



# Approaches Towards the Valuation of Mineral Deposits

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## Abstract

*The present paper is dedicated to the approaches towards the valuation of mineral deposits in accordance with specially developed codes for the valuation of deposits in individual countries, including Poland. The article consists of three chapters. The introduction to the paper describes its main purpose. The second chapter constitutes the main part of the work, presenting the individual codes in the context of the approaches towards the valuation of various stages of an investment's life cycle. The final chapter provides a summary of the paper. The whole article ends with a list of literature.*

**Keywords:** valuation of a mining investment, codes of mineral deposit valuation, methods of valuation, stages of a mining investment in the context of valuation

## Introduction

The valuation of mining investment projects is a difficult and complex process. When conducting an economic assessment, one should take into account a number of factors, both internal and external. The commonly available methods which are usually used to estimate the value of a mineral deposit include the discounted cash flow, the comparative and cost-based methods. However, not every method mentioned above may be implemented in any phase of an investment project. It is due to this and other reasons that many countries including Poland have developed their own codes, based upon which the value of deposits is estimated. Among the earliest ones is the Code for the Technical Assessment and Valuation of Mineral and Petroleum Assets and Securities for Independent Expert Reports, in short the VALMIN Code (Uberman R. 2009), developed by the Australasian Institute of Mining. Since 2003, Canada has been using its code named Standards and Guidelines for Valuation of Mineral Properties – in short the CIMVAL Code (Uberman R. 2009), the contents of which resemble the one originating from Australia. A similar code was also established in South Africa, i.e.: the South African Code for the Reporting of Mineral Asset Valuation – the SAMVAL Code. Following the abovementioned codes, Poland also developed its mineral deposit valuation code in 2007 (POLVAL), prepared by the Polish Association of Mineral Asset Valuers. The purpose of the present paper is to present the mineral deposit valuation methods presented in the individual mineral deposit valuation codes.

## Approaches towards valuation

The valuation of mining investment projects is a difficult process, and the selection of a proper

method used to estimate the value of a mineral deposit depends on the phase in which the given investment project is. In general, three approaches towards valuation can be distinguished: the income-based, market-based and cost-based methods. The income-based approach differentiates between the following methods (Cimval. 2003):

- The Discounted Cash Flow (DCF) – very commonly used and accepted.
- The Monte Carlo Analysis – less common than the DCF method, but still used nonetheless.
- The Real (actual) Options Valuation (ROV) (Option Pricing) – used more rarely – its drawback being that it is less comprehensible, however it is acceptable.
- Probabilistic Methods – they are not commonly used and accepted in the valuation of mining investment projects.

The market-based approach differentiates between the following methods (Cimval. 2003):

- Comparative (Comparable Transactions) – as part of the market-based approach it is the most commonly used method in various variants – this method is also widely accepted by analysts.
- Option Agreement Terms – used relatively often
- Resource values (Gross “in situ” Metal Value) – reflects the value of all resources; the method is not commonly accepted considering it does not take into account numerous key factors in the valuation of a mineral deposit.

Value per Unit Area – usually used to value a real estate occupying a considerable area.

The market-based approach differentiates between the following methods (Polval. 2008):

- The estimated value
- Expenses on geological tasks

Tab. 1. Approaches towards valuation recommended by the VALMIN Code (Valmin. 2015)

Tab. 1. Podejścia do wyceny rekomendowane przez Kodeks VALMIN (Valmin. 2015)

Approach towards valuation	Geological prospecting work	Tasks preceding the development work	Development work	Extraction
Income-based	No	In certain cases	Yes	Yes
Market-based	Yes	Yes	Yes	Yes
Cost-based	Yes	In certain cases	No	No

Tab. 2. Approaches towards valuation recommended by the CIMVAL Code (Cimval. 2003)

Tab. 2. Podejścia do wyceny rekomendowane przez Kodeks CIMVAL (Cimval. 2003)

Approach towards valuation	Geological prospecting work	Tasks preceding the development work	Development work	Extraction
Income-based	No	In certain cases	Yes	Yes
Market-based	Yes	Yes	Yes	Yes
Cost-based	Yes	In certain cases	No	No

During the last dozen or so years some countries developed their own approaches towards estimation of the value of mineral deposits. The present paper presents several selected codes on the basis of which such estimates are conducted. The first one is the VALMIN Code, created by the Australasian Institute of Mining. Table 1 presents an approach towards valuation depending on the current phase of an investment project.

The VALMIN Code distinguishes between four phases of a mining investment, which are: the geological prospecting work, the tasks preceding the development work, the development work and the extraction. According to the abovementioned code, income-based methods are allowed mainly in the last two phases (in some cases it is possible to use income-based methods in the phase of the tasks preceding the development work). The use of market-based methods is allowed in any phase of an investment project. The cost-based method acceptable by the VALMIN Code is allowed practically only in the first phase of an investment process, namely during the geological prospecting work (in some cases it is possible to use this method in the phase of the tasks preceding the development work). A very similar (if not identical) approach towards valuation is presented by the CIMVAL Code developed by the Canadian Institute of Mining. The approach according to the abovementioned code is presented in table 2.

Another examined code presenting an approach towards the valuation of mining investment projects is the SAMVAL Code, developed by the Southern African Institute to estimate the value of mineral assets. In contrast to the abovementioned approaches towards valuation, the SAMVAL Code is characterised by listing additional phases in the life cycle of an investment, such as the dormant mine (with an option of the mine still having or not having any economic value) as well as the shutdown. The approach towards the valuation of a mining investment for the individual phases of its life cycle is presented in table 3.

Similar to the previous cases, the SAMVAL Code distinguishes between three approaches towards valuation. The income-based method is recommended for use in the case of development work, extraction and in the case when a mine is dormant and has some economic value. The use of the market-based method is suggested virtually in any phase of the life cycle of a mining investment except for the development phase. According to the SAMVAL Code, the cost-based method is recommended in the phase of geological prospecting work and in the shutdown stage. Poland also created its mineral deposit valuation code in 2007 (POLVAL). The aforementioned code is inspired by all previously developed ones. Unlike the first two and similar to the SAMVAL Code, it assumes the possibility of valuation in the shut-

Tab. 1. Approaches towards valuation recommended by the VALMIN Code (Valmin. 2015)

Tab. 3. Podejścia do wyceny rekomendowane przez Kodeks SAMVAL (Samval. 2008)

Approach towards valuation	Geological prospecting work and preceding work	Development work	Extraction	Dormant mine		Shutdown
				Having an economic value	No value	
Income-based	Not commonly used	Widely used	Widely used	Widely used	Not commonly used	Not commonly used
Market-based	Widely used	Less commonly used	Relatively commonly used	Relatively commonly used	Widely used	Widely used
Cost-based	Relatively commonly used	Not commonly used	Not commonly used	Not commonly used	Less commonly used	Relatively commonly used

Tab. 4. Approaches towards valuation recommended by the POLVAL Code (Polval. 2008)

Tab. 4. Podejścia do wyceny rekomendowane przez Kodeks POLVAL (Polval. 2008)

Approach towards valuation	Method	Geological prospecting work	Exploration and documentation of a mineral deposit	Planning and development of a mineral deposit	Extraction of a	Discontinuation of extraction
Income-based	DCF	No	In certain cases	Yes	Yes	No
	ROV					
Market-based	Comparable Transactions	Yes	Yes	Yes	Yes	Yes
Cost-based	Estimated value	Yes *	Yes *	No	No	Yes
	Expenses on geological tasks					

down phase of a mineral deposit. The approach towards valuation according to POLVAL is presented in table 4.

The POLVAL Code suggests using income-based methods in two phases of a mining investment's life cycle, namely in the phases of: planning and development of a mineral deposit as well as in the extraction phase. In compliance with the abovementioned code, the market-based approach can be used in any phase of the investment's life cycle. According to the POLVAL Code, the cost-based approach should be used in the mine shutdown phase, however it is possible to

use these methods in the first two phases, provided that the obtained results are positive.

### Summary

As indicated by the presented paper, there are many different approaches towards valuation used in the individual phases of the life cycle of a mining investment. Based on the cited codes used in the individual countries, not every method can be used to evaluate an investment in all of its phases. An exception in that regard is the market-based method, which according to all the codes can be used to valuate the mining investment projects.

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### *Podejścia do wyceny złóż*

*Niniejszy artykuł został poświęcony podejściom do wyceny złóż zgodnie ze specjalnie opracowanymi kodeksami wyceny złóż w poszczególnych krajach, w tym również w Polsce. Opracowanie składa się z trzech rozdziałów. We wstępie do artykułu przedstawiono cel artykułu. Główną część pracy przedstawia drugi rozdział w którym to przedstawiono poszczególne kodeksy w kontekście podejść do wyceny w poszczególnych etapach cyklu życia inwestycji górniczej. Ostatni rozdział stanowi podsumowanie opracowania. Całość artykułu została zamknięta spisem literatury.*

*Słowa kluczowe: wycena inwestycji górniczej, kodeksy wyceny złóż, metody wyceny, etapy inwestycji górniczej w kontekście wyceny*