limited time availability and complexity of model modification under changed conditions, conditioned by the availability of input data. The next problem many times is an improper structure of the input file. We must be very careful during selection of proper method, construction of the correspondent model and during its single interpretation, since it can lead to the considerable bad estimation of its predictive ability. However, the advantage is it´s very good quality of prediction during existence of qualitative data file (Altman, 2006). The disadvantage is determination of a strict boundary for the interpretation. It can lead to ranking of companies with almost identical values of financial indexes to various groups. The next disadvantage is that it does not consider in most cases possible relations between indexes, evaluated individually.

According to Cybinski (2001), there are problems with the application of the classical statistical methods used for bankruptcy prediction. It is due to the following areas: assumption of bipolar independent variables, methodology for selected data files for sample companies (Ohlson, 1980), nonstationarity and instability of input file data (Mensah, 1984), the problem of nonstationarity and using of basic samples combination, financial reporting as a data source, time dimension (Balcaen and Ooghe, 2006).

From the mentioned, there is obvious that it is proper to combine prediction methods. The goal of the contribution, in accord with above-stated problem, is to use a combination of the prediction methods for the Extraction Company, having a special position in the economy due to the risky business with an aim of finding the methods that prove the predicted situation.

1. LITERATURE REVIEW

Financial problems of companies are caused many times by access to credit (Akseli, 2012). Antoniades (2013) shows the crisis has given rise to new global debt relations. The recent debt crises in Europe and the U. S. states feature similar sharp increases. These debt experiences result from the ability of governments to interfere in private external debt contracts (Arellano et al., 2016). Booth et al. (2001) assess whether indebtedness and capital structure are portable across countries with different institutional structures, finding there are persistent differences across countries. But there is still a need to analyse this area in another grouping of countries and sectors.

The specific group of tools for evaluation of the extraction company are certain methods for complex evaluation. Summary indexes are orientated to the determination of performance from the view of value creation or they present bonity indicators evaluating a company according to the ability to pay its debts.

Long-time development evaluation used classical statistical methods for the development of a single-dimensional discrimination analysis. Such methods mostly used classification procedures for distribution of companies to the group of prospering or companies with bankruptcy threat. The most used statistical method is multi-dimensional discrimination analysis, followed up by logit analysis (Altman et al., 2010). The next classification methods are risk index models (Ennouri, 2015), probit analysis, and linear probability models.

Beaver (1967) was one of the pioneers of models for bankruptcy prediction, based on financial rate indexes. The result of this method is many times different from the practice, when the number of rate indexes has a non-linear dependence on bankruptcy status (Atiya, 2001). While using single dimensional model rate indexes, resulting from financial accounting, there is very difficult to evaluate the importance of one concrete index individually, since the majority of indexes connects together.

In reaction to this fact, Tamari (1966) understood that evaluation of financial health is impossible only by one index. The risk index model is a very simple point system, including various rate indexes, generally accepted as indexes of the financial health of the company. The risk index also regards the fact that some rate indexes have higher importance, compared with others, considered by weight of individual criteria (Kiseláková et al., 2015).

In 1968, Altman applied the technique of multi-dimensional statistical analysis in connection with the prediction of bankruptcy and created a model, called Z-score model. During the following years, many studies published Altman Z-score model. Altman et al. (2010) determined a final Z-score model, regarding also new standards of financial reporting. For example, the Altman Z-score model presents a linear combination of these parameters: working capital / total assets, undivided profit / total assets, EBIT (Earnings before interest and taxes) / total assets, market value of equity / total indebtedness and sales / total assets (Altman, 1968).

Taffler (1983) adapted values that do not correspond with UND through the transformation. The second assumption before model development, based on MDA, is an assumption of dispersion matrix equality. Nevertheless, MDA models are very often applied in an improper way and conclusions are disputable (Eisenbeis, 1977). To remove such an improper way, during optimal score selection, deciding about the group, probability of mistaken evaluation should be considered (Zavgren, 1983). To the period when MDA where the clear dominant method for model creation, this method was replaced by less demanding statistical techniques, for example logit analysis (LA), probit analysis (PA) and models of linear probability (LPM). Ohlson (1980) used first LA in the creation of his models. Zmijewski (1984) was, on the other hand, orientated to PA. Till the present time LA is considered as a most favourable method for bankruptcy prediction. The number of studies using PA is less, since in comparison with LA, it demands a bigger number of calculations.

Bhimani et al. (2010) analyzed the relation between chosen indexes and bankruptcy probability according to data of Portugal joint stock companies, concluding interesting results. They included 11 financial rate indexes into the analysis and two non-financial indexes (volume of the company and its life cycle). They concluded that between the volume of the company (volume of total assets) and probability of bankruptcy there is positive correlation. On the other hand, between the life cycle of the company and bankruptcy probability, there is a negative correlation. In case the volume of the company would increase by one unit, probability of bankruptcy will increase by 0.013. In case the life cycle of the company would increase by one unit, bankruptcy probability will decrease by 0.001. Among financial indexes for bankruptcy estimation following indexes have the best effective impact: interest cost / EBIT (increasing of the Index by one-unit increase the bankruptcy probability by 0.121) increasing the index by one-unit decreases probability by 0.058) and net working capital / total assets (increasing the index means probability decreasing by 0.041). Altman et al. (2010) dealt also with the possibility to enrich the models, constructed from financial indexes by qualitative characteristics. They add to the model, constructed by logistic regression only according to the financial indexes, constructed by Altman and Sabato in 2007, several non-financial indexes (connected with an audit, volume and life cycle of the company). They concluded that by adding of these qualitative characteristics classification ability of the model increased by 13%. They confirmed the hypothesis that between life cycle of the company and bankruptcy probability there is an indirect relation. In spite of mentioned, they concluded that while the company will be at the market during 3-9 years, there would be a direct relation between it´s life cycle and bankruptcy probability. This fact is possible to explain by effort of business to hold market position also in case of the financial problems, but when there is possible gradual increasing of losses, yet after several years' single bankruptcy of the company can arise. Grunert et al. (2005) belonged to authors, confirming that models, consisting of financial and non-financial indexes report higher reliability during bankruptcy prediction in comparison with models, based only on financial or non-financial indexes. From the information mentioned, we see that any of the evaluation of the companies cannot use present models universally in time and space. In spite that any other model tried to solve shortages of the previous models, presently there is not clear if a universal model will arise according to the mathematical and statistical basis.

2. METHODOLOGY AND RESEARCH METHODS

Prediction of company development is in chosen Slovakian extraction company. We used multi-dimensional discrimination analysis, which predicts the situation in the company by certain file of various indexes with given weights to make a prognosis of the financial situation and to rank the company among prospering or non-prospering companies. The analysis is made by Altman, Taffler and in IN test.

Altman model

The model presents Altman test of credibility or Z-score. By multivariable discrimination analysis, the index predicts the future financial development of the company. Altman found out that the following indexes reflect the best financial situation and its future development (Altman, 2006):

$X1$ = net working capital/total assets,
$X2$ = undivided profit/total assets,
$X3$ = EBIT /total assets,
$X4$ = market value of equity/debts,
$X5$ = sales/total assets.

Since the analyzed extraction company presents from the legal view limited companies, we used a constructed discrimination function for limited companies in the following equation:

$$Z = 0.717\ X1 + 0.847\ X2 + 3.107\ X3 + 0.42\ X4 + 0.998\ X5 \qquad (1)$$

Altman defined for the model following classification conditions:

$Z < 1.20$ financial situation is critical, bankruptcy is very probable,
$1.21 < Z < 2.89$ area of vague results (grey zone), bankruptcy is possible,
$Z > 2.90$ financial situation of the company is good.

Index IN

Index IN evaluates the financial health of the company by bonity and bankruptcy models. Index IN has modifications with several types, when Neumaier and Neumaierová (1995) modified the index for the post-communist countries, having difficulties with creation of the value for creditors and owners. Since the analyzed company is from post-communist countries, we used IN99, calculated as follows:

$$IN99 = -0{,}017\ X1 + 4{,}573\ X2 + 0{,}481\ X3 + 0{,}015\ X4 \qquad (2)$$

Where: $X1$ = assets/debts,
               $X2$ = EBIT /total assets,
               $X3$ = sales/total assets,
               $X4$ = current assets/short term liabilities.

IN99 interpretation is following:

IN99 over 2.070   Company creates value (achieves net profit),
IN99 under 0.684   Company create negative value of net economic profit,
IN99 in interval between 0.684 – 2.070 Uncertain future.

Taffler model

Taffler model presents the bankruptcy model (Taffler, 1983) developing a linear model with five rate indexes:

$$T = 0.53\ X1 + 0.13\ X2 + 0.18\ X3 + 0.16\ X4 \qquad (3)$$

Where: X1 = EBT/ short term liabilities,
                 X2 = current assets / debts,
                 X3 = short term liabilities / assets,
                 X4 = sales / assets.

    Intervals for T index:

T > 0.3   low probability of bankruptcy (company is financially healthy),
T < 0.2   high risk of bankruptcy (company is considered as bankrupting).

At the companies´ comparing, Taffler emphasized always that companies are from the frame of equal sector.

3. DATA AND MATERIAL

Due to the importance of the mining industry and it´s contribution to the national economy, we analyzed chosen extraction company in Slovakia. We used data from financial statements of the analyzed company, obtained from the publicly available database Register of Financial Statements in Slovakia (www.registeruz.sk). We also used data from own research in the area limitation of bankruptcy using in Slovakia (Csikósová et al., 2019) and actual data of sector analysis according to Trend Analysis (2017) and data from institution INFIN, ltd. (Medium values of financial indexes of economic activities in Slovakia, 2017). In the evaluation of the present state of the sector, we used trend analysis of chosen economic indexes development in time series and their comparison. Finally, synthesis of factors that could influence improving of the competitive position of the sector has been considered.

Before our own prediction of the company, we analyzed the overall economic situation in the mining industry. We compare how many companies are acting in V4 in time horizon 2014-2020. Table 1 illustrates the development.

Table 1. Number of mining companies

| GEO \ TIME	2014	2015	2016	2017	2018	2019	2020
Czech Republic	333	348	359	363	380	376	371
Hungary	469	459	448	448	429	428	409
Poland	1785	2 014	1 944	1 657	1 852	2008	2 054
Slovak Republic	108	138	125	157	182	187	223

Source: own processing according to Eurostat (2020)

The decline in overall production occurred, which created the fear of a double-dip recession. The production of the mining industry has not been in correlated relationship with overall economical productions in European countries. We can conclude that the mining industry had to some extend forecasted the coming trend of GDP development in all European economy.

The latest published prognosis of the future of mining globally shows (see Figure 1):

– Rising overall demand for minerals.
– Mineral demand vulnerability and risks.
– Role of recycling and reuse.
– Emission mitigation and reduction opportunities. (Regueiro and Alonso-Jimenez, 2021)

Figure 1. European mining trends (in % of world mining)
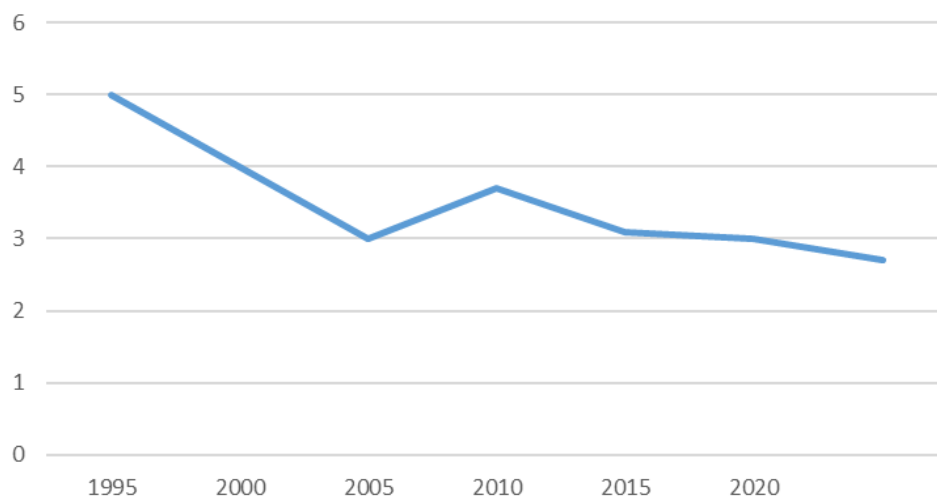
Source: own processing according to Regueiro and Alonso-Jimenez, 2021

The trend in the mining sector in Slovakia is very similar to industrial production. In the mining industry, it is also important to follow up the development of sales that is illustrated in Figure 2.

Figure 2. Sales volume in mining industry in Slovakia in mil. EUR
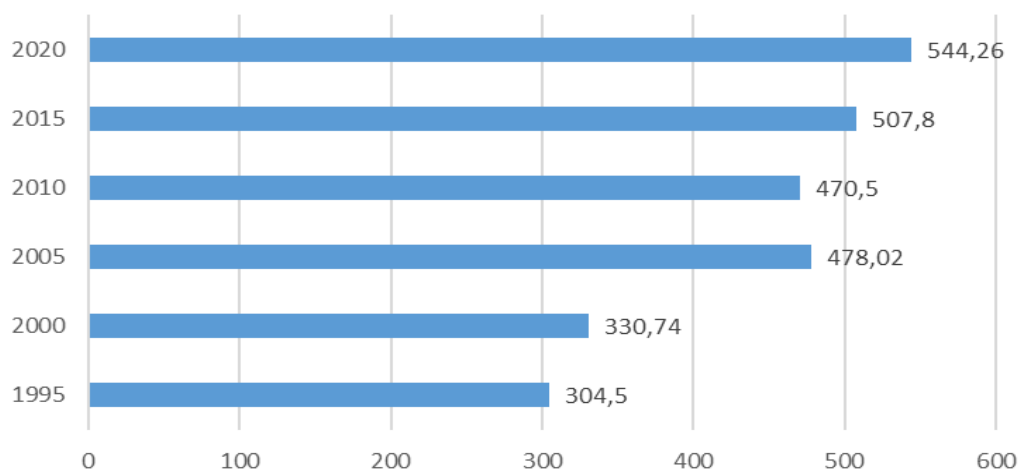
Source: processed according to Statistical office SR (2020)

In general, it could be stated that mining increased in 2020 compared to 1995 by 239.76 mil. € per year, while the average year-on-year index in the analyzed period showed a level of 47.95. Due to the information mentioned it is very important to monitor the development tendencies of mining.

4. EMPIRICAL RESULTS

Consumption of aggregate in Slovakia during the last years decreased significantly and therefore, there is interesting to compare the development of consumption during the last years also with other members of European association of the the aggregate producers (UEPG – European Aggregates Association), where members are grown-up country of the aggregate industry. Consumption of aggregate UEPG country,

including Slovakia (in representation with Slovak Association of Aggregate Producers) depends on the development of the construction industry in Europe, from which UEPG estimation for aggregate consumption (based on which UEPG performs prognostic estimates of aggregate consumption) is developed for the following years (Pavelková and Knapková, 2005). Countries with moderate growth of aggregate consumption and its decline in 2013 (including Slovakia) present the biggest group of countries and therefore we can say that they also present the most characteristic development of the aggregate consumption of UEPG members. The present situation in the aggregate industry in Slovakia illustrates Table 2.

Table 2. Estimates of Aggregates Production Data 2008-2016 in Slovakia (mil.tonnes)

Aggregates	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sand & Gravel	13	11	8	9	10	9	10	10	10
Crushed Rock	21	19	18	16	13	13	15	20	16
Total Production	34	30	26	25	23	22	25	30	26

Source: own processing according to https://slovak.statistics.sk/ , 2020.

Economical and financial crisis caused the development of the Slovakian aggregate industry that was similar in average as other member states UEPG. We must only believe that prognosis of Euro construct, UEPG for the next years will be achieved, and there would be repeated growth of aggregate consumption again in Slovakia. The chosen extraction company elaborates and sales products from crushed rock from andesite, 13lovak13ne, dolomite and limestone. It offers aggregate for the construction for production of the asphalt mixture, concrete, tracks seating, water buildings, as well as the dimension stone (Pavelková and Knapková, 2005). Table 2 gives a review of chosen development indexes in the extraction company.

Table 3. Review of the chosen development indexes in the extraction company

Index	2017	2018	2019	2020
Production (tones)	1,114 709	1,500 409	1,417 340	1,170 650
Volume of sale (tones)	1,037 964	1,430 747	1,185 566	1,367 007
Sale (th. EUR)	6 714	9 471	7 311	8 937
Stocks (th. EUR)	568	801	2 017	1 079
Stocks volume (tones)	130 643	203 017	431 523	234 855
Average sale price (EUR)	6.47	6.62	6.17	6.54
Economical result (EUR)	609 025	1 037 616	450 370	477 765

Source: own processing according to https://slovak.statistics.sk/ , 2020

The organization obtained in area of the Slovak republic mining spaces, according to this statement, it obtained the right to elaborate mined raw material and mine. Except of reserved layers, organization mines also layers of not reserved raw material.

In the following Table 4, there are mentioned items during evaluated period for calculation of indexes X1 – X5 due to the determination of Altman index and the calculated values of Altman index.

Table 4. Input data and calculated values of Altman index

Index	2017	2018	2019	2020
Short term property (EUR)	2,165 486	3,229 148	3,543 356	3,674 700
Short term liabilities (EUR)	1,341 640	2,868 305	2,712 809	2,364 696
Working capital (EUR)	823 846	360 843	830 547	1,310 004
Total capital (EUR)	7,945 796	11,105 196	12,375 806	13,394 595
Not divided profit (EUR)	768 687	1,249 928	547 730	597 736
EBIT (EUR)	909 462	1,628 433	959 151	1,029 686
Interest (EUR)	140 775	378 505	411 421	431 950
Own equity (EUR)	615 027	1,649 324	2,099 160	4,070 286
Foreign capital (EUR)	7,330 769	9,455 872	10,276 646	9,324 309
Sales (EUR)	6,422 071	9,499 562	7,308 913	6,752 935
Altman index	1.275	1.327	0.887	0.809

As for the development of Altman index, during the evaluated period there was significant decrease of Altman index in 2020, since this year negative influence of the economic crisis started that is also a serious warning for the firm against negative development in the next years. Mentioned is illustrated in Figure 3.

Figure 3. Development of Altman index
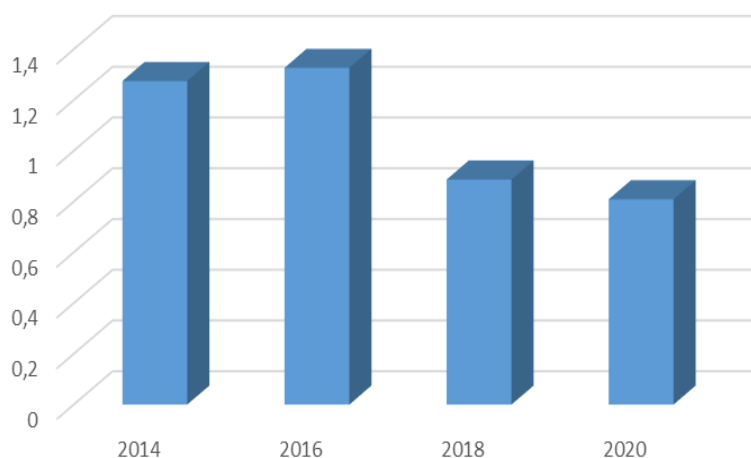
Z < 1.20   financial situation is critical, bankruptcy is very probable,
1.21 < Z < 2.89   area of vague results (grey zone), bankruptcy is possible,
Z > 2.90   financial situation of the company is good.

In Table 5, there are calculated values for Taffler index during the evaluated period. It calculates similar rate indexes as Altman index.

Table 5. Input data and calculated values of Taffler index

Index	2014	2016	2018	2020
X1	0.573	0.435	0.202	0.252
X2	0.295	0.341	0.344	0.394
X3	0.168	0.258	0.219	0.143
X4	0.807	0.855	0.590	0.409
Tafler index	0.500	0.456	0.284	0.246

The value of Taffler index during the evaluated period has decreasing tendency and it does not reach in 2018 and 2020 value higher than 0.3 that predicts negative development of the financial situation of the extraction company for the next business period (see Figure 4).
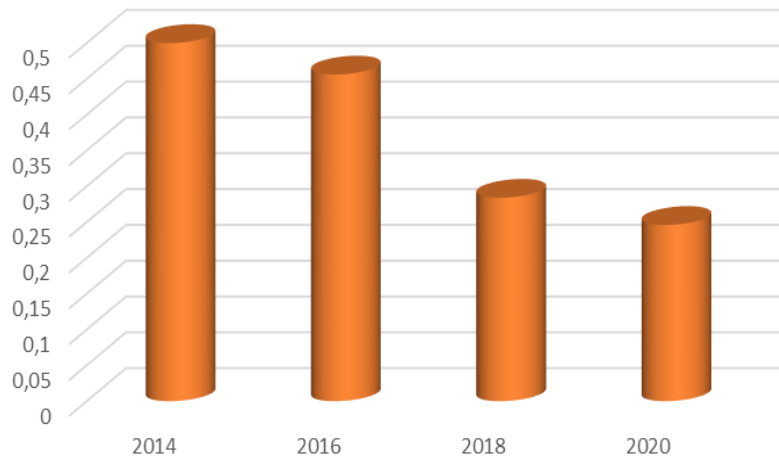
Figure 4. Development of Taffler test

Table 6 illustrates input data and calculated values of Index IN99 during the evaluated period of the extraction company.

Table 6. Calculation of IN99 index

Index	2014	2016	2018	2020
X1	1.083	1.174	1.204	1.436
X2	0.114	0.146	0.077	0.076
X3	0.808	0.855	0.590	0.504
X4	1.614	1.125	1.306	1.553
IN99	0.915	1.06	0.635	0.588

During 2014 and 2016, the index IN99 is in the frame of the so-called grey zone (ambiguous financial situation) and consequently, during 2018 and 2020 it has negative value of economical profit that means firm does not create value for its owners.

Figure 5. Development of IN99 index
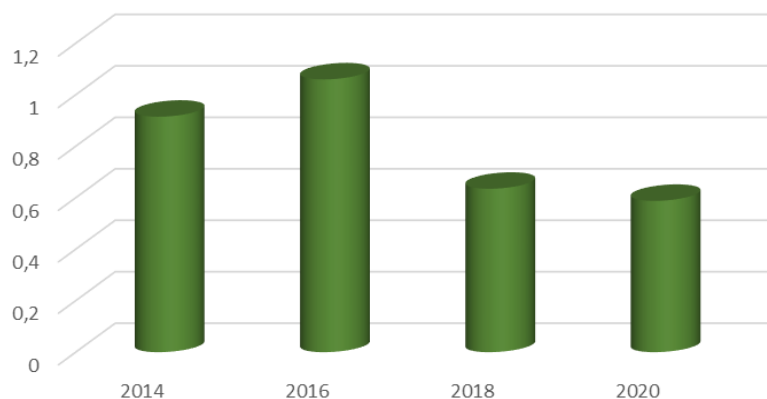
DISCUSSIONS AND CONCLUSIONS

Problems that resulted from the economic crisis also reached economy of the mining industry (Ishchenko, 2013). Mining companies recorded worsening of the economic and financial situation due to the decreasing of aggregate sale, average selling price, and profit and due to the increasing of stocks, liabilities and bank's credits. Therefore, the company must make permanent and rapid decisions about saving, it must calculate with a long-term view of crisis development. Due to the prediction, it is very important to use available models for prediction of financial situation development, with consideration of specifics in area of mining business. Only by the way, the firm can obtain easy, rapidly and objectively proper decisions in area of its economy (Csikósová et al., 2000).

During the elimination of the negative impacts of the crisis and due to the overcoming of the negative development, there is necessary to give increased attention to the management of working capital, since stocks, claims and financial means are very important. Such an element has to provide fluent production, sale, profitability and liquidity that are very important factors for the future development of the firm. Stocks increase has to transmit to the change of the production volume. During the management of claims there is necessary to decrease payment with a discount used during prompt payment (Grigonyté and Maknickiené, 2014). In the decision about optimal level of financial means, it is necessary to result from the operative budgets for incomes and expense of the firm (gross cash flow) for the next period.

Results of the prognosis of the development in concrete extraction companies serve as precious knowledge about the negative impacts of the crisis to the firm's economy during the evaluated period and they become important assumption during elaboration of suggestions and recommendations for the firm. Such recommendations can be very timely in the present changing economic environment and they can be very important for decreasing the negative impacts of the economic crisis. Partial and final results provide a new glance to the solved problems, and they contribute to the enrichment of knowing about firm's financial situation.

Numbers of Slovakian companies' overreach recommended level of indebtedness. In this way, they threaten their future actions. It is mainly due to high payments, bureaucracy and tax burden of business by useless state intervention to the market. In addition, such factors burden business in Slovakia to create positive values of indebtedness, but also external factors, which single companies cannot influence. Therefore, they need to evaluate their own financial possibilities during obtaining of financial means for covering their property and when they overreach determined optimum, they need to find the proper alternative to it´s financing. The aim of the contribution was to analyze indebtedness in companies of chosen sectors and to find out possibilities to solve the problem. According to the results of the analysis, there were determined areas of business, in which indebtedness is the highest and sectors with the lowest value of indebtedness. The area with the highest level of indebtedness and paying disability is the area of human resources. Companies in this sector have problems to cover their liabilities, and they do not use their own capital sufficiently. Companies with optimal indebtedness and economy are from area of information and communication. The subject of further research will be analyzing of indebtedness indicators correlation depends on property structure, cost, and revenues in the sectors. We believe the main implication of our results is the benchmark of chosen sectors from the view of indebtedness, which is possible to use for further determination of its development in individual V4 countries that present an important area for improvement of the European economy.

ACKNOWLEDGEMENT

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