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**DEFINING A STRATEGY OF COAL ENTERPRISES  
IN CRISIS SITUATION**

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***Abstract***

Since 2014 Polish coal enterprises, particularly mines, have been struggling with a crisis caused by, among other things, the decrease of coal prices, its overcapacity on both global and domestic markets, competition from the coal importers or high coal production costs. In this situation, in order to survive, the coal enterprises must formulate new strategies appropriate for the development potential of their mines, including possible ways of overcoming the crisis, as well as their recovery and economically effective functioning in the future. This article includes the results of research in this field. First of all, it presents the essence of the strategy formulation process in an enterprise in a crisis situation, emphasizing the importance of strategy-related choices and the implementation programme. It was the background set for the strategy formulation stages of a coal enterprise in a crisis situation, and next the cognitive gap covering five research issues, concerning the following: the identification of internal and external factors which determine the possibility of development of the Polish mines and drawing a schedule of their changes in the future, determining possible strategic options and corresponding schedules, appropriate for the specific nature of the mines, modelling a decisive problem concerning the choice of strategy, adequately to the development potential of the mines and modelling a decisive problem concerning the choice of actions for the implementation of the strategy, adequately to the assessment of the results of actions for the stakeholders.

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**Keywords:** Coal enterprise, crisis, strategic choice, Poland.



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## **1. Introduction**

Since 2014 the crisis of Silesian coal enterprises inevitably provokes questions about the importance of this sector for Poland. There appear negative assessments and opinions that coal mining is a declining branch, and it does not contribute to the economic growth (Bukowski, Maśnicki, Śniegocki, & Trzeciakowski, 2015). However, it is worth mentioning that the assessment of mining shall be different if it is acclaimed as an element of domestic power safety (Baca-Pogorzelska & Surdej, 2016), which it definitely is. It is expected that at least until the year 2030 (Ministry of Energy, 2017), and even until the year 2050 (Gawlik 2013; Gawlik, & Mokrzycki, 2014), coal shall be important in shaping the production potential of Polish energy, even considering scenarios of extremely adverse provisions of EU energy and climate policy, increase of renewable sources of energy and the development of unconventional hydrocarbons exploitation, or nuclear energy. Though, one must remember that the power safety in Poland, covering the current and future needs for energy, must be justified not only technically and ecologically but economically as well. It poses challenges for these Silesian coal enterprises which include unprofitable coal mines. To survive on the competitive market, such enterprises must formulate strategies corresponding to the development potential of their mines, in the aspect of possible overcoming the crisis, their recovery and economically effective functioning in the future.

## **2. Problem Statement**

### **2.1. Results of previous research regarding formulating the strategy in a crisis situation**

The issue of formulating the strategy of an enterprise in a crisis situation or the crisis itself is vast, and the scientific research concerning this matter can be found in works on, among others, strategic management, management in crisis or enterprise restructuring. It is popular due to at least two reasons. First, the crisis phenomena are inevitable and common. Instead of “if”, one should ask “when shall this happen” and “is the enterprise ready for it?” (Ponis & Koronis, 2012). Secondly, these phenomena are dual in nature. Currently, one does not perceive a crisis situation and crisis in particular solely as a danger or threat but also as an effect of unexpected disturbances in the enterprise activity (Mitroff & Anagnos, 2001), which inhibits some of its basic functions and further existence (Zelek, 2003). Crisis is understood as a turning point, a decisive moment, a breakthrough followed by a change (Nowakowski & Rzemieniak, 2003), which is the beginning of a new direction – a chance for development (Stabryła, 2014; Nogalski & Macinkiewicz, 2004). It is essential in the aspect of formulating the strategy of an enterprise in a crisis situation, which should refer to the future development as well as medium and long distance rules of functioning (Kosińska, 2008).

Formulating the strategy of an enterprise in a crisis situation should be perceived as a process whose course is strongly limited by time and it causes strong pressure (Zelek, 2002). Despite these conditions, in order to achieve success, it is inevitable to formulate a strategy matching the causes of the crisis, its demonstrations and intensity (Zakrzewska-Bielawska, 2008). It needs research which should start with the analysis of the main strategic goal of the enterprise. In literature it is common to claim that the goal is to create an economic value, tightly related to the development (Kowal, 2012; Sierpińska, 2007; Wodarski, 2009).

The basis for strategy formulation is strategic choices (Urbanowska-Sojkin, Banaszyk, Witczak, 2007). First of them is the choice of strategy – from all possible options, and the other one – the choice of the action programme to implement the strategy (Oblój, 2007). Literature presents many different strategic options for the enterprise in a crisis situation (Alas, Gao, & Vanhala 2010), which also include the characteristics of actions for their implementation (Wawrzyniak, 1999; Stabryła, 2007; Zelek 2003). However, due to different causes and manifestations of crisis, the solutions are merely suggestions which may become a basis for the development of strategic options and actions that should be adjusted to the enterprise in question.

Choosing the strategy is important, therefore it is essential to avoid mistakes which may result from accidental or intuitive choice. Hence, the choice of a strategy should be based on the assessment of development potential of the enterprise (Romanowska, 2004; Urbanowska-Sojkin et al., 2007). Such an assessment requires a diagnosis of the enterprise and its environment, which should include research into internal and external factors, determining the possible development of the enterprise.

There are many approaches to the research of distinguished factors, which results from the assumptions of different schools of strategic management (Zakrzewska-Bielawska, 2014). With regard to internal factors, a common basis for the research become the resource approach (Urbanowska-Sojkin et al., 2007; Wyrwicka & Jaźwińska, 2014) and the positioning approach (Porter 2001; Rojek, 2014), also in the complementary aspect (Spanos & Lioukas 2001; Sheehan & Foss, 2009; Dzikowska & Gorynia, 2012, Oblój, 2007). The result of the research should be the identification followed by gathering information about the key internal factors, which determine the strategic potential of the enterprise (Urbanowska-Sojkin et al., 2007). Considering the distinguished approaches, this potential is created by factors connected with resources and their use, which determine possible development of the enterprise thus help to create its value. The results of the research concerning internal factors should refer to the surrounding conditions, determined by external factors. These factors can be studied in a global, macro or micro scale (Godziszewski, 2010). It should aim at the identification of the most important, key external factors, and then developing agendas for their future changes (Van der Heijden, 2000). The confrontation of the research results concerning internal factors (as an assessment of the strategic potential), as well as external factors (in the form of agendas for the surrounding changes), determines the possible development of the enterprise in the environment, whose benchmark is the development potential. In a crisis situation this potential permit to assess the perspective of the environment in three categories:

- developmental, which means the ability to overcome the crisis, to renew and function economically and effectively in the future,
- of average possible development, which means the ability to overcome the crisis and renew,
- non-developmental, which means lack of ability to overcome the crisis.

Since the development potential of the enterprise is determined throughout the confrontation of information concerning many internal factors with the agendas of changing the environment, the choice of strategy requires a decision based on the multi-criteria assessment. It is similar to choosing the correct program for strategy implementation. This choice should depend on the assessment of economic, political, social and environmental criteria, connected with different groups of creditors (Prusak & Stefanow, 2014), whose regard is very important, especially in a crisis situation of an enterprise (Zelek,

2003). In literature there are many methods supporting decision making on the basis of multi-criteria assessment. The most commonly used are (Zopounidis & Pardalos, 2010; Prusak & Stefanow, 2014):

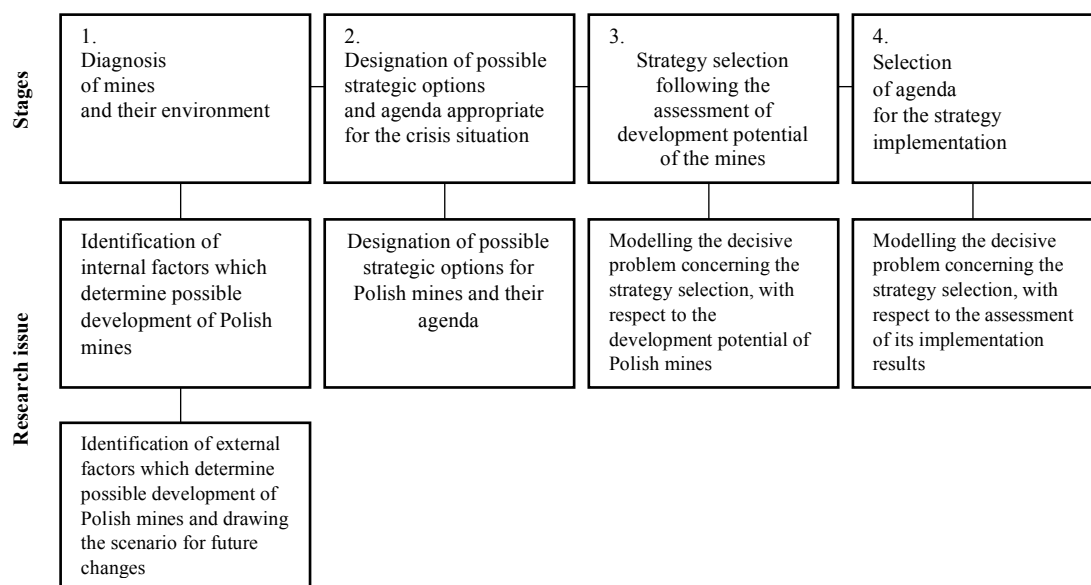
- method groups: ELECTRE (Elimination et Choix Traduisant la R Ealité), PROMETHEE & GAIA (Preference Ranking Organization Method for Enrichment of THE Evaluations & Geometrical Analysis for Interactive Aid), UTA (UTilités Additives),
- methods: TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution), EVAMIX (Evaluation of Mixed Date), MACBETH (Measuring Attractiveness by a Categorical Based Evaluation Technique), VDA (Verbal Deision Analysis), AHP (Analytic Hierarchy Process).

One of the most popular methods is AHP (Huang, Keisler, & Linkov, 2011). Stages of AHP and their mathematical basis are presented in nearly every publication of its creator (e.g. Saaty 2000, 2008; Saaty & Vargas 2001).

## **2.2. Cognitive gap in formulating a strategy for a coal enterprise in a crisis situation**

Since the beginning of the crisis situation in Polish coal mining in 2014 there have been many issues concerning restructuring changes or the assessment of its future development (among others, Gawęda 2014; Jakowska-Suwalska & Sojda 2014; Sojda 2016; Jonek-Kowalska 2015, 2016; Turek & Michalak, 2016; Nawrocki & Jonek-Kowalska, 2016). However, there have been no strategy formulation in respect to the assessment of development potential of the enterprises' mines. Meanwhile, the crisis situation in Polish mining deteriorated. Now, the enterprises are in deep crisis, which requires rational decisions concerning the selection of strategy and agenda, which shall help to overcome the crisis, renew, and, in the future, shall enable the potentially developing mines to function effectively and shut down the ones without such potential.

To support such decisions there is a need to determine a model of strategy formulation for the mines which are part of the coal enterprise in a crisis situation, and which would establish the proceedings for a rational choice of correct strategy and agenda. Based on the submitted references, it has been adopted that the model consists of 4 stages (figure 01). Identifying their guidelines involves 5 research issues, which determine the cognitive gap in formulating strategies for mines which are a part of a coal enterprise.



**Figure 01.** Model of formulating the strategies for mines which are part of the coal enterprise with the corresponding research issues

### 3. Research Questions

The solutions produced in particular research issues (figure 01) shall provide answers to the following research questions:

- 1) How to assess the potential of coal mines which are a part of coal mining enterprise?
- 2) How to make a choice of coal mines strategy, and the actions for its implementation, to be right for their potential?

### 4. Purpose of the Study

On the basis of these considerations, the main purpose of the study was to develop a model of defining the strategy of coal mining enterprise in a crisis situation, which assists decision-making in terms of strategic choices, regarding coal mines, which are a part of coal mining enterprise. These choices relate to the strategy and actions, which allow the renewal and development of coal mines with some potential, as well as shutting down the ones without such potential.

### 5. Research Methods

#### 5.1. Identification of internal factors which determine possible development of Polish mines

Research has been conducted by experts selected from managerial staff and scientists to identify the internal factors which determine possible development of Polish mines. The research was carried out by means of a survey based on a literature study and verified by 6 interviews according to a questionnaire of lesser standardization. The survey presents 78 factors, connected with resources (physical, financial, human, organizational, technological, information and legal, marketing), as well as actions carried out in the coal production, in particular the following processes: preparatory (developing the deposit and preparing it for exploitation), basic (exploitation, machining), auxiliary (ventilation, work safety, transport, economy: electric power, proppant, compressed air, workshop and storage, administration and

non-production services), support (environmental protection, removing mining damage). In the survey 25 competent experts assessed the influence of particular internal factors on possible development of mines, according to a given scale. On the basis of these assessments, by means of the method of relative importance of objects (Bijańska, 2011), the factors which determine the possible development of Polish mines have been found.

## **5.2. Identification of external factors and agendas scenario for future changes**

The research conducted for the identification of external factors was similar as in case of internal factors. The survey was verified in 7 questionnaire interviews and included a list of 30 external factors connected with global, macro and micro environment. These factors were assessed by 25 experts. Next, by means of the method of relative importance of objects, the factors have been found, which determine the possible development of Polish mines. The identified external factors received agendas for future changes. Therefore, in a survey the experts were asked to present forecast changes (trends: beneficial, adverse, stagnation) in shaping these factors in years 2017 - 2021 including the probability of their occurrence.

## **5.3. Designation of possible strategic options and their agendas**

Considering suggestions described in literature, three possible strategic options for Polish mines were presented. The accepted solutions were verified according to free interviews with 2 experts.

## **5.4. Modelling the decisive problem with respect to strategy selection**

For modelling this problem, the AHP method and zero unitarization method were used.

## **5.5. Modelling the decisive problem relating to the selection of agenda**

For modelling this problem, the AHP method and zero unitarization method were used.

# **6. Findings**

## **6.1. Identification of internal factors which determine possible development of Polish mines**

On the basis of the research, 14 factors have been found, which determine the possible development of Polish mines. The factors connected with resources are as follows: Z1) the amount of coal resources, Z2) mining and geological conditions, Z3) development investments, Z4) the degree of debt, Z5) employees' competences, Z6) work efficiency, Z7) share in the market, Z8) relationship with local community. The factors connected with actions are the following: D1) preparing the exploitation front, D2) performance of machines and devices, D3) performance of the exploitation front, D4) profitability of coal mining, D5) safety due to existing hazards, D6) environmental protection. Information about the identified factors shall be used to assess the development potential of mines.

## **6.2. Identification of external factors and scenario for future changes**

On the basis of the research 8 factors have been found, which determine the possible development of Polish mines. They are: 1) the price of coal in the domestic market, 2) the demand for coal in the domestic market, 3) prices for foreign services used in coal mining, 4) prices of materials used in coal

mining, 5) prices of electric energy, 6) import of coal to Poland, 7) tax policy – taxes and other fees, 8) price of coal in foreign market, 9) the demand for Polish coal in foreign market – coal export.

The identified external factors received agendas for future changes. Considering the results of 25 surveys, the average change (z) was calculated as well as its average probability of occurrence (p), whose product is the expected change in shaping particular factors (Ez). It was the base for four patterns (table 01): optimistic – on the basis of beneficial trends in Ez, pessimistic – on the basis of adverse factors in Ez, stagnation – on the basis of stabilization trends in Ez and expected – on the basis of the sum of Ez in previous patterns.

**Table 01.** Scenario for changing the external factors, determining possible development of mines

Names of factors	Optimistic scenario	Pessimistic scenario	Stagnation scenario	Expected scenario
	Ez (%)	Ez (%)	Ez (%)	ΣEz (%)
The price of coal in domestic market	4,66	-1,27	0,46	3,85
The demand for coal in domestic market	1,82	-2,73	0,28	-0,63
Prices for foreign services used in coal mining	-1,09	4,38	0,39	3,68
Prices of materials used in coal mining	-1,16	3,05	0,40	2,29
Prices of electric energy	-1,08	3,83	0,33	3,08
Import of coal to Poland	-4,38	1,07	0,32	-3,00
Tax policy – taxes and other fees	-0,86	3,26	0,19	2,58
Price of coal in foreign market	3,54	-0,89	0,09	2,74
The demand for Polish coal in foreign market – coal export	2,79	-1,05	0,37	2,11

### 6.3. Designation of possible strategic options and their agendas of actions

On the basis of the research, three possible strategic options for Polish mines were presented, the choice of which depends on the assessment category of development potential (table. 02). To implement the accepted options, there were indicated alternative variants of agendas and their synthetic characteristics.

**Table 02.** Strategic options for mines and variants of their agendas

Categories of assessment of development potential	Strategic options	Variants of agendas for strategic options	Characteristics of actions in the programme
Developing mine	1. DEVELOPMENT STRATEGY	v.1.1. Developmental restructuring	Proactive actions
		v.1.2. Making alliances	
		v.1.3. Fusion, takeover transactions	
Mine with average possibilities for development	2. SANATION STRATEGY	v.2.1. Recovery restructuring	Reactive actions
		v.2.2. Selling the mine	
		v.2.3. Internal consolidation	
Non-developing mine	3. BLANKING STRATEGY	v.3.1. Mine shutdown	Actions halting the work of a mine
		v.3.2. Mine bankruptcy	
		v.3.3. Suspending the mine	

#### 6.4. Modelling the decisive problem with respect to strategy selection

In order to select a strategy with respect to the development potential of particular mines which are a part of a coal enterprise, there have been determined a hierarchic AHP consisting of 4 levels (figure 02):

- PI) objective – the assessment of development potential of the mine,
- PII) main criteria for the assessment of the development potential of the mine – identified internal factors which determine development possibilities of the mines,
- PIII) partial criteria for the assessment of development potential of the mine – measures for the main criteria, accepted at considering the possibilities of getting relevant information from the mines,
- PIV) decision alternatives – categories for the assessment of development potential of the mines which imply the selection of appropriate strategic option.

For individual main and partial criteria the weighting factors were made. It happened in the course of research, where 9 experts compared in pairs particular levels with reference to the previous level. In order to be able to compare particular mines, the result of the assessment of the development potential should be of relative character. Therefore, it was assumed that the measure units for the criteria should be unified by means of zero unitarization method (Kukuła, 2000). Considering weighting factors of main and partial criteria ( $w$ ) and their values confronted with expected agenda of changes in the environment, the assessments of the development potential of individual mines ( $Pr$ ) should be made on the basis of the following aggregation:

$$P_r = Z1 \cdot w_{Z1} + Z2 \cdot w_{Z2} + \dots + D6 \cdot w_{D6}, \quad (1)$$

where:

$$Z1 = z.1.1 \cdot w_{z.1.1} + z.1.2 \cdot w_{z.1.2}, \quad (2)$$

$$Z2 = z.2.1 \cdot w_{z.2.1} + z.2.2 \cdot w_{z.2.2} + z.2.3 \cdot w_{z.2.3}, \quad (3)$$

$$D6 = d.6.1 \cdot w_{d.6.1} + d.6.2 \cdot w_{d.6.2}. \quad (4)$$

Symbols used in the formulas are the same as in figure 02.

The obtained result  $P_r$  should be referred to the category of assessment of the development potential of the mines. In particular, it has been assumed that:

- development category features a mine whose result is  $Pr \geq 0,75$ ,
- average development possibilities category features a mine whose result is  $Pr < 0,75$ ,
- non-development category features a mine whose result is  $Pr < 0,25$ .

The mine category is determined by the selection of the correct strategy, from three possible strategic options - development, sanation, blanking (table 02).



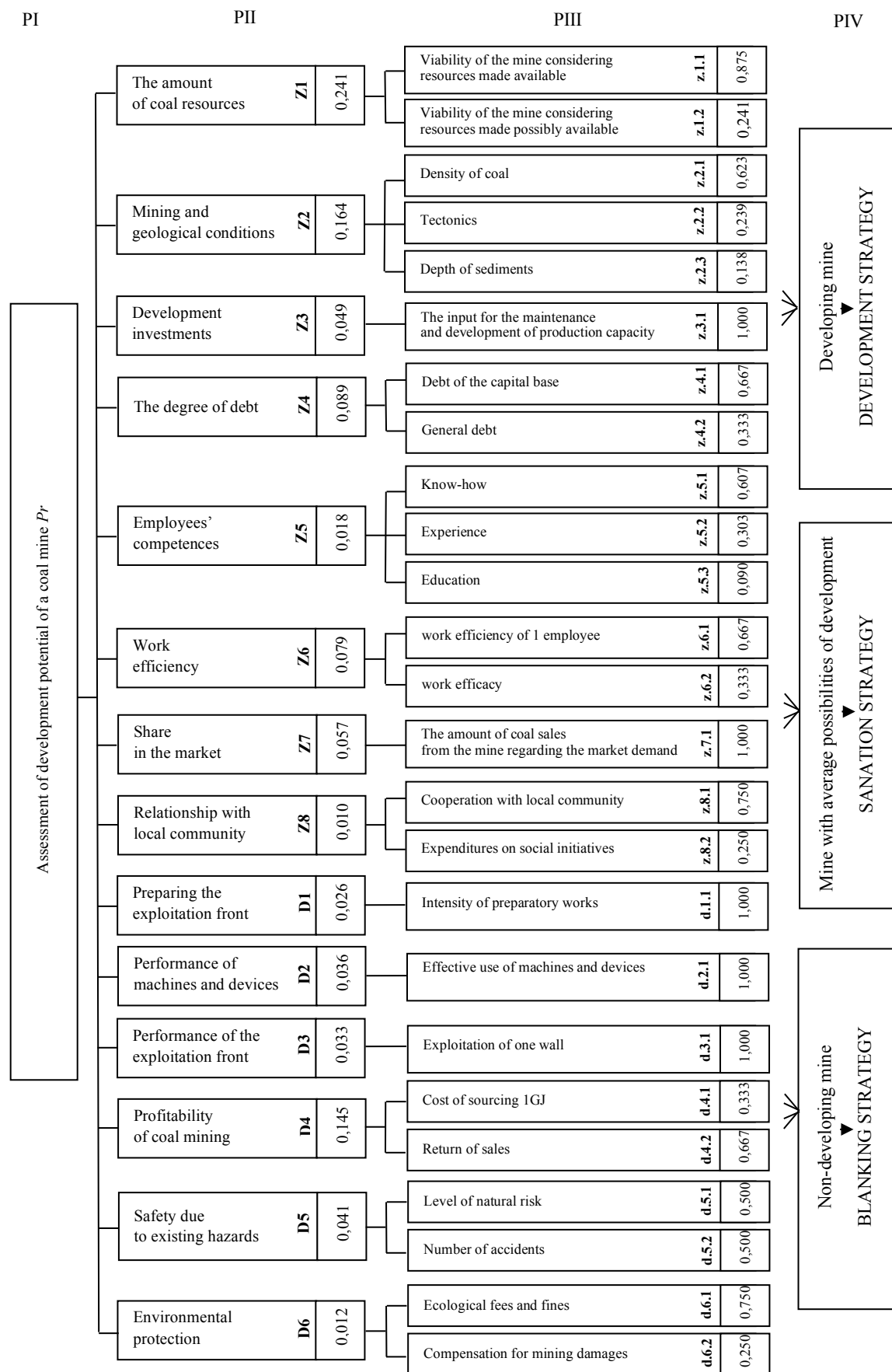


Figure 02. Hierarchic structure of the assessment of development potential of a mine for particular strategies

## 6.5. Modelling the decisive problem relating to the selection of agenda

The decision concerning the agenda for the given strategy should be made regarding the point of view of the most important stakeholders, who shall who shall feel them and/or have some influence on the choice itself. Hence, while creating a hierarchic structure, the stakeholders and some chosen areas of the external environment should be taken into account (Dyer, & Forman, 1992, Diakoulaki 2005).

In order to choose the best agenda for the accepted strategy, the hierarchic structure was drawn, consisting of five levels (figure 03):

- PI) objective – the assessment of effects of the chosen agenda for the given strategy,
- PII) main criteria for the assessment of the results of the activities – featuring also the external environment,
- PIII) stakeholders – the most decisive members and social groups dependant on the result of the decision,
- PIV) partial criteria for the assessment of the results of the activities - factors which are important for the stakeholders while assessing the effects of the chosen agenda with respect to the main criteria,
- PV) decisive alternatives – variants of agenda for the strategy.

For individual main criteria, stakeholders and partial criteria, the weighting factors have been calculated – in the course of research, where 14 experts compared in pairs particular levels with reference to the previous level. The measure units for particular criteria were unified by means of the zero unitarization method. Having considered the values and weighting factors ( $w$ ) for individual levels, the assessment of the effects of the chosen agenda ( $S_{pd}$ ) should be made on the basis of the following aggregation:

$$S_{pd} = S_E W_{S_E} + S_p W_{S_p} + S_E W_{S_S} + S_S W_{S_S}, \quad (5)$$

where:

$$S_E = Ie.1 w_{Ie.1} + Ie.2 w_{Ie.2} + \dots + Ie.5 w_{Ie.5}, \quad (6)$$

$$Ie.1 = ie.1.1 w_{ie.1.1} + ie.1.2 w_{ie.1.2} + \dots + ie.1.5 w_{ie.1.5}, \quad (7)$$

...

$$Ie.5 = ie.5.1 w_{ie.5.1} \quad (8)$$

...

$$S_S = I\acute{s}.1 w_{I\acute{s}.1} + \dots + I\acute{s}.3 w_{I\acute{s}.3}, \quad (9)$$

$$I\acute{s}.1 = i\acute{s}.1.1 w_{i\acute{s}.1.1} + i\acute{s}.1.2 w_{i\acute{s}.1.2}, \quad (10)$$

$$I\acute{s}.3 = i\acute{s}.3.1 w_{i\acute{s}.3.1} \quad (11)$$

Symbols used in the formulas are the same as in figure 03.

The assessment of the effects of the chosen agenda should be conducted for variants corresponding to the previously chosen strategy (table 02). For instance, if, as a result of the assessment of the development potential of the mine the sanation strategy was chosen, then, in order to make the correct choice of agenda, the results of three possible variants should be assessed: v.2.1. Recovery restructuring, v.2.2. Sale of the mine, v.2.3. Internal consolidation – merge with another mine included in the mine enterprise.

The obtained assessment results of the particular variants support the selection of the most beneficial agenda for the chosen strategy. It is the variant of the highest  $S_{pd}$  rate. The results of the implementation of this variant are the most beneficial from the point of view of the criteria for the stakeholders' decision concerning the agenda for the mine strategy implementation

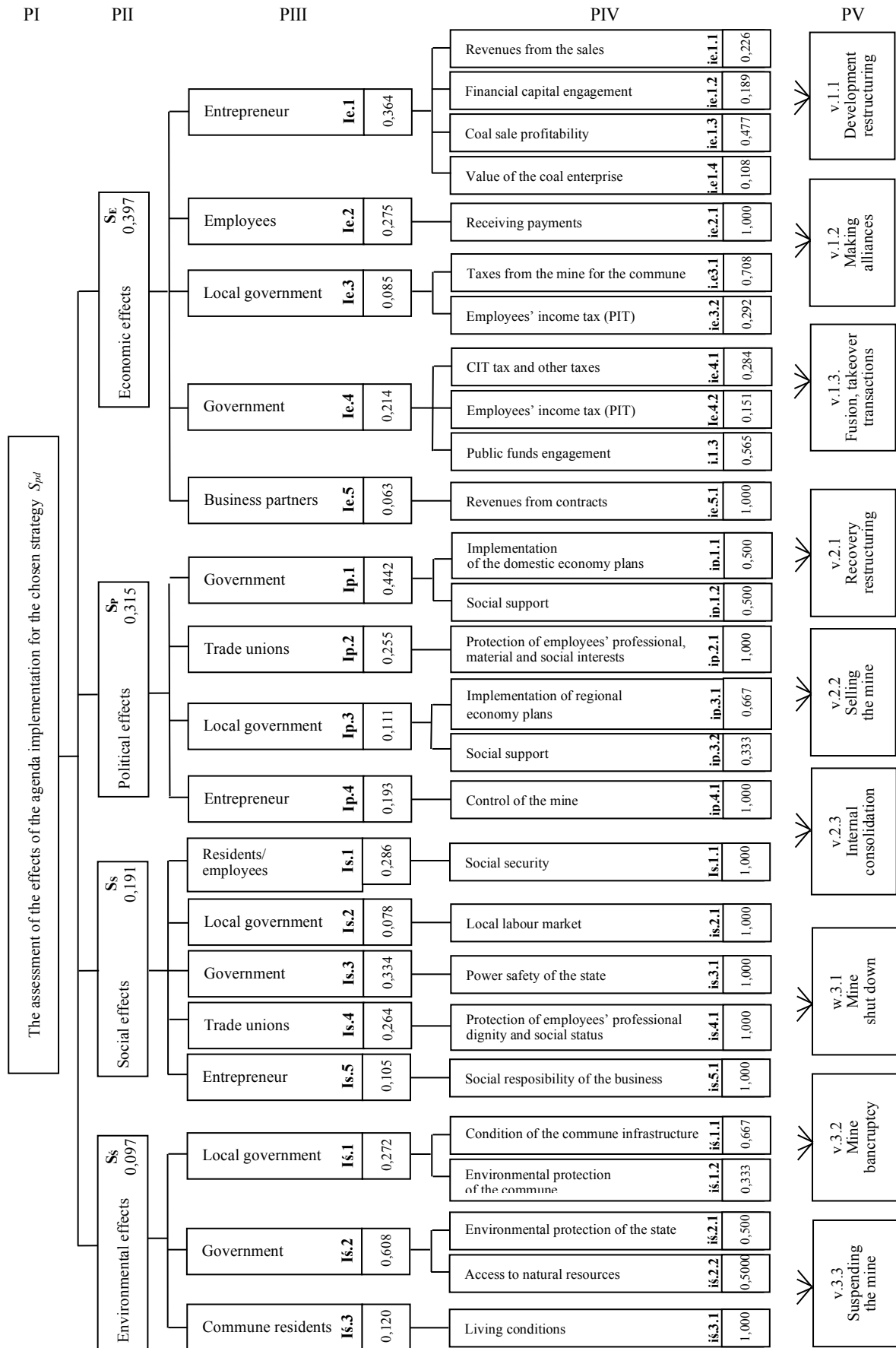


Figure 03. Hierarchic structure of the assessment of the effects following the implementation of the agenda variants in order to choose the most profitable one

## 7. Conclusion

To complete the deliberations, the following conclusions have been drawn:

Polish coal enterprises, including non-profitable coal mines, in order to survive on the competitive market should make important and difficult decisions concerning the mine strategy and its agenda. These decisions should lead to overcoming the crisis, recovery and future economically effective functioning of the mines with development potential and blanking the ones without such potential. To support the decision-making process the course of action presented in this article may be implemented and it specifies the following stages of strategy formulation of mines included in a coal enterprise: 1) diagnosis of the mines and their environment, 2) indication of possible strategic options and agenda variants, 3) selection of the strategy, 4) choice of agenda for the implementation of the strategy.

In stage 1) it is important to identify and then investigate the internal and external factors which determine the mine's development possibilities in the environment. Research has shown that 14 internal factors are crucial for Polish mines, and they are connected with resources and activities concerning coal production, as well as 8 external factors, connected with global, macro and micro environment.

In stage 2) one should determine possible strategic options which should be adapted to the mine specificity. While implementing the strategic options it is crucial to indicate relevant agenda. On the basis of research for Polish mines, 3 strategic options have been adopted. Each of them received 3 alternative agendas.

In stage 3) for each mine included in a coal enterprise, a strategy should be chosen, relevant to the assessment of their development potential. It has been adopted that the AHP method shall be used. The main criteria for this assessment are the mines' internal factors, which determine their development possibilities. In the assessment it is important to take into consideration the scenarios of external factors' changes. The result of the assessment of the development potential should be relevant to the mines' category: developmental, with average development possibilities, non-developmental, on the basis of the accepted decisive standards. The determination of the category implies the choice of strategy, among available options.

In stage 4) the most profitable agenda should be chosen for the strategy, from the point of view of stakeholders, who shall feel the effects of its implementation and/or influence the decision-making. It has been adopted that the AHP method shall be used, aiming at multiple-criteria assessment of the effects of particular agendas, in the aspect of assessment criteria which are crucial for the stakeholders. The results of the assessment of the effects of the particular variants allow to choose the most profitable agenda for the accepted strategy.

Although the research results presented in this article concerning formulating strategies relate to Polish coal enterprises, the presented course of action may be applied in other enterprises, not only coal enterprises. However, it requires further research concerning the following:

- in stage 1:
  - identification of internal factors which determine the development possibilities of the enterprise, and then gathering information about them,
  - identification of external factors which determine the development possibilities of the enterprise, and then drawing agendas for their future changes;

- in stage 2:
  - determining strategic options and alternative implementation agendas possible for the enterprise;
- in stage 3:
  - modelling the decisive problem concerning strategy selection according to the assessment of the enterprise's development possibilities by drawing up its hierarchic structure and estimation and aggregation of the weighting,
  - accepting decisive standards relating to the assessment of the enterprise's perspectives measured in development categories;
- in stage 4:
  - modelling the decisive problem relating to the choice of the most profitable agenda by drawing up its hierarchic structure and the aggregation of the weighting factors.

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