

Załącznik 3

Dr inż. Jolanta Bijańska

AUTOREFERAT
WRAZ Z OPISEM OSIĄGNIĘCIA NAUKOWO – BADAWCZEGO
w odniesieniu do art. 16 ust. 2 ustawy z dnia 14 marca 2003 roku
o stopniach i tytule w zakresie sztuki
(Dz.U. 2016 r., poz. 882 ze zm. w Dz.U. z 2016 r. poz. 1311)

w języku angielskim

1. Course of education, diplomas and scientific degrees

- 1994 - 1999 Master's degree at the Faculty of Mining and Geology of Silesian University of Technology in Gliwice on specialization „Organization and Economy of Mining”.
- 26.05.1999 **Obtaining a higher education diploma and a master's degree in engineering.** Master thesis titled „Changes in the Technical and Economic Indices of the Polish Hard Coal Mining Sector in the Years 1989-1998 with Respect to the Implementation of the Sector Restructuring Programs”.
- 2002 - 2003 Study of pedagogical improvement for academic teachers at the Centre for Research and Improvement of Didactics of the Silesian University of Technology in Gliwice.
- 1999 - 2003 Doctoral studies at the Faculty of Mining and Geology of Silesian University of Technology in Gliwice.
- 15.11.2006 **Obtaining the scientific degree of doctor [PhD] in technical sciences in the field of mining and engineering geology** at the Central Mining Institute in Katowice, on the basis of a doctoral thesis titled „Method of Planning Investment Activity in Hard Coal Mines”.

2. Information of employment in scientific institutions

- 1998 - 1999 Silesian University of Technology in Gliwice, Faculty of Organization and Management; Trainee in the Department of Fundamentals of Technical Systems.
- 1999 - 2000 Silesian University of Technology in Gliwice, Faculty of Organization and Management; Assistant in the Department of Fundamentals of Technical Systems.
- 2000 - 2006 Silesian University of Technology in Gliwice, Faculty of Organization and Management; Assistant in the Department of Enterprise Management and Production Organization.
- 2006 - still Silesian University of Technology in Gliwice, Faculty of Organization and Management; An assistant professor in the Department of Enterprise Management and Production Organization, transformed into the Institute of Management, Administration and Logistic.

3. Description of the of scientific - research achievements, in relation to Article 16 paragraph 2 of the Act of 14 March 2003 on degrees and titles in the field of art (Journal of Laws 2016, item. 882, as amended in Journal of Laws 2016, item. 1311)

As a scientific - research achievement - that is the basis of my applying for postdoctoral degree I present a monograph titled:

„Possibilities for development of a mining company in a crisis situation - a study”.

[Bijańska J., 2017, Possibilities for development of a mining company in a crisis situation - a study, Silesian University of Technology Publishing House; The reviewers: prof. Józef Dubiński PhD, Eng., prof. Maciej Kaliski PhD, Eng.]

Scientific problem taken in this monograph is related to the determination of how to study the possibilities of development of coal mines belonging to the mining company in crisis, to support the decision concerning the choice of strategy and anti-crisis program measures. Undertaking the research in this area resulted directly from the needs of economic practice the coal mining industry and the region of Silesia. It should be noted, however, that the achieved results are methodologically relevant related to the field of technical sciences, discipline of mining and engineering geology, specialty of economics and organization of mining. Because their **main objective** was defined as: developing a model of research and development capabilities of the mining company in a crisis situation, to assist the selection of strategies and programs for mines, in terms of their ability to overcome the crisis, renovation and economical operation in the future.

For that objective a following **research hypothesis** has been formulated: the implementation of the model testing development opportunities of the mining company in a crisis situation helps make rational decisions concerning the choice of strategy and anti-crisis measures for its hard coal mines. The rationality of these decisions is due to their focus on the development of the mining company, taking into account taking into account economic, social and environmental considerations.

Specific purpose and hypothesis is consistent with the basic premise of scientific research in the field of technical science, mining and geological engineering scientific discipline, specialty economics and organization in the mining industry, which is equipping mining companies with the tools of knowledge, explaining and transforming reality, as well as to support these enterprises in solving problems specific to functioning of the mining industry in the conditions of the struggle for efficiency.

Achieving the stated goal and verifying the hypotheses required to carry out the **research process**. It was based on **diagnostic tests** described in Chapter 1. These included the systematization of the existing scientific achievements in the field of the research in the context of the possibility to use previously developed solutions in the study of the development prospects of coal mines in a crisis situation, being a part of the mining enterprise.

As a result of diagnostic tests, I found that in the work area of specialty economics and organization of the mining industry, there is a **theoretical - empirical gap**. In theory, it refers to the lack of test method to examine the development opportunities tailored to the specific conditions of the mining enterprise including coal mines in crisis, and in empirical terms - the lack of comprehensive research in this area, because the published results of scientific investigations deal with selected areas connected with this problem. I also stated that the theoretical aspects of the applied nature have been presented so far on the basis of management sciences, the synthesis of which allows mapping the way of conducting research on the development potential of a company in a crisis situation. I assumed that this method can be applied to research the development capabilities of the mining company comprising mines in crisis, but after its implementation to the specific conditions of the functioning of the coal mining industry. This required tests on several issues.

In particular, I assumed that way of conduct in exploring the opportunities of coal mines belonging to the mining company in a crisis situation will include 3 stages.

Stage 1 involves gathering information about the factors that determine the development potential of coal mines in the context of overcoming the crisis, recovery and cost-effective functioning in the future. Defining guidelines to this stage of testing required researches in the following areas:

1. Identification of internal factors that have the greatest impact on the development opportunities of coal mines.
2. Identification of external factors that have the greatest impact on the development opportunities of coal mines and the development of scenarios for their future changes.

Stage 2 covers the assessment of the development potential of coal mines in a crisis situation and indicates the appropriate strategic option. Formulating guidelines for this stage required research on the following issues:

3. Defining strategic options for coal mines in a crisis situation.
4. Developing a method for assessing the development potential of coal mines to indicate the appropriate strategic option.

Stage 3 includes an assessment of the impact of the implementation of the action programs for the implementation of the adopted strategic option in coal mines and the indication of the best program. Formulating guidelines for this stage required research on the following issues:

5. Identification of action programs for the implementation of strategic options in coal mines in a crisis situation.
6. Developing a method for assessing the effects of completion of action programs on the implementation of strategic options, to identify the best program taking into account economic, social and environmental conditions..

Research on the above issues is described in the following sections of the monograph.

The results of scientific investigations on research issues No. 1 and 2 were presented in **Chapter 2**. In particular, I described **the research of factors influencing the development potential of Polish coal mines**, conducted in 7 steps using several methods and research tools (fig. 1).

The first research issue was related to the identification of internal factors that have the greatest impact on the development potential of coal mines (fig. 1, steps 1 - 3). The research conducted with the participation of experts and calculations using the methods of the relative importance of objects shows that those factors are as follows: 1) the amount of coal resources, 2) mining and geological conditions, 3) the profitability of coal production, 4) the degree of indebtedness, 5) work performance, 6) market share, 7) development investments, 8) security due to threats, 9) the efficiency of machinery and equipment, 10) performance of mining front, 11) preparing the mining front, 12) competence of employees, 13) protection of the environment, 14) relations with the local community.

The second issue of the research included the identification of external factors that have the greatest impact on the development potential of coal mines and the development of scenarios of changes in the future (fig. 1, steps 4 - 7). Basing on the results of studies involving experts and calculations in the course of the method of the relative importance of the objects I assumed that these factors include the following: 1) the price of coal on the domestic market, 2) the demand for coal in the country, 3) the price of outsourced services used in coal mining, 4) the price of materials used in coal mining, 5) the price of electricity, 6) the import of coal to Poland, 7) fiscal policy - taxes and other charges 8) the price of coal on the global market, 9) demand for coal on international markets. For specific factors, based on the predictions of experts, I developed scenarios for the expected changes in the perspective of 2021, which allowed me to determine the opportunities and threats that will determine the development potential of mines in the future.

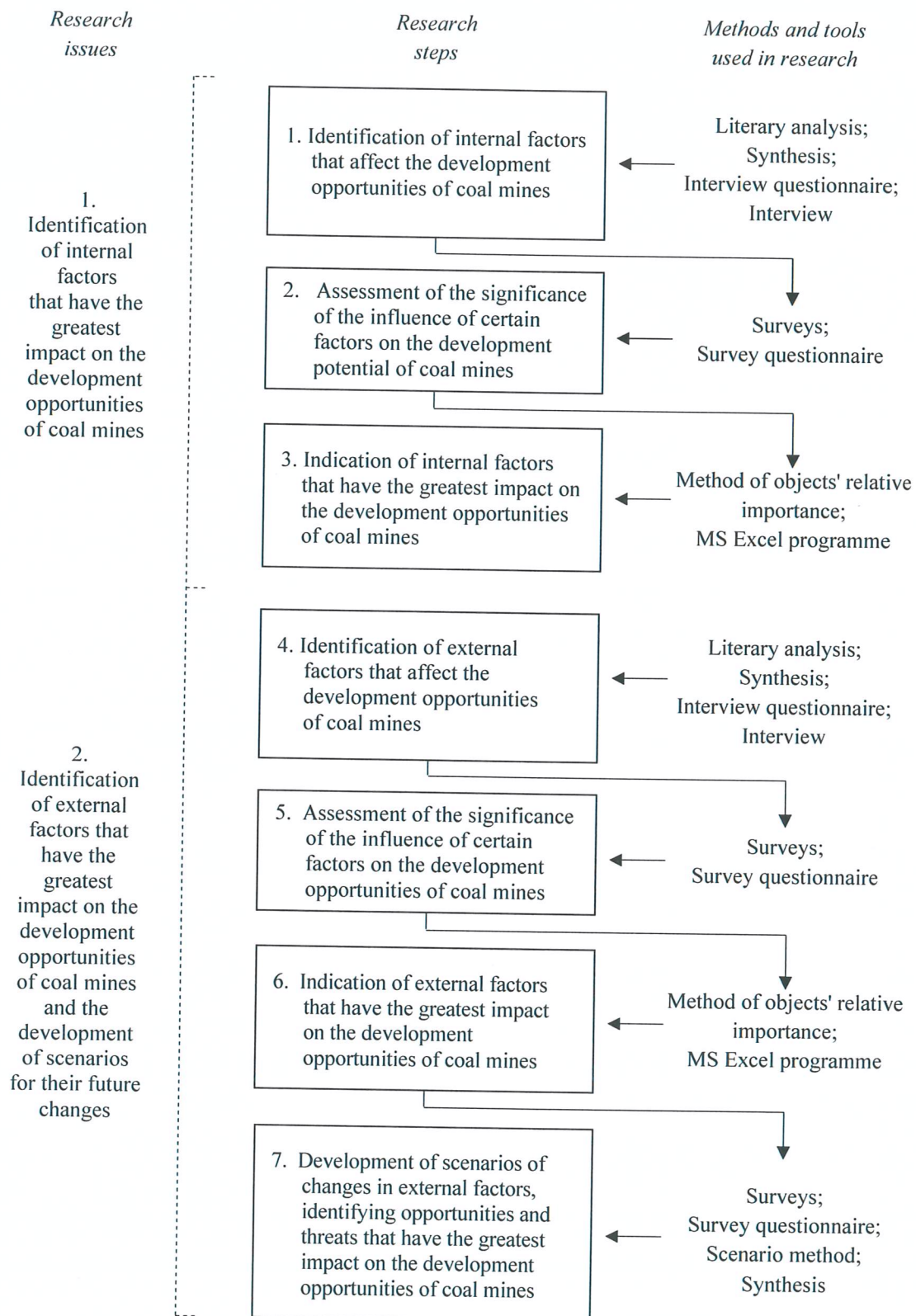


Fig. 1. The course of research on the factors affecting the development potential of Polish coal mines

The results of scientific investigations concerning research issues No. 3 and 4, I presented in **Chapter 3**. In particular, I described in **the study for the evaluation of the development potential of coal mines in a crisis situation**, carried out under the 5 steps using several methods and research tools (fig. 2).

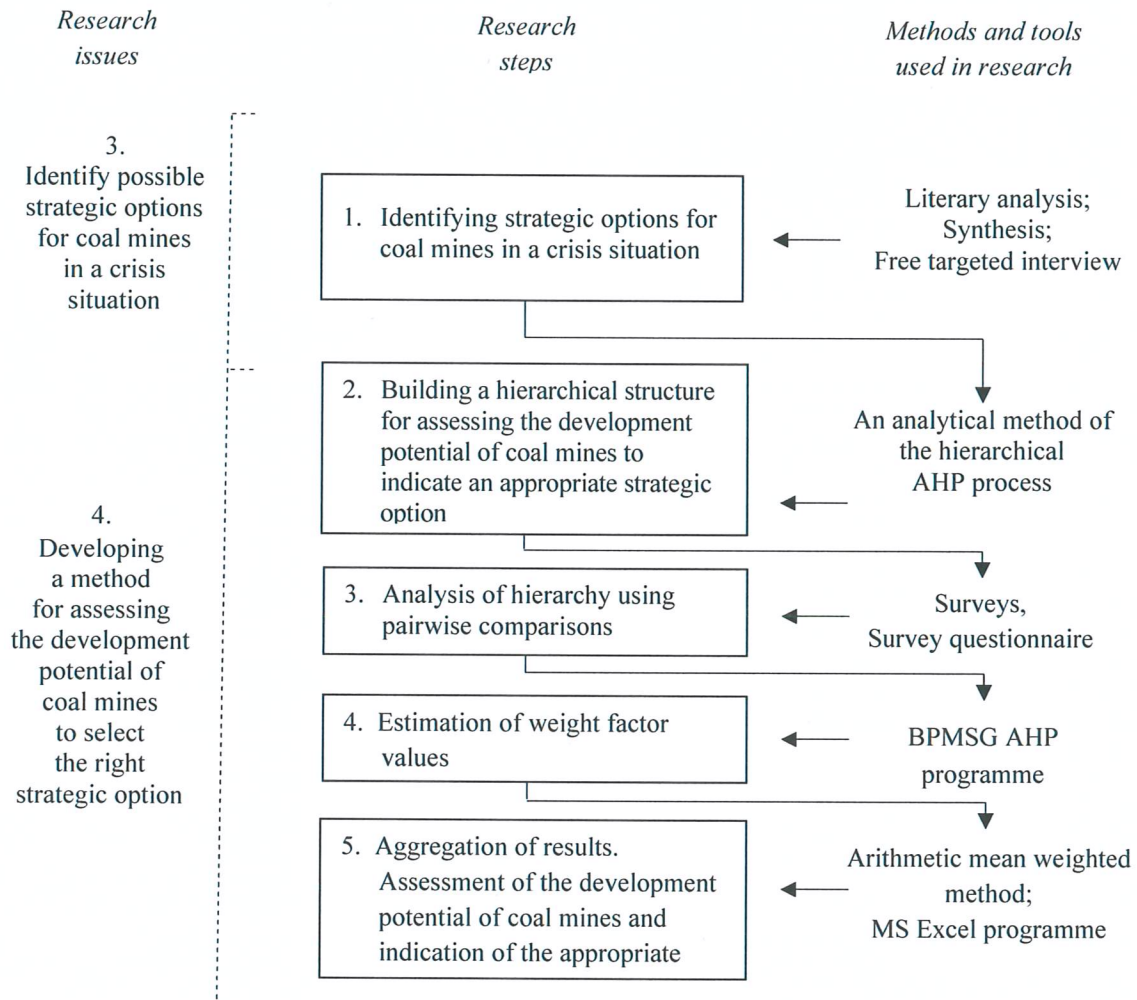


Fig. 2. The test procedure for the evaluation of the development potential of coal mines to identify a suitable strategic option

The third issue of the research involved the definition of strategic options for coal mines in a crisis situation (fig. 2, step 1). Basing on the analysis and synthesis solutions presented in the literature and in the course of free interviews with experts for mines in a crisis situation I suggested three possible strategical options: blanking, repairing, development. I assumed that, for the implementation of these options one should develop alternative programs of action: stopping mine working, reactive, proactive. Choosing the right strategic option should depend on the evaluation category of the development potential of the mines. In particular I assumed that to the categories will be as follows:

- I. will include non-progressive mines, characterized by the inability to overcome the crisis. For these mines one should adopt a strategy of blanking;
- II. will include mines of medium-sized development opportunities, characterized by the ability to overcome the crisis and renewal. For these mines one should adopt a strategy of repair;
- III. will include mines able of development, characterized by the ability to overcome the crisis, recovery and cost-effective functioning in the future. For these mines one should be adopted development strategy.

The fourth issue of the research focused on determining how to assess the development potential of coal mines to identify a suitable strategic option (fig. 2, steps 2 - 5). For this purpose, I used multi-criteria method of analytical hierarchy process (AHP), based on expert judgment. In the course of AHP I first established hierarchical structure of estimating development potential of the mines. I assumed that the main criteria for this assessment are identified internal factors that have the greatest impact on the development potential of the mines. Then I introduced measures of the main criteria, namely the partial evaluation criteria of development potential, the designation of which requires confrontation with the identified external factors and in particular with scenarios of their future changes.

Based on the pairwise comparisons made by experts I defined the weighting factors of the main criteria and sub-criteria, which I took into account in the calculation formula developed for the assessment of the development potential of coal mines. The result of this assessment is the basis for the present ranking of mines and to indicate the appropriate strategic option for them. To this end, I developed standards that support decision making in the scope of strategic options for the mines, according to the result of the assessment of their development potential.

The results of scientific investigations concerning research issues No. 5 and 6, I introduced **in Chapter 4**. In particular, I described **the research into the assessment of the impact of application of action programs for the implementation of strategic options in coal mines**, which was carried out under the 5 steps using several methods and research tools (fig. 3).

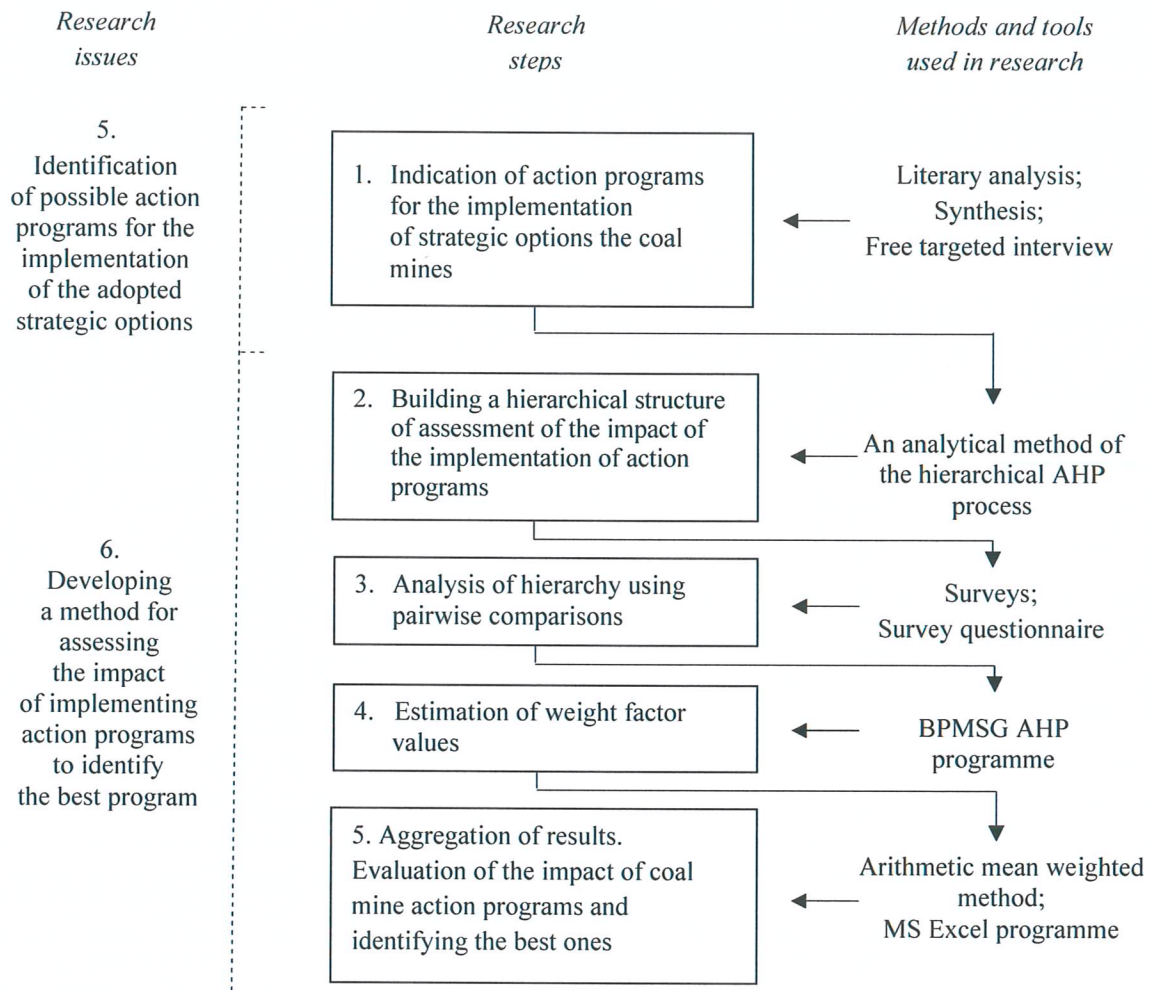


Fig. 3. The course of studies in the field of impact assessment implementation of action programs in the coal mines to indicate the best program

The fifth research issue involved the definition of action programs for the implementation of strategic options in coal mines in a crisis situation (fig. 3, step 1). In its scope, in cooperation with experts, I proposed three alternative action programs for each of the strategic options adopted. Especially for:

- the blanking strategy I accepted that the implementation of action programs aimed at: mine quarantine, partial dismantling of the mine, liquidation of the whole mine,
- the sanction strategy I accepted that the implementation of action programs aimed at: restructuring, mine sale, consolidation - merger with another mine belonging to the mining company should be considered,
- the development strategy I accepted that the implementation of action programs targeted at: development restructuring, alliance formation, merger transactions, acquisition of the mine should be considered.

I assumed that the decision on the choice of program activities will be based on an assessment of its economic, social and environmental consequences, from the point of view of their key stakeholders, to which I included a mining entrepreneur, employees, unions, government, local government, business partners and residents.

The sixth issue of research was associated with the development of a method for assessing the impact of action programs for the implementation of identified strategic options for the mine in order to determine the best program in terms of the criteria of economic, social and environmental (fig. 3, steps 2 - 5). I assumed that this method will be based on the method of AHP. In the course of research under this method I identified the hierarchical structure of the assessment of the impact of action programs, their most important stakeholders along with the partial evaluation criteria and weighting factors. These factors were taken into consideration in the calculation formula developed for the assessment of the implementation of action programs. That assessment supports the decision to choose the most beneficial action program for the implementation of the strategy, in terms of economic, social and environmental criteria.

As a result of synthesis and deduction of the results of research regarding the issues raised in **Chapter 5**, I developed **a model for exploring the development opportunities of a mining company in a crisis situation, and in particular coal mines belonging to it**. In this model, I included the mapping procedure in exploring the opportunities of mines (fig. 4), which enables:

- the development of the ranking of coal mines constituting the mining enterprise in terms of assessing their development potential, understood as the ability to overcome the crisis, to renew and economically operate in the future,
- an indication of strategic options relevant to the results of the assessment of the development potential of coal mines,
- identifying the most favourable action programs for the implementation of strategic options in individual mines, in terms of specific economic, social and environmental criteria.

This means that the developed model for studying the possibility of development of a mining enterprise provides information to make choices that support strategies and action programs for coal mines with respect to their ability to overcome the crisis, recover and economically operate in the future. It can therefore be concluded that the result of the discussions and studies have achieved the main objective of the monograph.

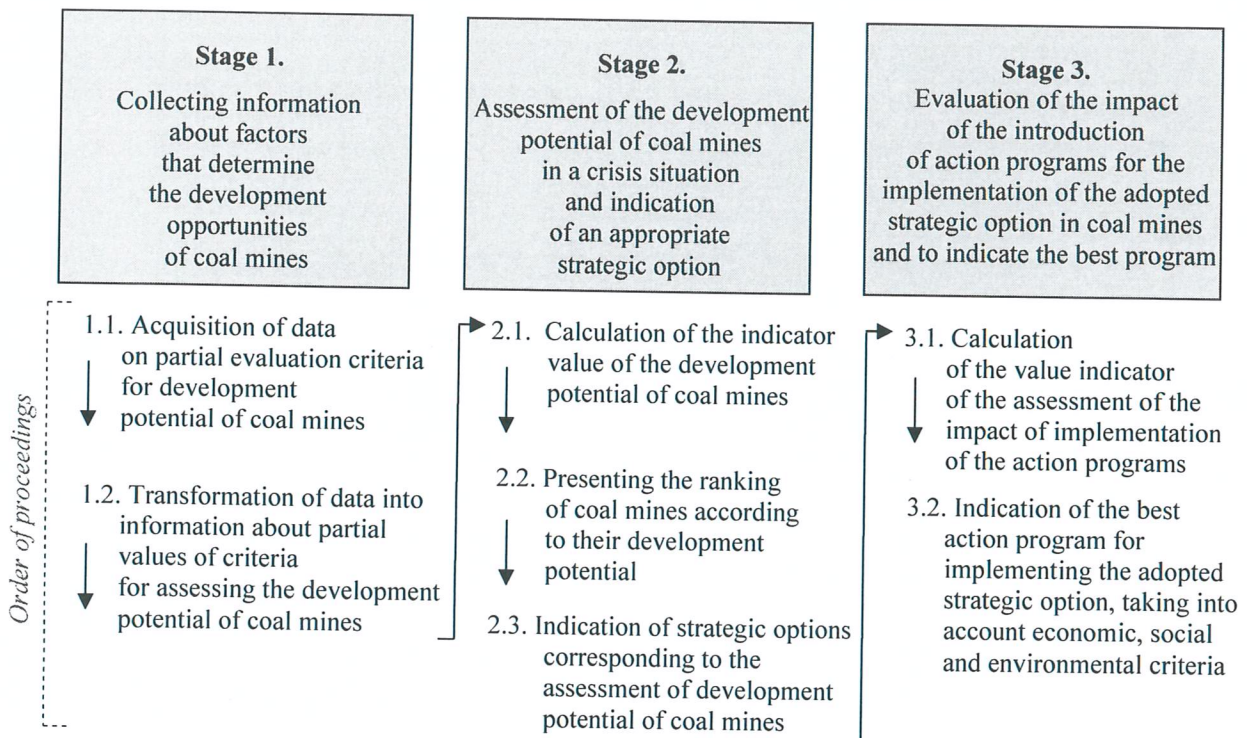


Fig. 4. Procedure in exploring the opportunities of coal mines in the crisis situation included in the mining company

I presented in **Chapter 6 the use of the model in the 5 coal mines** belonging to the mining company in a crisis situation. Following the formulated guidelines allowed me to indicate for these mines strategic options tailored to assess their development potential, as well as to present the best action programmes for their implementation. These programmes imply the best economic, social and environmental point of view, the mining entrepreneur, employees, unions, government, local government, business partners and residents. Decision on the implementation of these programs should therefore gain the support of these stakeholders. It should also be noted that due to the nature of the adopted evaluation criteria and their weighting factors, both with regard to the assessment of the development potential and assessment of the implementation of action programs, these results may provide a basis for making rational decisions aimed at the development of a mining enterprise in the economic aspect, taking into account social and environmental considerations. The use of the model in practice has allowed to positively verifying the formulated research hypothesis.

Monograph ends with a **summary**, in which I synthetically introduced obtained results and pointed their further directions.

To sum up, the described scientific - research achievement focuses on the scientific problem associated with the determination of the method of assessing the development opportunities of coal mines belonging to the mining company in crisis, to support the decision concerning the choice of strategy and anti-crisis program. A proposed model of assessing the development opportunities of the mining company including coal mines in a crisis situation is a solution to this problem. It is based on existing partial solutions, which are further supplemented with the results of my investigations and researches adapted to the specific mining companies and coal mines. This model is my original contribution to the discipline of scientific mining and geological engineering - specialization in economics and organization of the mining industry. Its use will allow better shaping the future of mining companies and improve decision-making on strategies and action programs for its coal mines.

4. Overview of other science - research achievements

4.1. Scientific - research activities before obtaining a PhD degree

My Master's degree was completed on May 26, 1999 at the Faculty of Mining and Geology of the Silesian University of Technology in Gliwice, in the specialty of Organization and Economy of Mining, with very good results. Master thesis, „Changes in the Technical and Economic Indices of the Polish Hard Coal Mining Sector in the Years 1989-1998 with Respect to the Implementation of the Sector Restructuring Programs”, I wrote under the supervision of associate professor Henryk Przybyła PhD, Eng. at the Silesian University of Technology.

On July 1, 1999 I was employed as an assistant at the Faculty of Organization and Management of the Silesian University of Technology, and on November 1, 1999 I started my PhD studies at the Faculty of Mining and Geology of the Silesian University of Technology. Between 1999 and 2000 I continued the research undertaken during the course of the Master's studies in the field of hard coal mining restructuring under the supervision of prof. Andrzej Karbownik PhD. Eng. The result was the publication of 1 article¹ and 1 monograph², which I co-authored. At that time I took part in the research project „Model of Information System of the Coal Company for the Efficient and Effective Management in Hard Coal Mining”³, financed by the Scientific Research Committee. The result of discussion within the framework of this project was the publication of one monograph⁴, which I was a co-author.

In the years 2001 - 2006 my research interests were related to economic - financial, organizational and technological aspects of the investment activities of coal mines. In this regard, I carried out my own research (OR). I presented the results (5 times) during scientific conferences, in particular on:

- conference „School of Economics and Management in Mining”, organized by AGH University of Science and Technology, Department of Mining and Geoengineering, Section for Mining Economics and Organization, Opencast Mining Section, Mining Committee of the Polish Academy of Sciences,

¹ Karbownik A., Bijańska J., 1999, The Assessment of the Government Implementation of Restructuring Programs for the Hard Coal Mining Industry in the Years 1993 - 1998, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 4, pp. 5-21.

² Karbownik A., Bijańska J., 2000, The Restructuring of the Polish Hard Coal Mining Industry in the Years 1990 - 1999, Silesian University of Technology Publishing House, 125 pages.

³ 9T12A 027 17; 1999 - 2001.

⁴ Bendkowski J., Kaźmierczak J., Karbownik A., Wodarski K. (red.), Senczyzna S., Bijańska J., Tchórzewski S., 2001, An Organization Structure and the Information System Modeling of Coal Company, Silesian University of Technology Publishing House, 120 pages.

- conference „Modern Methods of Management of Business Enterprises” organized by the Faculty of Organization and Management of the Silesian University of Technology,
- conference „Modernity of Industry and Services. Innovation and Creativity in Modernizing Industry and Services”, organized by the Society for Research Organization and Management.

The results of these studies I published in the form of 9 articles in national magazines⁵, 2 chapters in monographs⁶ and 1 article in the conference materials⁷. Complementing the author's research with the practical aspects was my participation (as prime contractor) in 4 scientific - research works⁸, which have been done for coal companies.

⁵ Bijańska J., Drożdż J., 2001, The Organization of Planning of the Investment in Coal Companies, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 4, pp. 5-21.

Bijańska J., Gumiński A., 2002, The Analyze of the Structure of Coal Company Financing, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 7, pp. 19-26.

Karbownik A., Bijańska J., 2003, Optimization of Investment Programme of the Coal Company, Mining News, No. 1, pp. 2-6.

Karbownik A., Gumiński A., Wodarski K., Bijańska J., Kloc L., 2003, Computer Aided System of Investment Programme Management of a Coal Company, Mining News, No. 9, pp. 374-382.

Wodarski K., Bijańska J., 2003, Forming of Coal Company Investment Plan with Application of Computer Simulation, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 15, pp. 203-216.

Bijańska J., 2004, Analysis of Structure and Cost of Capital Financing Investment Activity in Mining Companies in the Years 1998 - 2002, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 21, pp. 315-332.

Bijańska J., 2005, Method of Investment Programme Optimization for Multi-Plant Coal Company in Crisis Situation, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 27, pp. 15-26.

Bijańska J., 2006, Technological Aspects of Investment Activity in Coal Mines, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 34, pp. 7-18.

Bijańska J., Wodarski K., 2006, Planning the Investment Activity of Hard Coal Mines, Scientific Bulletin of University of Bielsko - Biała, Paper 25, pp. 11-22.

⁶ Gumiński A., Karbownik A., Wodarski K., Bijańska J., 2003, Computer Aided Forming of Company Investment Plan, [in:] Knosala R. (ed.): Computer-integrated Management, Vol. I, Publishing House of the Polish Society for Production Management, pp. 354-359.

Wodarski K., Bijańska J., 2002, Management of Investment Activity of Multi-Plant Company, [in:] Pyka J. (ed.): Modernity of Industry and Services, Scientific Society of Organization and Management, pp. 493-501.

⁷ Karbownik A., Bijańska J., 2002, Optimization of Investment Programme of Coal Company, School of Economics and Management in Mining, Bukowina Tatrzańska, pp. 167-175.

⁸ „Assessment of demand for coking coal by 2020 on the domestic and foreign markets and its potential impact on the JSW S.A. [Coal Company in Jastrzębie] business strategy”, 2003.

„Investment Management System of Kompania Węglowa S.A.”. Stage 1: Development of the investment program management system with the use of a computer program adapted to the needs of Kompania Węglowa S.A., 2004.

„Optimizing crew and material transport systems in KW S.A. in terms of lowering the cost of coal production and the use of working time in flat ends and longwall workings”. Stage I: a) Analysis of current crew and material transport systems in KW S.A. Mine, b) Proposals for new technical solutions and organizational changes in existing transport systems, 2005.

„Optimizing crew and material transport systems in KW S.A. in terms of lowering the cost of coal production and the use of working time in flat ends and longwall workings”. Stage II: a) Analysis of the impact of proposed solutions on the cost of coal production in mines, b) The impact of proposed new solutions on increasing the use of working time in flat ends and longwall workings, 2006.

On October 20, 2006 in the Central Mining Institute in Katowice I defended my PhD thesis titled „Method of Planning Investment Activity in Hard Coal Mines”, which was supervised by prof. Andrzej Karbownik PhD, Eng. The reviewers were prof. Roman Magda PhD, Eng. (University of Science and Technology in Cracow) and prof. Marian Turek PhD, Eng. (The Central Mining Institute in Katowice). On 15 November 2006, the Scientific Council of the Central Mining Institute in Katowice awarded me with a doctorate in technical sciences in mining and engineering geology.

4.2. Scientific - research activities after obtaining a PhD degree

On December 1, 2006 I was hired as an assistant professor at the Faculty of Organization and Management at the Silesian Technical University in the Department of Business Administration and Organization of Production - now Institute of Management, Administration and Logistics, where I work till today. Since that time, my research interests and the resulting publications focused on the determinants of cost-effective operation of coal mines in the modern economy and were the part of technical sciences, and in particular scientific discipline of mining and geological engineering - specialization in economics and organization in mining.

In my research and the resulting publications, three areas can be distinguished (fig. 5), in which I developed methods and tools for exploring and clarifying the reality of supporting hard coal mines belonging to mining enterprises in solving problems related to the requirement of economically effective functioning in a competitive environment, which falls within the scope of interest in the specialty of economics and organization in mining.

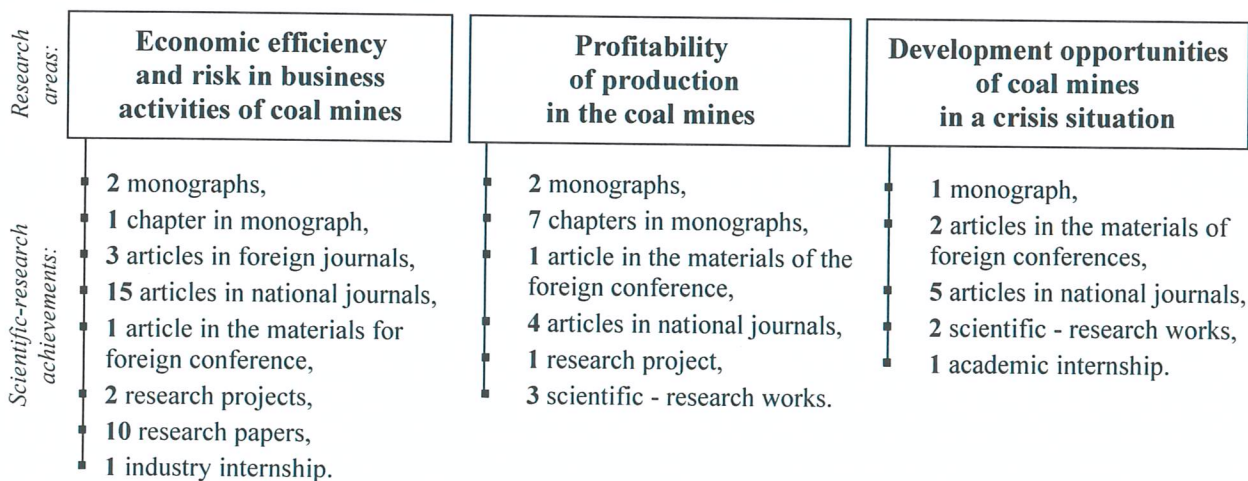


Fig. 5. Research areas and research achievements after obtaining a PhD degree Specialization in economics and organization in mining

4.2.1. Research area: Economic Efficiency and Risk in the Activities of Hard Coal Mines

In the realities of modern economy, coal mines must be economically efficient and accept the risk of not meeting the expected economic effects. My research in this area was a continuation of scientific research, which resulted in a dissertation as well as development of the issue of measurement and evaluation of economic efficiency and risk. The results of research in this area were realized in the framework of statutory research (SR) and own research (OR). They have been published in:

- 1 post-doctoral monograph⁹, for which I received an individual award from the Rector of the Silesian University of Technology for achievements in the field of science,
- 8 articles in national journals¹⁰,
- 1 article in a foreign journal, which can be found in the Journal Citation Reports database (JCR)¹¹,
- 1 article in foreign conference materials¹².

The results of this research I also presented (4 times) at scientific conferences in the series „Modern Methods in Enterprise Management”, organized by the Faculty of Organization and Management of the Silesian University of Technology, and at the conference „Innovation Process Management in Ukraine: Problems, Prospects, Risks” by the Lviv Polytechnic.

⁹ Bijańska J., 2006, Planning the Investment Activity of Hard Coal Mines, Silesian University of Technology Publishing House, 173 pages.

¹⁰ Bijańska J., 2007, Classification of Investment Tasks in Coal Mines, Mining News, No. 4, pp. 231-237,
Bijańska J., 2007, Planning the Investment Activity of a Group of Coal Mines, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 41, pp. 7-18.

Bijańska J., 2011, Analysis and Evaluation of Economic Efficiency of Innovation, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 56, pp. 7-26.

Bijańska J., Wodarski K., 2014, Risk In Enterprises' Investment Decisions, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 70, pp. 53-65.

Bijańska J., 2015, About Some Problems in the Evaluation of Economic Effectiveness of Development Projects Production Enterprises, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 78, pp. 37-50.

Wójcik J., Bijańska J., Wodarski K., 2015, Economic aspects of preparing the production of a new product, Management Systems in Production Engineering, Scientific and Technical Quarterly, No. 4 (20), pp. 233-236.

Bijańska J., 2016, Modelling and Simulation in Investments Planning in Production Enterprises, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 89, pp. 39-51.

Bijańska J., Wodarski K., 2016, Risk Management of Activating and Mining of a Longwall in a Coal Mine, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 91, pp. 61-73.

¹¹ Bijańska J., Wodarski K., 2014, Risk management in the planning of development projects in the industrial enterprises, Metalurgija, Vol. 53, No. 2, pp. 276-278.

¹² Bijańska J., 2010, Ocinnuvannâ ekonomičnoi efektivnosti investicijnih proektiv, International Scientific Conference „Innovation process management in Ukraine: problems, prospects, risks”, Visn. Nacional. Univ. L'vivs'ka Politehnika, Probl. Ekon. Uprav, No. 683, pp. 149-154.

The results of my scientific considerations in mining practice were of great importance for practical use in mining. My contribution (as a prime contractor and a manager) in the implementation of 9 scientific research - works, carried out on behalf of the coal companies, coal mines¹³ and the Office of Mining Studies and Projects¹⁴ should be mentioned.

In my research work in this area it was also important to participate (as the main contractor) in 2 projects of the Ministry of Science and Higher Education.

In the research project titled „Risk Management in the Process of Strategic Planning in Hard Coal Mining”¹⁵ I carried out the analysis and assessment of the value of mining companies, which resulted in writing 1 chapter in a monograph¹⁶.

In the research project titled „Investigation of Technical Possibilities and Economic Determinants for the Design of Residual Coal Deposits Exploitation in Mines of the Upper Silesian Coal Basin”¹⁷ my scientific research was related to measurement and evaluation of economic efficiency and the risk of exploitation of residual deposits. The research results in this area were presented in:

- 1 monograph¹⁸, for which I received the Silesian University of Technology's team award for scientific achievements (I estimate my share in monograph at 75%),
- 9 articles in national journals¹⁹, 1 of which is in the JCR database,

¹³„Optimization of the Crew, Machine, Equipment and Material Transport System in the Pniówek Mine in the Aspect of Lowering Capital Expenditures, Coal Production Costs and Maximizing the Use of Working Time during Preparatory and Exploitation Work”, [in:] „Development of a Comprehensive Design System of Transport Modernization to the Level of 1000”, Silesian University of Technology, Organization and Management Department, 2010.

„Evaluation of Economic Efficiency of Modernization of ZPMW JSW S.A. Budryk mine”, 2012.

„Evaluation of Economic Efficiency for the Updated Technical and Economic Assumptions of an Investment Project to Build a 1290m. Level in the Budryk mine”, 2012.

„Analysis and Assessment of the Economic Efficiency of Mining Resources Management in the Gokowice Coal Seam”, 2012.

„Concept of Development of Chelms II Part of Hard Coal Deposit Together with Assessment of Economic Efficiency of Construction of a New Coal Mine Chelms for Kompania Węglowa S.A.”, 2013.

„Assessing the Risk of Activating and Mining a New Wall in the Mines of Jastrzębska Coal Company S.A.”, 2014-15.

„Determining the Optimum Level of Employment in the Coal Mine „Czatkowice” Sp. z o. o. [LLC]”, 2015.

„Diagnosis of the Current State and Structure of Employment of the Companies Belonging to the Katowicki Holding Węglowy S.A. in terms of Further Optimization and Restructuring”, 2015.

¹⁴„Functional - Utility Program for the Task of: „Adjustment of Land Surface in the Area of Foch II Shaft to New Function after Modernization in JSW S.A. Ruch Knurów „Knurów - Szczygłowice”. Economic Analysis”, 2015.

¹⁵4T12A04530; 2006 - 2008.

¹⁶Bijańska J., 2008, Analysis and Assessment of Value of Selected Mining Companies, [in:] Karbownik A. (ed.): Factors Shaping the Elements of the Modern Organization's Management System, Silesian University of Technology Publishing House, pp. 7-26.

¹⁷NN 524 340640; 2011 - 2013.

¹⁸Bijańska J., Wodarski K., 2014, Economic Conditions of Exploitation of Residual Coal Deposits in Mines of the Upper Silesian Coal Basin, Difin, 162 pages.

- 2 articles in foreign journals²⁰, 1 of which is in the JCR database.

I also presented scientific results (3 times) during scientific conferences, in particular on:

- conference „School of Economics and Management in Mining”, organized by AGH University of Science and Technology, Department of Mining and Geoengineering, Section of Mining Economics and Organization, Opencast Mining Section, Mining Committee of Polish Academy of Sciences,
- conference „Modern Methods in Business Management”, organized by the Faculty of Organization and Management of Silesian University of Technology,
- conference „Chances and Barriers in the Development of Hard Coal Mining”, organized by the Faculty of Mining and Geology of Silesian University of Technology.

The most important results of my scientific investigations in the field of measurement and evaluation of economic efficiency and the exploitation of residual deposits are included in the monograph „**Economic Conditions of Exploitation of Residual Coal Deposits in Mines of the Upper Silesian Coal Basin**”.

The problem raised in this monograph resulted from the economic practice of the coal mining industry, as the research conducted under the project¹⁷ revealed that:

- coal mines in the Upper Silesian Coal Basin contain hard coal deposits in residual deposits that have not been used up so far and are of significant economic importance, particularly for mines where resource depletion occurs,

¹⁹Bijańska J., 2012, Evaluation Criteria for Economic Efficiency of Exploitation in the Residual Hard Coal Deposits, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 60, pp. 7-25.

Bijańska J., 2012, Factors Influencing the Economic Efficiency of Exploitation of Hard Coal Deposits, Mining Overview, No.10, pp. 577-573.

Bijańska J., 2012, Evaluation of Economic Efficiency of Residual Coal Mining Taking into Consideration the Uncertainty of Information, Mining Overview, No. 9, pp. 37-39,

Bijańska J., 2013, Selected Problems in Assessment of Economic Efficiency of Exploitation of the Residual Hard Coal Deposit, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 63, pp. 27-41.

Bijańska J., 2013, Model for Assessing Economic Efficiency and Risk of Exploitation of Residual Coal Deposits, Mining Overview, No. 9, pp. 20-23.

Wodarski K., Bijańska J., Poniewiera M., 2014, Use of IT tools to Design the Exploitation of Residual Coal Deposits, Mining News, No. 5, pp. 250-258.

Wodarski K., Bijańska J., 2014, Evaluation of Economic Efficiency and Risk of Exploitation of Residual Coal Deposits on a Selected Example, Mining Overview, No. 9, pp. 86-89.

Bijańska J., Wodarski K., 2014, Use of IT Tools to Assess the Economic Effectiveness and Risk of the Projected Exploitation of Residual Coal Deposits, Mining News, No. 11, pp. 572-578.

Wodarski K., Bijańska J., Gumiński A., Evaluation of possibilities of extracting residual seam part of hard coal, Archives of Mining Sciences (in the issue, after 2 positive reviews).

²⁰Wodarski K., Bijańska J., 2014, Valoración de las posibilidades de explotación de las reservas remanentes de carbón en Polonia. Industria y Minería, No. 396, pp. 15-23.

Wodarski K., Bijańska J., Gumiński A., Tchórzewski S.: About economic profitability and risk of residual deposits exploitation in Polish collieries. Acta Montanistica Slovaca (transferred to the publishing house in 2015).

- there are currently technical possibilities for the exploitation of these deposits, but a final decision in this respect requires an economic assessment of the effectiveness of the developed design solutions, as well as, a risk assessment of the failure to achieve the desired economic effect.

The main objective of the considerations, research and analysis presented in that monograph was **to develop methods for assessing the exploitation of residual coal deposits, which would make it possible to indicate the optimal design option, from the point of view of economic efficiency and risk, taking into account certain geoengineering restrictions.**

In order to achieve the stated goal a research process that covered the following issues was required:

1. Presentations the economic efficiency assessment taking into account the uncertainty and risk conditions (I estimate my share at 100%).
2. Carrying out an analysis of the potential use of individual methods, criteria and accounting rules to assess the economic efficiency and risk of residual coal mining (I estimate my share at 100%).
3. Carrying out a research on the identification of factors that have a significant impact on the economic efficiency of residual coal mining and may be a source of risk for failure to meet expected economic effects (I estimate my share at 80%).
4. Synthesis of existing methodology and own research results for the development of a method for assessing the economic effectiveness and risk of residual coal mining (I estimate my share at 80%).
5. Development of computer program (OPER) to support the practical application of the method of estimating the economic efficiency and risk of the projected exploitation of residual coal deposits (I estimate my share at 40%).
6. Verification of the developed method of estimating the economic efficiency and risk of the projected exploitation of residual deposits in a selected coal mine (I estimate my share at 50%).

The results obtained in the course of the selected issues allowed me to develop a method for estimating the economic efficiency and risk of exploitation of residual coal deposits, which is integrated in the process of technical design of the exploitation of residual deposits in a way enabling the use of information resources (fig. 6).

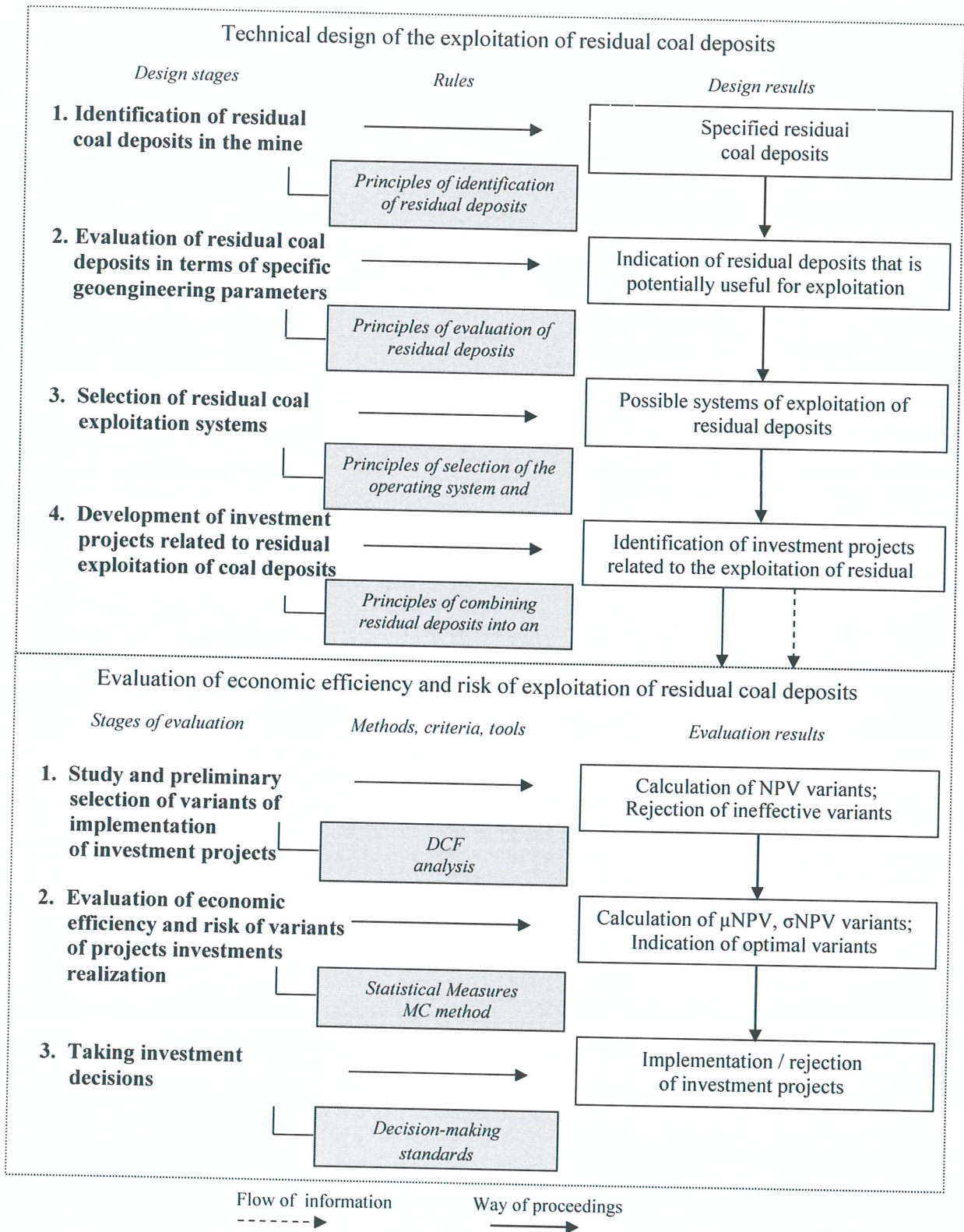


Fig. 6. Stages of technical design and evaluation of economic efficiency and risk of exploitation of residual deposits in hard coal mines

Using the developed method in practice in assessing the economic effectiveness and risk of exploitation of residual deposits in a selected mine, allowed me to state that:

1. Using the desired method allows you to define optimal variant of design solution²¹ from the point of view of economic efficiency and risk, taking into account the stated geoengineering limitations.
2. Information obtained in the course of using the method support the process of making decisions about the exploitation of residual coal deposits in the mine.

Results of a methodological nature presented in the monograph were used to achieve the cognitive goal, which was an assessment of the economic efficiency and risk of exploitation of residual deposits in 16 Silesian coal mines belonging to Kompania Węglowa and Jastrzębska Coal Company. The results of this evaluation are presented in the article to the magazine stored in JCR database²². There was a conclusion that you can exploit a significant part of coal left in the past in the residual deposits of those mines. Most of the shown project designs were commercially viable and had an average, acceptable level of risk. Thus, after developing and implementing an appropriate action taking into account the risk, the residual deposits in the analyzed mines could bring 29 646 038 Mg of power coal, and 3 099 674 Mg of coking coal.

A developed method for evaluating the economic efficiency and the risks of exploitation of residual deposits was also verified during an industrial internship, which I took in the company „EKSPLO - TECH” Sp. z o.o. [LLC] (11-12.2014). Practical experience gained during this internship I used for the implementation in that company the scientific - research²³ work (as prime contractor), the results of which I presented in the article to the journal is in the JCR database²⁴.

4.2.2. Research area: Profitability of coal mining

Profitability of hard coal production is one of the basic conditions for proper functioning of mines in the contemporary environment. My scientific research in this area was related to the realization of the research project of the Ministry of Science and Higher Education entitled „Research on the Profitability of Coal Production in Mines in a Multi-

²¹The variants of the design solution for the exploitation of residual deposits may vary, for example in the exploitation system, technical equipment or the way it is financed.

²²Wodarski K., Bijańska J., Gumiński A., Tchórzewski S.: About economic profitability and risk of residual deposits exploitation in Polish collieries, *Acta Montanistica Slovaca* (transferred to the publishing house in 2015).

²³„Analysis and Assessment of the Potential of a Consortium of Companies: „TECHGÓR” sp. z o.o. [LLC] and „EKSPLO-TECH” sp. z o.o. [LLC] in Terms of the Possibility of Exploitation of Residual Coal Deposits”, 2015.

²⁴Wodarski K., Bijańska J., Gumiński A.: Evaluation of possibilities of extracting residual seam part of hard coal, *Archives of Mining Sciences* (in the issue, after 2 positive reviews).

annual Perspective until 2020 for Further Restructuring of Hard Coal Mining in Poland”²⁵, of which I was the manager. As part of my research in this area, I have focused on two issues. The first was an analysis of profitability of production of coal in the mines belonging to the Silesian mining companies in the years 1995 - 2010, while the second - to forecast the long-term perspective of profitability in 2020.

The results of research in the area of profitability of coal production I presented in:

- 2 monographs²⁶, for which I received an individual award of the Rector of the Silesian University of Technology for achievements in the field of science,
- 7 chapters in monograph²⁷,
- 4 articles in national magazines²⁸,
- 1 article in foreign conference materials²⁹.

²⁵NN 524167735; 2008 - 2011.

²⁶Bijańska J., 2011, Analysis of Production Profitability in Coal Mines in the Years 1995 - 2009, Silesian University of Technology Publishing House, 144 pages.

Bijańska J., 2011, Forecasting of Production Profitability in Coal Mines in the Years 2010 – 2020, Silesian University of Technology Publishing House, 203 pages.

²⁷Bijańska J., 2009, Principles of Profitability Analysis of Coal Mines, [in:] Karbownik A. (ed.): Selected Issues of Modern Enterprise Management, Silesian University of Technology Publishing House, pp. 5-18.

Bijańska J., 2009, Identification of Factors Affecting the Profitability of Coal Production in Poland, [in:] Sitko W. (ed.): Management: Experience and Problems, System-Graf Printing House, Advertising and Publishing Agency, pp. 127-136.

Bijańska J., 2009, Factors Affecting the Profitability of Coal Production in Poland, [in:] Pyka J. (ed.): Modernity of Industry and Services. Creativity and Innovation in the Modernization of Industry and Services, Scientific Society of Organization and Management, pp. 233-242.

Bijańska J., 2010, Principles of Forecasting factors Influencing the Profitability of Coal Production in Mines, [in:] Pyka J. (ed.): Modernity of Industry and Services. Models, Methods and Tools for Managing Organizations, Scientific Society of Organization and Management, pp. 375-390.

Bijańska J., Wodarski K., 2010, Computer Aided Forecasting the Profitability of Coal Production in Mines, [in:] Pyka J. (ed.): Modernity of Industry and Services. Models, Methods and Tools for Managing Organizations, Scientific Society of Organization and Management, pp. 391-404.

Bijańska J., Wodarski K., 2011, Forecasting the Profitability of Coal Production Using a Computer Model, [in:] Knosala R. (ed.): Computer-integrated Management, Vol. I, Publishing House of the Polish Society for Production Management, pp. 56-67.

Bijańska J., 2011, Information Resources for Predicting Profitability of Coal Production, [in:] Borowiecki R., Czekaj J. (ed.): Managing Information Resources in a Time of Economic Crisis, Organizer's House, pp. 65-84.

²⁸Bijańska J., 2010, Methods of Analysis of the Factors Determining Profitability of Production in Selected Enterprises, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 53, pp. 7-21.

Bijańska J., 2010, Selected Problems in Predicting the Profitability of hard coal Production in Mines, Mining Overview, No. 9, pp. 9-11.

Bijańska J., Wodarski K., 2010, Simulation Model for Predicting Profitability of Coal Mine Production, Mining Overview, No. 9, pp. 12-15.

Bijańska J., Wodarski K., 2011, Forecasting the Profitability of Hard Coal Production on the Example of a Selected Mine, Mining Overview, No. 9, pp. 173-176.

²⁹Bijańska J., 2011, Forecasting profitability of sales methodology in selected enterprises of heavy industry, Proceedings of the 13th International Scientific Conference „Finance and risk”, Wydawnictwo ECONÓM, pp. 231-241.

I also presented results (6 times) during scientific conferences and in particular on:

- conference „School of Economics and Management in Mining”, organized by AGH University of Science and Technology, Department of Mining and Geoengineering, Section of Mining Economics and Organization, Opencast Mining Section, Mining Committee of Polish Academy of Sciences,
- conference „Modern Methods in Enterprise Management”, organized by the Faculty of Organization and Management of the Silesian University of Technology,
- conference „Modernity of Industry and Services. Creativity and Innovation in the Upgrading of Industry and Services”, organized by the Scientific Association of Organization and Management.

It was important to refer my scientific considerations to the economic needs of coal mines. By order of the coal companies, coal mines and the Municipal Office in Gliwice, I took part in the implementation (as prime contractor) of 3 scientific - research works related to the analysis and evaluation of opportunities for carrying out profitable activities³⁰.

Key results of my research into the profitability of coal production are included in monographs „**Analysis of Production Profitability in Coal Mines in the Years 1995 - 2009**” and „**Forecasting of Production Profitability in Coal Mines in the Years 2010 – 2020**”.

The main objective of the considerations, research and analyses presented in those monographs was **to develop a simulation model for forecasting the profitability of coal production and its use to provide forecasts of the level of profitability in Polish coal mines to 2020**. I decided that this model should provide the answer to two basic questions:

- what will be the profitability of production in a selected coal mine in the perspective of 2020 if individual factors affecting this profitability will take on certain values?
- at what level should individual internal factors be formed in order to obtain the desired level of profitability of production in selected coal mine, assuming a certain level of external factors?

³⁰ „Analysis and Evaluation of the Possibility of Running a Profitable Mining Activity in „Murcki - Staszic” Coal Mine”, 2014-2015.

„Analysis and Assessment of Development Possibilities of Running a Profitable Exploitation in the „Sośnica - Makoszowy” mine”, 2014.

„Analysis and Assessment of the Possibility of Running a Profitable Mining Activity in „Wujek” Coal Mine, Ruch „Śląsk””, 2016.

In order to achieve the formulated goal a research process that covered the following issues was required:

1. Presentation the profitability, and in particular its essence and measures and the basic principles of analysis in comparative and causal analysis.
2. Conducting a comparative analysis of the profitability of coal production in 28 mines belonging to Kompania Węglowa, Katowice Capital Group and Jastrzębska Coal Company between 1995 and 2009.
3. Carrying out a causal analysis of the profitability of coal production in 28 mines belonging to Kompania Węglowa, Katowice Capital Group and Jastrzębska Coal Company, which required:
 - identifying factors that have a significant impact on the profitability of coal production in mines, by means of questionnaire surveys with experts,
 - gathering information on the development of factors that had a significant impact on the profitability of hard coal production in the analysed 28 mines from 1995 to 2009,
 - determining the linear relationships between the values of identified factors and the accepted means of profitability of coal production in the analysed 28 mines, by means of correlation analysis.
4. Developing assumptions for the construction of a simulation model, in particular in terms of the modelling the prognostic problem in the model, set of data used in the model, forecasting methods affecting the profitability of coal production and simulation methods.

Basing on the results obtained in the scope of the issues I developed a simulation model that allows the development of deterministic and probabilistic forecasts of production profitability in the mines in the perspective of 2020, and in particular (fig. 7):

- A type forecasts that are developed on the basis of a specific econometric equation of a given profitability measure and forecasts of internal and external factors derived from historical data and used forecasting methods,
- B type forecasts that are developed on the basis of a particular calculation algorithm of a given profitability measure and forecasts of internal factors derived from historical data and adopted forecasting methods,

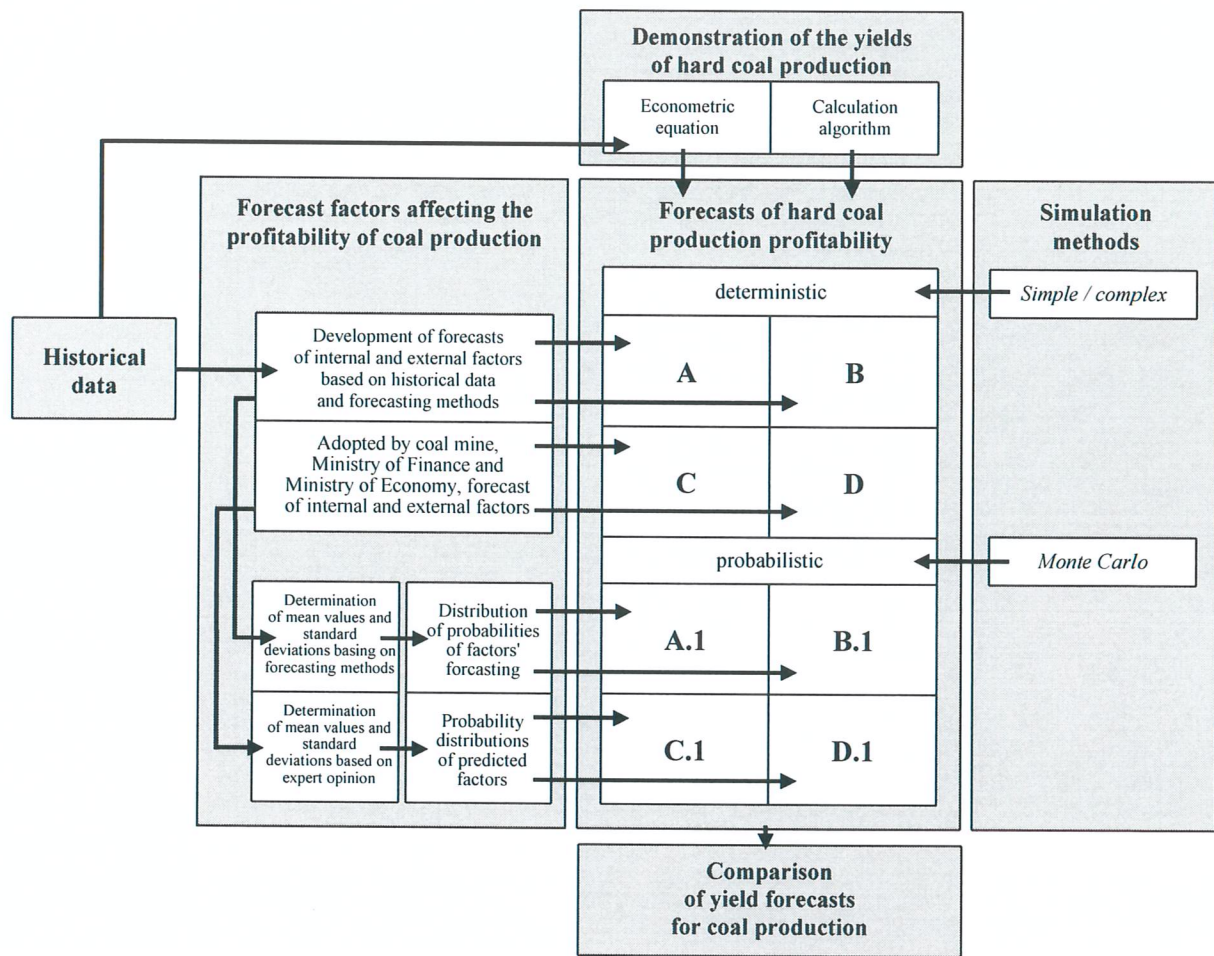


Fig. 7. Simulation model for predicting the profitability of hard coal production in mines

- C type forecasts that are developed on the basis of a specific econometric equation for a given measure of profitability and forecasts of internal factors adopted by individual coal mines, as well as forecasts of external factors adopted by the Ministry of Economy and the Ministry of Finance,
- D type forecasts that are developed on the basis of a specific calculation algorithm of a given profitability measure and forecasts of internal factors adopted by particular coal mines,
- A.1 type forecasts that are developed on the basis of a particular econometric equation for a given measure of profitability, and probability distributions of the predicted values of internal and external factors obtained using the results of the adopted forecasting methods,
- B.1 type forecasts that are developed on the basis of a specific calculation algorithm of a given measure of profitability and the probability distributions of the predicted

values of internal factors obtained using the results of the adopted forecasting methods,

- C.1 type forecasts that are developed on the basis of a specific econometric equation for a given profitability measure and probability distributions of the predicted values of internal and external factors obtained using expert opinion, with respect to forecasts adopted by individual mines and the Ministry of Economy and Finance,
- D.1 type forecasts that are developed on the basis of a specific calculation algorithm of a given yield measure and the probability distributions of the predicted values of internal factors obtained using the experts' opinion, in relation to the forecasts adopted by individual mines.

The simulation model, supported by the SPRP program, has been used to develop deterministic and probabilistic forecasts for trends for specific yield measures till the year 2020 for coal production in the 22 mines included in Kompania Węglowa and Jastrzębska Coal Company. Basing on them, I have assessed the development potential of individual mines in terms of:

- the adopted values of profitability measures forecasted for 2010-2020,
- direction of development tendencies and fluctuations in the value of profitability measures in 2010-2020,
- the ability of individual mines to react to unfavorable market changes, including the fall in demand for coal and the decline in its prices.

The obtained assessment of development possibilities allowed me to formulate general directions of restructuring measures for the tested coal mines.

4.2.3. Research area: Development opportunities for coal mines in a crisis situation

Since 2013, coal mines belonging to Silesian mining companies have been struggling with the crisis and many of them are in a state of an acute crisis that threatens their further functioning. This situation implies the need to make difficult decisions about the choices of strategies and action programs that will help overcome the crisis, restore and economically operate in the future of those mines that have development potential, and to quench those that do not. Due to the effects of these decisions, which concern not only mining enterprises but also the Silesian region, it is important to prepare information that will support them and lead to rational choices. This is related to the issues, which I decided to research, of exploring the opportunities of development of mining companies, and in particular coal mines, which are part of them.

The research results in this area were presented in:

- 1 monograph³¹,
- 5 articles in national journals³²,
- 2 articles in foreign conference materials³³, indexed in the Web of Science database (WoS).

I also presented scientific results (twice) during scientific conferences, in particular:

- conference „School of Underground Mining” organized by the Institute of Mineral Resources and Energy Management of the Polish Academy of Science,
- conference „Modern methods in the management of business enterprises”, organized by the Faculty of Organization and Management of Silesian University of Technology.

It was important that I had a great practical experience in solving issues related to this area which I gained during the implementation of 2 research works³⁴, commissioned by coal companies and mines. It was also important to have a research internship at the Faculty of Economics of Maria Curie-Skłodowska University in Lublin (07.2017), during which I was able to exchange views on the results of my research (among others during the seminar) and to verify them in the course of freely targeted interviews.

³¹Bijańska J., 2017, Possibilities for development of a mining company in a crisis situation - a study, Silesian University of Technology Publishing House, 267 pages.

³²Bijańska J., 2017, From Crisis To Success. Considerations for Hard Coal Mining Enterprise Development in Crisis Situation, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 101, pp. 41-53.

Bijańska J., 2017, Role of Strategic Analysis in the Study of the Development Possibility of Hard Coal Mining Enterprise in the Crisis Situation, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 101, pp. 55-67.

Wodarski K., Bijańska J., 2017, Scenarios of Environmental Changes, as an Element of Research the Possibility of Mining Enterprises Development, Scientific Papers of Silesian University of Technology, Organization and Management Series, Paper 101, pp. 545-556.

Bijańska J., Issues of Exploring the Development Possibilities of Hard Coal Mines, Bulletin of the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences (in the issue, after 2 positive reviews)

Bijańska J.: Wodarski K., Use of AHP method in strategic decision - making in hard coal mines in a crisis situation. The article was submitted for presentation at 3rd International Scientific Conference on Management, Economics, Ethics, Technics, which will be held in Zabrze at the Faculty of Organization and Management of Silesian University of Technology, 22-23 September 2017 with the participation of The National Mineral Resources University „Gornyi” in Sankt Petersburg (Russian Federation). After the conference the article will be published in Silesian University of Technology Scientific Papers, Organization and Management Scientific Paper.

³³Bijańska J., Wodarski K., 2017, Defining a strategy of coal enterprises in crisis situation. 4th BEci International Conference on Business and Economics, Vol. I, pp. 91-105.

Bijańska J., Kuzior A., Wodarski K., 2017, Social perception of hard coal mining in perspective of region's sustainable development. 4th BEci International Conference on Business and Economics. The European Proceedings of Multidisciplinary Sciences EpMS.

³⁴„Analysis of the Appropriateness of Decommissioning of Mining Centres with the Simultaneous Creation of Complex Mines Taking into Account Technical and Economic Factors”, 2009.

„Development of Mining Evaluation Criteria, Analysis for the Needs of the Strategy Development of Kompania Węglowa S.A. for the years 2010 - 2015”, 2010.

The results of research in this area are included the monograph „**Possibilities for development of a mining company in a crisis situation - a study**”, which I presented as my scientific - research achievement, in relation to Article. 16 paragraphs. 2 of the Act of 14 March 2003 on degrees and titles in the field of art (point 3).

The results obtained in this area are not only of methodological relevance for the preparation of a model analysis of a mining company development possibilities , which helps to make rational decisions on the choice of anti-crisis policy strategy and program for its coal mines. These results also have a cognitive importance that is related to two issues.

The first issue is related to obtaining information about the development potential of coal mines belonging to the Silesian mining companies, understood in the context of their ability to overcome the crisis, recovery and cost-effective functioning in the future. Information is relevant, among others, or the management of the mining company, as they support making strategic decisions regarding the future functioning of mines. The results of research conducted in this area in 10 Silesian coal mines³⁵ made it possible to assess their development potential, to present their rankings - starting from the best mines in terms of development potential, as well as showing options and variants of programs of future actions for their implementation appropriate to the assessment of development potential.

The second issue is related to obtaining information on the social perception of hard coal mining in the perspective of sustainable development of the Silesian region. Environmental polls have been conducted on this issue. The research results³⁶ made it possible to conclude that the image of mines in Silesia is positive, despite the consequences of the crisis and the nuisance associated with the production of coal. The results also found that for the Silesian community it is important to take measures aimed at overcoming the crisis, renewal and cost-effective operations of mines that have development potential for the future.

³⁵Bijańska J.: Wodarski K., Use of AHP method in strategic decision - making in hard coal mines in a crisis situation. The article was submitted for presentation at 3rd International Scientific Conference on Management, Economics, Ethics, Technics, which will be held in Zabrze at the Faculty of Organization and Management of Silesian University of Technology, 22-23 September 2017 with the participation of The National Mineral Resources University „Gornyi” in Sankt Petersburg (Russian Federation). After the conference the article will be published in Silesian University of Technology Scientific Papers, Organization and Management Scientific Paper.

³⁶Bijańska J., Kuzior A., Wodarski K., 2017, Social perception of hard coal mining in perspective of region's sustainable development. 4th BEci International Conference on Business and Economics. The European Proceedings of Multidisciplinary Sciences EpMS.

5. Summary of the scientific - research results

Publications

The result of my previous scientific - research activities is 65 publications, including 49 done after obtaining a doctoral degree (table 1).

Table 1. List of publications

Specification	Before obtaining a doctoral degree	After obtaining a doctoral degree	Together
Articles in journals included in the JCR database	0	3	3 ³⁷
Monographs	2	5	7
Chapters in monographs	3	8	11
Articles in foreign journals	0	1	1
Articles in national magazines, including () in English	11	28 (4)	39 ³⁸
Articles in foreign conferences publications, including () in WoS database	0	4 (2)	4
Total publications	16	49	65
Total points for publications	82	446	528

Publications after obtaining a doctoral degree include:

- 3 articles in foreign and national journals located in the JCR database (I estimate my share at 50%: in 1, and 40% 2³⁷),
- 5 monographs (I estimate my share at 100% share in 4, 75% share in 1),
- 8 chapters of monograph (I estimate my share at 100% share in 6, 50% share in 2),
- 1 Article in a foreign journal (I estimate my share at 50%),
- 28 articles in national journals³⁸ (I estimate my share at 100% in 15, 50% in 8, 33% in 4, 30% in 1),
- 2 articles in foreign conference publications indexed in WoS database (I estimate my share at 50% in 1, 33% in 1),
- 2 articles in foreign conference publications (I estimate my share at 100% participation in 2).

³⁷2 pending publications - sent to the publishing houses in 2015 (1 after 2 positive reviews).

³⁸2 pending publications - sent to the publishing houses in 2017 (1 after 2 positive reviews).

Scientific - research works

The realization of scientific - research works for mining companies and coal mines was important in my scientific - research work in the field of economics and organization in the mining industry (table 2).

After obtaining a doctoral degree, I participated in:

- 14 scientific - research works (I was in charge of 3 of them),
- 4 works in the field OR and 1 SR.

Table 2. Realization of scientific – research works

Specification	Before obtaining a doctoral degree	After obtaining a doctoral degree	Together
Realization of scientific - research work; In charge of (estimated share)	0 (4)	3 (11)	18
The completion of OR / SR works; In charge of (estimated share)	0 (8)	0 (5)	13
Together including: in charge of (estimated share)	12 0 (12)	19 3 (16)	31 3 (28)

Indicators of scientific achievements

The results of my scientific - research activity are reflected in scientific achievements indicators (table 3).

Table 3. Indicators of scientific achievements

Specification	Before obtaining a doctoral degree	After obtaining a doctoral degree	Together
Impact Factor	0	0,959	0,959
The number of citations according to the Web of Science database	0	4	4
Hirsch index by Web of Science database	0	1	1
Hirsch index by Publish and Perisch	0	4	4
The number of citations according to Publish and Perisch database	0	70	70

Research Projects

After obtaining a doctoral degree I was in charge of 1 research project and I was the main contractor for 2 research projects for Ministry of Science and Higher Education - MSHE (table 4).

Table 4. Management and participation in research projects

Specification	Before obtaining a doctoral degree	After obtaining a doctoral degree	Together
Implementation of projects MSHE; In charge of (estimated share)	0 (1)	1 (2)	1 (3)

Prizes for scientific activity

For scientific achievements in the field of economics and organization in mining I received three awards of the Rector of the Silesian University of Technology.

Holding lectures at international and national conferences

I presented the results of my scientific - research achievements after obtaining a doctoral degree 15 times at conferences (table 5).

Table 5. Holding lectures

Specification	Before obtaining a doctoral degree	After obtaining a doctoral degree	Together
Lectures at national conferences	4	12	16
Lectures at international conferences	1	3	4
Together	5	15	20