Assessment of valuation methodology for land properties with mineral deposits used in Poland

***Agnieszka Bieda*[1], *Ewelina Wójciak*[1] *and* *Piotr Parzych*[1]**

Land properties with mineral deposits are the specific good whose valuation is an extremely demanding task. The difficulty in evaluating such properties is associated with attributes that go beyond the catalogue of typical market value influencing factors, attributable to land properties. The valuation is also affected by the fact that properties with mineral deposits are evolving as the investment processes progress. Following the example of world standards, the Code for the Valuation of Mineral Assets POLVAL has been in force in Poland since 2008. It creates substantive grounds for the valuation, and these grounds have been attempted to be assessed in this publication. Part of the research involves the assessment of the methodology used in Poland for the valuation of land properties with mineral deposits using the SWOT/TOWS analysis. In the analysis, three strengths and three weaknesses of the valuation procedure have been used, as well as three opportunities and three threats associated with the expected future events that may affect the valuation procedure. As a result of the conducted analysis, it turns out that the methodology used in Poland for valuation of land properties with mineral deposits has great potential, but it should be restructured to overcome potential future threats. The Authors also state that the SWOT/TOWS analysis is not the best way to assess the valuation methodology, but it could be used for its preliminary assessment.

Keywords: *geological and mining assets, SWOT/TOWS analysis, valuation methodology, land properties with mineral deposits, Code for the Valuation of Mineral Assets POLVAL*

Introduction

Although mining is one of the oldest industries, the valuation of geological and mining assets is relatively recent. The value of these assets may be determined for their sale, carrying out a merger or acquisition, specifying the minimum price under a tender procedure, conducting transactions on terms other than market terms, court proceedings, expropriation or insurance claims (Roscoe, 2002).

Many countries have introduced the codes regulating valuation of geological and mining assets. For the mining industry, the need to understand the factors affecting the value of real estate with mineral deposits, and the ability to effectively and consistently evaluate investments and facilities associated with their mining is essential (Lilford and Minnitt, 2002).

It is commonly believed that the first code devoted exclusively to the valuation of geological and mining assets was the code VALMIN introduced in Australia in 1995 (Uberman, 2014). The version which is currently in force was adopted on 29 February 2005 and is called the VALMIN Code 2005 (2005). Soon after, in 1999, Canada began work on the CIMVal Code (2003), which was adopted in February 2003. Both were recommended by relevant capital market authorities for use by mining companies. Then, in 2008, the SAMVAL code (2008) was developed in South Africa. In the US, the USMinval code became the subject of discussion, still functioning as a proposal, but has never become legally binding (Zielińska, 2017).

In 2005, as a result of the publication of the Interpretative Note No. 14 "Valuation of Properties in the Extractive Industries", geological and mining assets have also become subject to International Valuation Standards. As a result of the review carried out as part of a special project aimed at improving all valuation standards, a decision was made to withdraw this Interpretative Note in February 2010, and in June 2011, a project aimed at its improvement and updating was launched. It is expected that it should be re-issued in the revised version.

Poland has also had a specialised code for the valuation of geological and mining assets since 2008. Established in 2006, the Polish Association of Mineral Asset Valuation developed and published the Code for the Valuation of Mineral Assets POLVAL in 2008. Following the example of foreign codes, it creates substantive grounds for the valuation of all geological and mining assets, including mineral deposits associated with land properties. The current version is recommended for use since January 1, 2017 (2017).

Following the European law, we divide mineral deposits in Poland into those subject to mining property right and real estate ownership right. Pursuant to the Act on Geological and Mining Law (Act, 2011), the assets of hydrocarbons, hard coal, methane occurring as accompanying mineral, lignite, metal ores with the exception of bog iron ores, native metals, ores of radioactive elements, native sulfur, rock salt, potassium salt, potassium-

[1] *Agnieszka Bieda, Ewelina Wójciak, Piotr Parzych,* AGH University of Science and Technology, Faculty of Mining Surveying and Environmental Engineering, Department of Geomatics, 30 Mickiewicza Av., 30-059 Krakow, Poland, agnieszka.bieda@agh.edu.pl , ewelina.wojciak@agh.edu.pl , piotr.parzych@agh.edu.pl

magnesium salt, gypsum and anhydrite, precious stones regardless of their place of occurrence, are covered by mining property right. The mining property also includes deposits of therapeutic waters, thermal waters and saline. In addition, the mining property includes parts of the rock mass outside of geospatial boundaries of land properties, especially those located within the boundaries of the maritime areas of the Republic of Poland. The mining property right is a separate property right vested solely in the State Treasury. The remaining mineral deposits, not mentioned above, are covered by the land ownership right. The further part of this study is devoted to this group of deposits.

Material and Methods

The research involved the evaluation of the methodology used in Poland for the valuation of land properties with mineral deposits using the SWOT/TOWS analysis. For this purpose, the assessed procedure was described, the analysis factors and their weights were determined, and the relationships between them were identified.

The methodology used in Poland for the valuation of land properties with mineral deposits

Land properties with mineral deposits are the specific good. Their uniqueness associated with attributes that go beyond the catalogue of typical market value influencing factors, attributable to land properties, gives a special character to the valuation process. Hence, there is a need to analyse a number of specific conditions affecting the value of this type of real estate. The source of knowledge about the market characteristics of specific real property is the field inspection and the documents allowing to determine the status and intended purpose of this real estate (Tab.1.). The status of the real estate should be understood as the state of development, legal status, technical and utility status, level of equipping with technical infrastructure devices, as well as the condition of the property surroundings, including its size, character and degree of urbanization of the locality where the property is situated (Act, 1997).

Tab.1. Documents used for valuation of land properties with mineral deposits.

Documentation of real properties	Documentation of mineral deposits	Documentation of mineral extraction
– study of conditions and directions of spatial development of the commune, – local land use plan, – real estate cadastre.	– geological documentation of deposit, – deposit information sheets, – local land use plan of the mining area, – deposit development plan, – environmental impact assessment, – deposit mining license, – mining plant operation schedule, – survey and geological documentation of deposit, – design and cost documentation of land reclamation.	– lease agreements, – water law permits, – permits for decommissioning of components, including logging of trees, – Minutes of inspection of District Mining Offices, – balance sheet and profit and loss account, – list of tangible fixed assets of mining plants together with their balance sheet values.

Based on the analysis of the documents listed in Table 1, as well as field inspection, market recognition in economic and supply-demand terms, the real estate valuer analyses a number of specific conditions affecting the value of the property with a mineral deposit. Their classification has been prepared in the form of a diagram illustrated in Fig. 1.

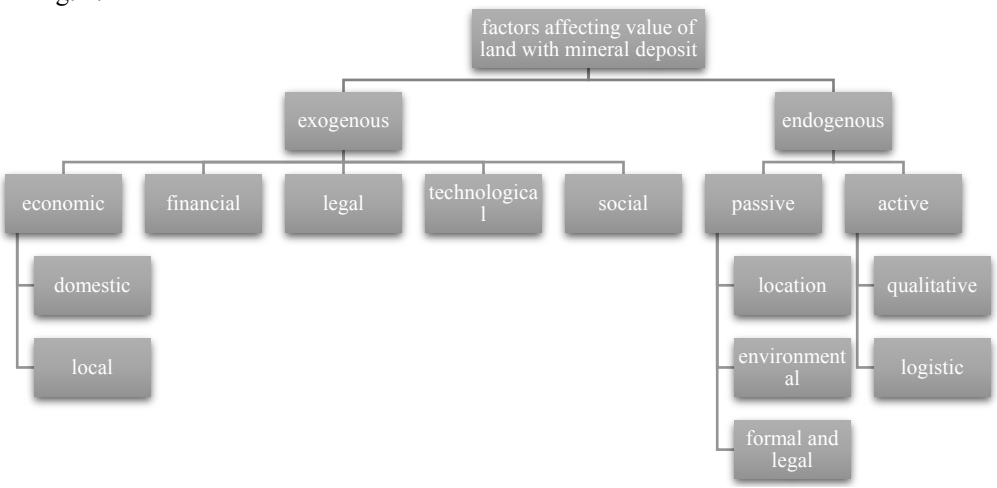

Fig. 1. Classification of factors affecting the value of land with mineral deposit..

External factors constitute the socio-economic background of the type of real estate being valued. They were divided into five groups: economic, financial, legal, technological and social. The economic aspect should be considered on a macro (i.e. domestic) and micro (i.e. local) scales. Domestic factors are associated with the country's economic situation, inflation, unemployment, public wealth or the market index. The factors typical for a specific location include the supply-demand situation considered on two levels: the real estate market with mineral deposits and the mineral deposit itself, including the sale price, investment conditions, or competition and development predictions. However, attention should be paid to the variable boundary between the macro and micro parameters. Depending on the type and size of the deposit, local factors should also be considered on a macro scale. Financial factors refer to the possibility of financing the real estate and the mining process. The legal group includes all the regulations regarding the real estate, mineral deposit and mining process in the light of the existing legal regulations. Technological factors are mainly related to the mining process and relate to the technology being used. Demographic situation, lifestyle, etc., were included in the group of exogenous social factors.

The catalogue of endogenous factors was divided into the passive, existing group, concerning mainly parameters related to the real estate with a mineral deposit, and the active group associated with the exploration and mining processes. In the passive group, the following factors were distinguished:

- **location factors** related to accessibility, location with respect to output markets, other deposits, mines, watercourses and surface water reservoirs in the context of reservoir water discharge, groundwater intake in the context of the possibility of water supply for technological and sanitary purposes, various types of development in the context of operating nuisance, both for the existing and future developments, comfort of life, safety and human health,
- **environmental factors** related to the type of land use, including permanent and temporary conversion of land to non-agricultural and non-forestry use, location with respect to legally protected areas, the impact of investments on the environment, e.g. logging of trees, water pollution, small-particle air pollution, noise,
- **formal and legal factors** covering the legal status of the real estate and its designation, the intended land use in the planning documents such as the local land use plan or, if there is no plan, in the study of conditions and directions of spatial development of the commune, and in the local land use plan for the mining area (if it has been prepared), the right to geological information, environmental conditions resulting from the relevant decisions, mining conditions established in the deposit mining license, findings contained in the mining plant operation schedule, findings resulting from other significant documents related to the extraction of the deposit, such as land lease agreements, water law permits, operating fees for extraction of minerals.

The active group includes these factors that may change as a result of changes in the surroundings or progress of the mining process. They were divided into:

- **qualitative factors** referring to the category of deposit exploration, quality of the mineral, thickness and type of the overburden, presence of increments, liquid rock inserts etc., the ratio of the thickness of the overburden to the thickness of the deposit, recoverable, industrial and operational resources, deposit abundance, other geological and mining conditions, including hydrogeological conditions, etc.,
- **logistic factors**, especially those related to accessibility of transport routes, road condition and related tonnage and cubic limitations, including limitations established on road culverts, bridges, overpasses, etc., accessibility for heavy equipment, availability of technical infrastructure (electricity, water, etc.).

Market analysis in the aspect of the factors mentioned above is a key element in the valuation process of the property with a mineral deposit. Based on its results, the real estate valuer chooses the right valuation approach and technique. The Polish legislation allows for the use of two approaches to valuation of the property with a mineral deposit: comparative approach and income approach (Regulation, 2004). Additionally, as part of good practice, at the stage of the mining plant decommissioning and land reclamation, it is possible to use a mixed approach (Standard, 2017). As the investment process progresses, we distinguish three stages of mining, with the following valuation approaches recommended (Standard, 2017):

1. The stage after exploration and documenting a deposit – the comparative approach.
2. Providing access and extraction of a deposit – the income approach, and in the case of suspended extraction – the income approach or the comparative approach.
3. Mining plant decommissioning and land reclamation – the comparative or mixed approach using the decommissioning costs method and the residual method.

The comparative approach is recommended at each stage of the investment process. According to the definition, it consists in the comparison of the real estate being the subject of valuation whose attributes are known, with comparable properties that were subject to real estate transactions and for which transaction

prices, transaction conditions and attributes are known (Regulation, 2004). The formal and legal significance for the assessment of the applicability of the comparative approach to the valuation of the real estate with mineral deposits is the assessment of meeting the requirements formulated for the concept of "comparable properties", which is comparable to the real estate being the subject of valuation due to its location, legal status, intended purpose, manner of use and other market value influencing factors (Act, 1997). For the real estate with a mineral deposit, the group of other market value influencing factors includes the factors shaping the value of the deposit, which in the case of comparable properties must be of the same type, have similar abundance and geological structure. The variety of value influencing factors for the property with a mineral deposit, determining the degree of their similarity, limits the application of the comparative approach. According to the Authors, the difficulty of valuation of the property with a mineral deposit increases with the progress of the investment process. With the progress of the mining process, new documents are collected that are a source of additional information about the real estate and about the deposit itself. Each stage of the investment process has a different type of real estate, although the subject of the valuation is still the same – the property with a mineral deposit. The property with a mineral deposit is evolving with the progress in the investment processes: most frequently from the agricultural land at the prospecting stage, through the investment real estate at the stage of exploration and providing access, to the operating real estate at the extraction stage. Decommissioning of the mining plant and land reclamation restores the original character of the property, and often imposes a new use to it, for example, recreational one. Therefore, it is necessary to change the method of valuation depending on the investment stage. The Authors of this research paper suggest that the selection of the valuation method should closely correlate with the stage of the investment process, i.e. with an exploration of the deposit. For the first two stages of the project, which include prospecting for an exploration of the deposit, the comparative and cost approaches are proposed, which have been omitted in the valuation of the property with a mineral deposit in the current legal status. Depending on the progress of works, at the stage of the legal and physical preparation of the deposit for extraction, it is recommended to apply the comparative, cost or income approach. During the extraction stage, the income approach is suggested, and in the last, decommissioning stage, the mixed approach is recommended (Fig. 2).

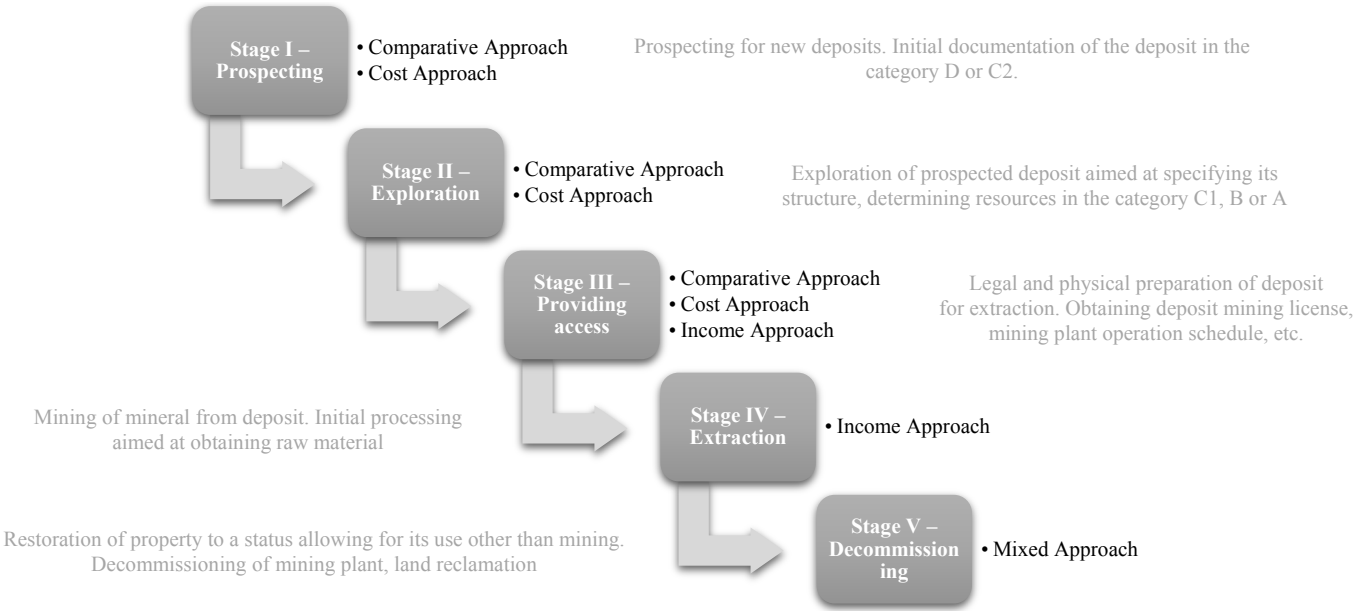

Fig. 2. Stages of the progress of the investment process with the recommended valuation approach.

A – The mineral deposit is explored to the extent allowing for current planning and extraction at the highest possible exploitation of the deposit. The error in estimating the average values of the deposit and resource parameters in individual blocks cannot exceed 10%.
B – The boundaries of the deposit are defined in a more specific way based on exploratory workings or geophysical surveys specially made for this purpose. The error estimating the average values of the deposit and resource parameters cannot exceed 20%.
C1 – The boundaries of the mineral deposit are defined based on the data from exploratory workings, natural exposures or geophysical surveys. The error estimating the average values of the deposit and resource parameters cannot exceed 30%.
C2 – The boundaries of the mineral deposit are defined based on the data from workings, natural exposures or geophysical surveys. The error estimating the average values of the deposit and resource parameters cannot exceed 40%.
D – The boundaries of the mineral deposit, its geological structure and expected resources are determined based on the existing, available geological data, especially isolated workings or natural exposures. The error estimating the average values of the deposit and resource parameters cannot exceed 40%.

The proposed division is a kind of generalisation of the investment process. In practice, we often deal with the staging of the investment. The property is divided into investment fields at various stages of development, and therefore, the use of a single valuation approach for the whole property is very restricted. It is necessary to apply a few approaches at the same time and to analyse the documentation from individual stages of development. Although the valuation of the real estate, carried out in the first three stages of the investment process and the last one, does not bring on too many problems, the determination of the operational value during the extraction stage goes beyond the typical procedure. Therefore, the further part of this research study is devoted to the determination of the market value of the operating real estate.

The market of land properties with mineral deposits is limited and inactive, both in terms of transaction prices and rents, especially during the extraction stage. Hence, the valuation methods in the income approach should be limited to the profit method. In this method, income from real estate, which is equivalent to rental income, is defined as part of the income from a business activity conducted on a given property by a typical, average user. In this case, the source of information about the amount of income from the real estate is the market data from the valued property. The income from the real estate is calculated based on the user's operating income, less the user's operating costs and operating expenditures. The scheme for the valuation of the property with a mineral deposit in the income approach, by the method of profits, is illustrated in the diagram in Figure 3.

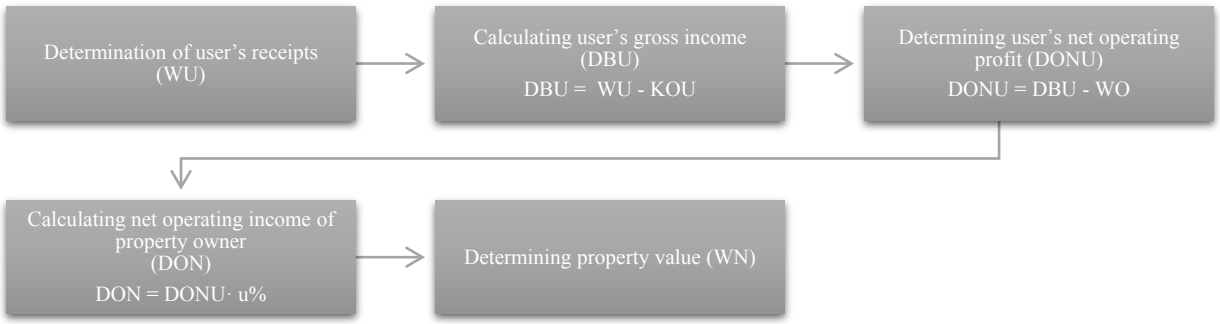

Fig. 3. Flowchart of a procedure in property valuation in the income approach, in the method of profits.

WU – is determined from the operating activity conducted on the property; DBU – is the difference between user's receipts and user's operating costs (KOU) which are all the expenses related to the running of business and which condition the expected receipts, including purchase of goods, materials, services, staff wages, costs related to replacement of fixed assets and equipment, advertising costs, etc.; DONU – corresponds to the user's gross income reduced by operating costs (WO) of annual expenses of property maintenance borne by the owner, for example, property taxes, fees for perpetual usufruct etc.; DON – is defined as the property owner's share *u*% in the user's net operating income.

The value of real estate is determined by capitalisation of DON or its discounting. The use of capitalisation is justified on the assumption of fixed income in the long-term which, with reference to the property with a mineral deposit and ongoing mining process, seems to be too much of a simplification. With the progressing mining works, the level of knowledge about the structure and quality of the deposit is increasing, which is reflected in the variability of the income. The predicted volatility should be reflected in the valuation process by using the technique of discounting income streams. The market value of the property (WN) estimated in the income approach, by the profit method, with the technique of discounting income streams, is expressed by Formula (1).

$$WN = \frac{DON_1}{(1+r_d)^1} + \frac{DON_2}{(1+r_d)^2} + \ldots + \frac{DON_n}{(1+r_d)^n} + \frac{RV}{(1+r_d)^n} \tag{1}$$

where according to Formula (2):

$$RV = \frac{DON_n}{R} = \frac{r \cdot net\ operating\ income}{capitalization\ rate} \tag{2}$$

where:
RV – residual value of the subject of valuation,
n – the number of years of prediction period,
DON_1, DON_2, …, DON_n – net operating income in subsequent prediction periods,
R – capitalisation rate,
r_d – discount rate.

The capitalisation rate (R) is an indicator of the economy of a specific (valued) real estate. It results from the relationship between net operating income obtained from the property which is the most similar to the one being valued, and transaction prices of comparable properties which have been sold. Therefore, each property has its own market capitalisation rate resulting from its attributes.

The discount rate (r_d) is also an indicator of the economy of a specific property. It is equal to the capitalisation rate adjusted for the risk resulting from the real estate market, related to the risk from other long-term investments.

Both rates can be determined in an alternative manner based on quoted financial market parameters, where the natural diversity of property attributes is included in the partial risk factor. The values of risk factors of investing in the valued property are therefore derived from its market characteristics. In the case of real property with a mineral deposit, the risk decreases with the progress of the investment process.

According to the Authors of this research paper, the described valuation procedure most closely reflects the physical and economic complexity of a property with a mineral deposit. The limitation in its application results from the lack of an active rent market for comparable properties with mineral deposits, based on rents calculated relative to the share in the operator's profits. In this paper, it is proposed that the share (u%) in the operator's profits is determined by the heuristic method based on the opinions and assessments of different people, not just experts. Preliminary research carried out in the form of brainstorming, based on a free exchange of views in a group of people selected with respect to their knowledge of the analysed problem, indicate a 15-20% share of the owner in the operator's profits. The group claimed that this level would meet the financial expectations of the property owner and is high enough for the owner of the property to resign from running a business on their own.

SWOT/TOWS analysis as a method of assessing procedures in property management

SWOT/TOWS analysis is a popular heuristic technique used for organising and analysing information. By definition, it is the process of studying the internal and external environments of the organisation, based on which it is possible to infer about the best development strategy of this organisation (Ghazinoory et al., 2011). Initially, the use of SWOT/TOWS was associated with the management of enterprises and formulating strategies for them (Weihrich, 1982). Later, however, the analysis was also used in such fields as agriculture (Baudino et al., 2017), health (Van Durme et al., 2014), tourism (Qian, 2017), environmental protection (Gao et al., 2017) and many more.

SWOT/TOWS has also been used in real estate management to determine the strategy of the future of the real estate cadastre (Polat et al., 2017), to assess the marine cadastre development strategy (Dawidowicz and Źróbek, 2014), for the methods of port resource management (Dawidowicz et al., 2017), for the analysis of legal methods of protecting agricultural land (Pawlikowska et al., 2017) and to determine the directions of spatial development of cities (Bieda and Brzozowska, 2017). That is why the Authors decided to attempt to assess the above-described procedure for valuation of land properties with mineral deposits using this specific method. The analysis was carried out in four stages, as described in (Obłój, 2001):

1. Determination and description of the factors that have either a positive or negative impact on the proper conduct of the valuation procedure for land properties with mineral deposits. The current conditions of the procedure were recognised as Strengths (S) and weaknesses (W), and opportunities (O) and threats (T) – the expected future events which may affect the assessed valuation procedure.
2. Assigning significance to individual factors through the determination of weights, which was performed based on a survey conducted in a group of 11 experts in the field of mining, deposit extraction and property valuation. The task of the respondents was to rank the presented factors from the most important to the least important ones. The respondents evaluated the validity of a given factor using the Tilgner five-point scale (Babbie, 2008): 1 point – no impact of the factor, 2 points – low impact, 3 points – average impact, 4 points – significant impact and 5 points – maximum impact. The weights (W_{Ci}) were defined by converting the results obtained in the questionnaires using Formula (3).

$$W_{Ci} = \frac{p_i}{\Sigma p_i}, \tag{1}$$

   where p_i represents the arithmetic mean of the values assigned by the respondents to the i-th factor.
   The values have been rounded up to 5%.
3. Analysis of interrelations between the selected factors by marking their relationship as strong – "2", weak – "1", or non-existent – "0". The relationships between the factors were identified by answering eight questions (Fig. 4).

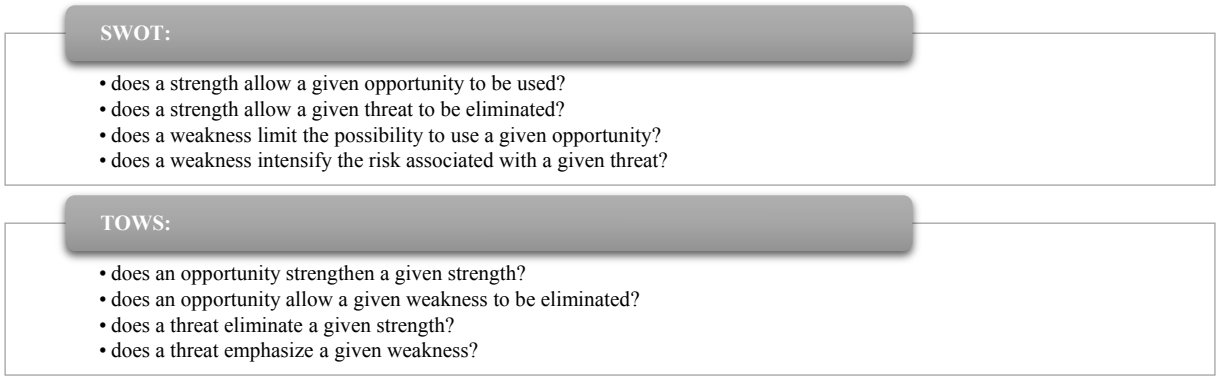

Fig. 4. The questions leading to the identification of relationships between SWOT/TOWS factors.

4. Selection of one of the four strategies that will allow assessing the methodology for the valuation of land properties with mineral deposits (Fig. 5).

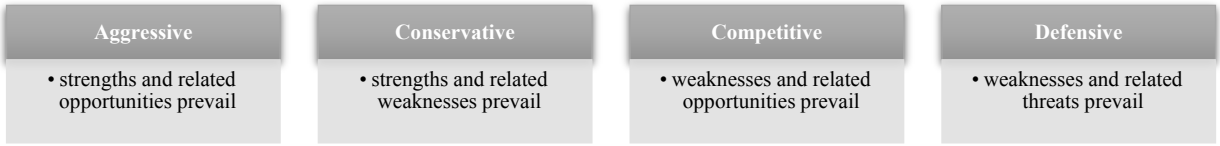

Fig. 5. Strategies that are feasible as a result of SWOT/TOWS analysis.

Results

In the performed SWOT/TOWS analysis, the three highest rated factors from each category were used. The strengths and weaknesses of the valuation methodology applied in Poland for land properties with mineral deposits, the opportunities and threats that have been observed for this methodology, as well as their weights, are presented in Table 2.

Tab. 2. Factors of the analysis.

No.	Weight	Internal factors	No.	Weight	External factors
-	**1,00**	**Strengths (S)**	**-**	**1,00**	**Opportunities (O)**
S1	0,40	mineral deposits are usually well-documented; therefore, property valuers receive full information about the property being valued	O1	0,35	state policy supports the extraction of minerals; therefore the market of land properties with mineral deposits has a chance to develop
S2	0,40	method of valuation depends on the degree of real estate investment, so the value resulting from the valuation process accurately reflects the state of the property	O2	0,35	conducted geological research may lead to exploration of new mineral deposits and thus to the development of the market of land properties with mineral deposits
S3	0,20	there is a standard for the valuation of land properties with mineral deposits, as a result of which such valuations are carried out in a uniform manner	O3	0,30	the valuation standard may lead to legal regulation of valuation procedures for land properties from mineral deposits
-	**1,00**	**Weaknesses (W)**	**-**	**1,00**	**Threats (T)**
W1	0,45	real estate valuer has limited access to documentation about properties comparable to the one being valued, and therefore their selection is hindered	T1	0,50	real property with mineral deposit is constantly evolving resulting in increased difficulty of valuation as the mining process progresses
W2	0,35	a poorly-developed market of real properties with mineral deposits may hinder valuation in the comparative approach, and no information about rents – in the profit approach	T2	0,25	staging of investment on land properties with mineral deposits may hinder their valuation
W3	0,20	the standard for valuation of land properties with mineral deposits is not a provision of law	T3	0,25	the strong correlation between the variable value of land properties with mineral deposits and the market value of the mineral

The interrelations between the factors contained in Table 2 are presented in Tables 3 (relationships in the SWOT analysis) and 4 (relationships in the TOWS analysis).

Tab. 3. SWOT analysis of interrelationships.

	O1	O2	O3	T1	T2	T3
S1	0	1	0	2	2	1
S2	0	1	1	2	2	0
S3	1	0	2	2	2	1
W1	0	2	1	2	2	2
W2	0	1	0	1	2	1
W3	1	0	2	0	0	0

Tab. 4. TOWS analysis of interrelationships.

	S1	S2	S3	W1	W2	W3
O1	1	1	0	0	2	0
O2	2	0	0	0	2	0
O3	0	0	2	1	0	2
T1	2	2	2	2	2	0
T2	1	2	1	2	2	0
T3	1	1	1	2	2	0

The cumulative summary of the SWOT/TOWS analysis is presented in Table 5, while the results of the strategic analysis and selection of the strategy in Table 6.

Tab. 5. Summary of the results of SWOT/TOWS analysis.

	Results of SWOT analysis		**Results of TOWS analysis**		**Summary of SWOT/TOWS**	
Combination	The sum of interactions	The sum of products	The sum of interactions	The sum of products	The sum of interactions	The sum of products
Strengths [S]/ Opportunities [O]	12	3.55	12	4.00	18	5.60
Strengths [S]/ Threats [T]	28	9.60	26	9.15	54	18.75
Weaknesses [W]/ Opportunities [O]	14	4.30	14	4.55	28	8.85
Weaknesses [W]/ Threats [T]	20	1.25	24	8.80	44	10.05

Tab. 6. Results of the strategic analysis and strategy selection.

	Opportunities [O]	**Threats [T]**
Strengths [S]	Aggressive strategy	Conservative strategy
	Number of interactions	Number of interactions
	24	54
	Weighted number of interactions	Weighted number of interactions
	7.55	18.75
Weaknesses [W]	Competitive strategy	Defensive Strategy
	Number of interactions	Number of interactions
	28	44
	Weighted number of interactions	Weighted number of interactions
	8.85	10.05

The cumulative summary (Tab. 6) contains the sums of the relationship from Tables 3 and 4 and the sums of products of weights and these relationships. They achieve the highest values for the conservative strategy. This means that the methodology used in Poland for the valuation of land properties with mineral deposits has great potential, but it should be restructured to overcome potential future threats.

Discussion

Valuation of land properties with mineral deposits is an extremely difficult task. In order to carry it out properly, it must be based on reliable source materials and a well-described procedure. Therefore, the Authors of this research paper attempted to evaluate the methodology used for the valuation of land properties with mineral deposits using the SWOT/TOWS analysis.

Although the Authors consider the described procedure for valuation of land properties with mineral deposits to be good, they hoped that the results of the conducted evaluation would allow identifying these elements of the procedure that should be improved. However, according to the Authors, the conclusions drawn from the SWOT/TOWS analysis are not entirely satisfactory. The highest values of interactions and weighted interactions between the factors of the analysis require pointing to the conservative strategy according to which the valuation method should be improved. This means that the methodology used in Poland for the valuation of land properties with mineral deposits has great potential, and possible changes should prevent the occurrence of the contingent future risk. According to the Authors, Polish legislation should allow access to full documentation of deposits for properties comparable to the one being valued, in the first place.

The results of the performed analysis were undoubtedly influenced by the fact that very few factors were identified to carry out the analysis. The Authors' approach to describing strengths, weaknesses, opportunities and threats was also important. Strengths and weaknesses are attributes of the current valuation procedure, and opportunities and threats are expected future events. If, however, the internal factors were considered to be strengths and weaknesses, and the external factors were considered to be opportunities and threats, or if the factors dependent on the creators of the procedure were considered to be strengths and weaknesses, and the objective factors on which they did not have direct causative influence were considered to be opportunities and threats, the results of the analysis would certainly be different.

Thus, it turns out that although the SWOT/TOWS analysis may not be the best way to assess the valuation methodology when determining its factors, it is possible to identify its sensitive elements. It is therefore suggested to use the proposed method for the preliminary assessment of the procedures related to real estate valuation (also for properties with mineral deposits). According to the Authors of this study, an interesting research topic could be the SWOT/TOWS analysis carried out for the global valuation procedures for land properties with mineral deposits.

***Acknowledgements**: This work is financed from the funds for science, no 11.11.150.006, realised at AGH University of Science and Technology, Faculty of Mining Surveying and Environmental Engineering, Department of Geomatics, allocated for the year 2018.*

References

Act of August 21, 1997 *on real estate management*, consolidated text of December 14, 2017 (Journal of Laws of 2018, item 121, as amended).

Act of June 9, 2011. *Geological and Mining Law*, consolidated text of October 16, 2017 (Journal of Laws of 2017, item 2126, as amended).

Babbie E. (2008). Podstawy badań społecznych. *Polskie Wydawnictwo Naukowe*, Warszawa.

Bieda, A. and Brzozowska A. (2017). Analiza SWOT/TOWS jako metoda określania kierunków rozwoju przestrzennego. *Acta Scientiarum Polonorum, Administratio Locorum*, 16(3), 151-160.

Baudino, C., Giuggioli, N. R., Briano, R., Massaglia, S. and Peano, C. (2017). Integrated methodologies (SWOT, TOWS, LCA) for improving production chains and environmental sustainability of Kiwifruit and Baby Kiwi in Italy. *Sustainability*, 9(9), 1621.

Dawidowicz, A., and Źróbek, R. (2014). Multipurpose water-marine cadastre in Poland-development directions. *Acta Adriatica: international journal of Marine Sciences*, 55(2), 127-144.

Dawidowicz, A., Klimach, A. and Szpara, A. (2017). Management of Seaport Real Estate Stock in Relation: Port–Marine City. *Geomatics and Environmental Engineering*, 11(4), 35-50.

Gao, X., Chen, L., Sun, B., & Liu, Y. (2017). Employing SWOT Analysis and Normal Cloud Model for Water Resource Sustainable Utilization Assessment and Strategy Development. *Sustainability*, 9(8), 1439.

Ghazinoory, S., Abdi, M., and Azadegan-Mehr, M. (2011). SWOT methodology: a state-of-the-art review for the past, a framework for the future. *Journal of business economics and management*, 12(1), 24-48.

Lilford, E. V. and Minnitt, R. C. A. (2002). Methodologies in the valuation of mineral rights. *Journal of the South African Institute of Mining and Metallurgy*, 102(7), 369-384.

Obłój, K. (2001). Strategia organizacji. Polskie Wydawnictwo Ekonomiczne, Warszawa.

Pawlikowska, E., Popek, P., Bieda, A., Moteva, M., and Stoeva, A. (2017). Analysis of the Legal Methods of Agricultural Land Protection in Central Europe On the Example of Poland and Bulgaria. *Real Estate Management and Valuation*, 25(2), 58-71.

Polat, Z. A., Alkan, M. and Sürmeneli, H. G. (2017). Determining strategies for the cadastre 2034 vision using an AHP-Based SWOT analysis: A case study for the turkish cadastral and land administration system. *Land Use Policy*, 67, 151-166.

Qian, W. (2017). SWOT Analysis and Related Countermeasures for Croatia to Explore the Chinese Tourist Source Market. *Croatian International Relations Review*, 23(78), 169-185.

Regulation of the Council of Ministers of September 21, 2004, *on property valuation and preparation of a valuation survey* (Journal of Laws of 2004, No. 207, item 2109, as amended).

Roscoe, W. E. (2002). Valuation of mineral exploration properties using the cost approach. *CIM Bulletin*, 105-109.

Special Committee of the Canadian Institute of Mining, Metallurgy and Petroleum on Valuation of Mineral Properties. (2003). Standards and Guidelines for Valuation of Mineral Properties (CIMVAL).

Specialist National Valuation Standard KSWS Valuation of land with mineral deposits covered by land property rights, recommended for use since January 1, 2017.

The Polish Association of Mineral Asset Valuators. (2008). Code for the Valuation of Mineral Assets POLVAL.

The SAMVAL Committee. (2008).The South African Code for the Reporting of Mineral Asset Valuation (SAMVAL Code).

The VALMIN Committee. (2005). Code for the Technical Assessment and Valuation of Mineral and Petroleum Assets and Securities for Independent Expert Reports (VALMIN Code).

Uberman, R. (2014). Valuation of mineral resources in selected financial and accounting systems. *Natural Resources*, 5(09), 496-506.

Weihrich, H. (1982). The TOWS matrix-A tool for situational analysis. *Long range planning*, 15(2), 54-66.

Van Durme, T., Macq, J., Anthierens, S., Symons, L., Schmitz, O., Paulus, D., Van den Heede, K. and Remmen, R. (2014). Stakeholders' perception on the organization of chronic care: a SWOT analysis to draft avenues for health care reforms. *BMC health services research*, 14(1), 179.

Zielińska, M. (2017). The issue of valuation of real estate located on mineral deposits. *Geographic Information Systems Conference and Exhibition "GIS ODYSSEY 2017"*, Conference proceedings, 436-440.