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POSSIBILITIES OF IMPROVING THE EFFICIENCY OF MINING COMPANIES BY CONTROLLING COSTS OF COAL PRODUCTION

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Abstract: Polish hard coal mining has been struggling with numerous problems for many years. Currently, the main challenge for the industry is the need to improve efficiency. It is the prerequisite for survival of mining industry. Considering the importance and topicality of the issue there are threats and opportunities regarding efficiency improvement in Polish mining enterprises in terms of production costs presented in the article. Main thesis states that the analysis and evaluation of production costs connected with monitoring the branch and economic environment allows to specify procedures aimed at improving the efficiency in mining companies. In the first stage of the research the costs of coal production in 2006–2009 are analyzed and evaluated. Then, based on the results of the previous stage and review of internal and external conditions of mining enterprises performance, a catalogue of opportunities and threats for efficiency improvement is established. In the first stage of the research following methods are used: analysis of financial records, analysis of the structure and dynamics of the unit cost of production, comparative analysis and case study. In the second part of the research the SWOT analysis is adapted for the purpose of verifying the potential area of efficiency.

Introduction

In *Polish Energy Policy up to the year 2030*, according to the European Union requirements, a gradual reduction of the carbon dioxide emission is assumed and the systematic decrease of quantity of coal used to fulfill the need for electrical energy. Such an assumption presents new challenges for Polish hard coal mining industry. In the long period, a chance for survival and development of the industry indicates the creation and implementation of pure coal technologies. Howev-

er, such a solution requires many years of preparations and substantial investments. In a short period improvement of activity efficiency achieved by controlling the mining costs is possible (Dudycz 2007, p. 138). This task is extremely important and up-to-date conditioning the realization of long-term investment plans.

Taking the above into account, the considerations in the article hereby were set in an area of analysis and assessment of mining enterprises costs. Research problems were formulated in a form of question to be determined: *Is it possible to identify the activities oriented at the improvement of Polish mining enterprise based on the analysis and assessment of production costs?* (Kaplan, Cooper 2000, p. 24) and a supplementary question (compare: Koziński 1969, p. 16 and Nowak 2008, p. 214): *In what way Polish mining enterprises may improve their activity efficiency under specific costs and external conditions?*

Based on the aforementioned research problems the main goal of the article was determined which is the identification of chances and threats to activity improvement in Polish mining enterprises in the area of production costs. The argument states that the analysis and the evaluation of production costs combined with monitoring of industry and general-economic area allows the determination of actions aimed at improving the efficiency in mining enterprises (Skrzypek 2002, p. 193–194).

The main goal consists of a sequence of research stages which encompass:

- literature concerning the area of analysis and assessment of cost and cost management in enterprise,
- assessment of unit changes of production cost,
- identification of unit costs by type and general (Sobańska 2006, p. 372),
- determining changes in particular groups of unit costs,
- assessment of fixed and variable costs levels,
- pointing out internal strengths and weaknesses in the area of efficiency forming,
- identification of external opportunities and threats to efficiency improvement.

In the research process the following research methods are used: analysis of financial records, analysis of the structure and dynamics of the unit cost of production, comparative analysis and case study. In the final stage of the research the SWOT analysis adapted to the needs of verifying the activity efficiency was used (Kowalczyk 2007, p. 3).

The research covered three mining enterprises marked in the text as ZG1, ZG2, ZG3. In order to make the results more objective the following criteria were used to choose the mines:

- affiliation to one of the three largest coal corporations in Poland (Kompania Węglowa JSC, Katowicki Holding Węglowy JSC, Jastrzębska Spółka Węglowa JSC), guaranteeing comparativeness of the research findings as well as covering by the analysis almost the whole mining industry,

- sufficiency of hard coal operational resources at least until the year 2030 securing the realization of development investment and long-term satisfaction of Polish energy industry needs,
- comparativeness of the extent and intensity of occurrences of technical and natural threats, typical for hard coal mine industry (gas, dust, crump, fire) restricting the possibility of major differences in the level of costs from their occurrence,
- the closeness of acquired material and intangible resources in terms of quantity and quality,
- good economic-financial results providing grounds to a high assessment of potential development capabilities.

Assessment and analysis of costs in current process in chosen mining enterprises representing three of the largest hard coal producers in Poland was conducted in the years 2006–2009. The activity horizon of actions aimed at efficiency improvement was determined by year 2020.

Assessment and analysis of production costs in examined enterprises

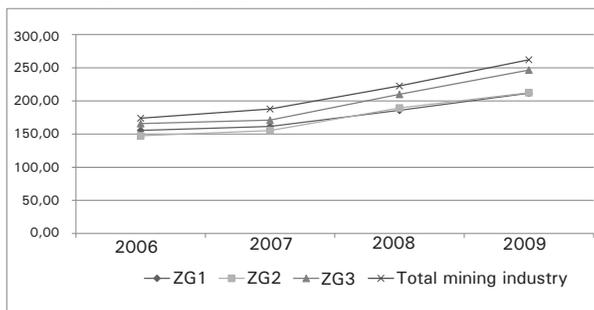
The assessment and analysis of production costs in researched mining enterprises began from the determination of variation in time of production unit costs (Sawicki 2000, p. 62). The results of this research stage are presented in the table 1 and illustrated with the figure 1, which additionally presents the level of unit production costs in hard coal mining in the analyzed period.

Table 1. Unit production costs in researched mining enterprises in the years 2006–2009 (zł/t, %)

Enterprise	Description	2006	2007	2008	2009
ZG1	Unit production costs	155,62	161,64	185,89	211,67
	Change in comparison to the previous year	-9,78%	1,36%	10,42%	9,99%
ZG2	Unit production costs	147,57	155,46	189,51	212,50
	Change in comparison to the previous year	5,80%	2,80%	17,04%	8,31%
ZG3	Unit production costs	165,89	171,02	209,98	246,64
	Change in comparison to the previous year	19,37%	3,09%	22,78%	17,46%
Total mining industry	Unit production costs	174,00	187,93	222,62	262,23
	Change in comparison to the previous year	3,26%	8,01%	18,46%	17,79%

Source: Own study based on source documents of the researched mining enterprises and the data of the Ministry of Economy.

Figure 1. The level of unit mining costs in the researched mines in the years 2006-2009 in comparison to the mining industry in general (zł/t)



Source: own study.

According to the data in the table 1 and the chart 1 the unit production cost in all examined enterprises and in mining industry in general was systematically rising (Nowak 2006, p. 10). An intensive increase in unit costs was noted in 2008 and 2009. In 2008 there was a significant rise in salaries in hard coal mining industry because of the trade unions pressure. A change in such an important part of generic costs, characterized by a 90-percent share of fixed costs heavily influenced the rise of unit production cost. Furthermore, in the researched period the mining production in Polish hard coal mining industry was systematically decreasing. The decrease in production was caused mainly by problems on the market for this resource. The production volume and its changes are presented in the table 2.

Table 2. Hard coal mining production and Polish mining industry in the years 2005–2009

Years	2005	2006	2007	2008	2009
Production (t)	103 463 919,06	100 866 218,39	93 000 776,89	88 338 702,72	76 249 273,54
Variation (%)	–	-2.51%	-7.80%	-5.01%	-13.69%

Source: own study based on the data from the Ministry of Economy.

Such large reduction of production with a very high share of fixed costs in overall costs caused harmful changes in the level of unit production cost. A significant increase in the level of inflation in the last two years of analysis also influenced harmfully the level of unit production costs in current prices.

It is worth adding that according to the data in the table 1 during the whole analyzed period the unit production costs were definitely lower in the researched mines than in hard coal mining in general. The lowest unit production cost characterized the ZG1 and ZG2 enterprises. The highest among researched enterpris-

es (but not exceeding the mining industry average) was noted in ZG3 enterprise. Therefore, it may be stated that in the structures of researched coal corporations there are mining enterprises in which there are real chances of improving the performance efficiency.

The statement above is strengthened by the analysis and assessment of the rate of unit cost changes. The tendencies in the area of changes of unit costs in all researched mining enterprise were correspondent with the directions of costs transformation in the hard coal mining in general. These costs increased with time. In the table 3, the average yearly rate of cost changes in the analyzed period in researched mines and hard coal mining industry in general were presented.

Table 3. Average yearly rate of unit production costs changes in the examined enterprises and hard coal mining industry in general (%)

Enterprise	Average yearly rate of changes
ZG1	3.00%
ZG2	8.49%
ZG3	15.67%
Total mining industry	11.88%

Source: own study based on source documents of the researched mining enterprises and the data of the Ministry of Economy.

According to the data in the table 3 the rate of unit costs increase in ZG1 and ZG2 is definitely lower than in the hard coal mining industry in general. Only in ZG3 enterprise the unit costs were increasing more quickly than in the whole hard coal mining industry while it has to be emphasized that the output level of these costs was definitely lower than that of the industry and in the year 2009 the costs of this mine were still about 6 % lower than the average for hard coal mining industry.

In the next stage of the research the structure of mining costs was analyzed in order to identify the role of particular components in forming the level of unit production cost (Messner 2006, p. 495). In the generic approach amortization, outer service, salaries, social security, other employee benefits, taxes and charges, and other generic costs were distinguished. The results including the presentation of the aforementioned costs in the general approach calculated per tons of production and as a share in the structure for particular enterprises are presented in the tables 4–6 and for hard coal mining in general in the table 4.

Table 4. Total production costs in ZG1 in the years 2006–2009 (total value in thousands zlotys, value per ton of production in zł/t, the share in structure in %)

Years	2006			2007			2008			2009		
	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share
Amortization	62 611,3	17,89	11,5	63 301,9	18,42	11,4	46 843,3	16,27	8,8	52 611,9	18,72	8,8
Materials and energy use	127 892,60	36,56	23,50	132 917,00	38,67	23,90	122 042,70	42,39	22,80	132 919,80	47,30	22,30
Outer service	159 262,8	45,52	29,2	163 668,0	47,62	29,5	148 550,0	51,59	27,8	166 804,0	59,35	28,0
Salaries payable	122 124,2	34,90	22,4	132 592,6	38,57	23,9	154 949,1	53,81	28,9	172 525,1	61,39	29,0
Social insurance and other provisions	52 140,30	14,90	9,60	45 486,20	13,23	8,20	41 801,00	14,51	7,80	47 464,30	16,89	8,00
Taxes and fees payable	14 597,9	4,17	2,7	15 448,7	4,50	2,8	12 255,0	4,26	2,3	12 840,8	4,57	2,2
Other generic costs	5 867,60	1,67	1,00	2 212,00	0,64	0,40	8 799,50	3,06	1,60	9 720,40	3,45	1,60
Total	544 496,7	155,62	100,0	555 626,4	161,64	100,0	535 240,6	185,89	100,0	594 886,3	211,67	100,0
Chain dynamics ratios	1,00	1,00	-	1,02	1,04	-	0,96	1,15	-	1,11	1,14	-

Source: own study based on source documents of the researched mining enterprises.

Table 5. Total production costs in ZG2 in the years 2006–2009 (total value in thousands zlotys, value per ton of production in z/t, the share in structure in %)

Years	2006			2007			2008			2009		
	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share
Amortization	25 597,9	10,35	7,0	31 103,9	12,60	8,1	44 311,1	17,72	9,4	41 753,9	17,18	8,1
Materials and energy use	52 663,90	21,30	14,40	55 677,90	22,55	14,50	64 297,70	25,71	13,50	67 253,50	27,66	13,00
Outer service	61 347,3	24,80	16,8	62 880,0	25,46	16,4	97 359,6	38,94	20,5	106 672,4	43,88	20,7
Salaries payable	158 833,1	64,24	43,5	163 941,3	66,39	42,7	188 678,2	75,46	39,8	214 151,0	88,10	41,5
Social insurance and other provisions	49 901,00	20,19	13,70	49 025,30	19,85	12,70	52 418,20	20,96	11,10	60 172,20	24,75	11,60
Taxes and fees payable	13 158,3	5,31	3,6	12 708,4	5,15	3,3	12 939,9	5,18	2,7	14 673,4	6,04	2,8
Other generic costs	3 356,4	1,36	0,9	8 566,1	3,47	2,2	13 835,9	5,53	2,9	11 881,4	4,89	2,3
Total	364 857,9	147,57	100,0	383 902,9	155,46	100,0	473 840,6	189,51	100,0	516 557,8	212,50	100,0
Chain dynamics ratios	1,00	1,00	-	1,05	1,05	-	1,23	1,22	-	1,09	1,12	-

Source: own study based on source documents of the researched mining enterprises.

Table 6. Total production costs in ZG3 in the years 2006–2009 (total value in thousands zlotys, value per ton of production in zł/t, the share in structure in %)

Years	2006			2007			2008			2009		
	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share
Amortization	33 929,14	11,26	6,81	35 912,31	12,56	7,36	31 275,40	14,24	6,90	57 484,49	26,67	10,78
Materials and energy use	105 099,26	34,85	21,05	113 220,34	38,65	22,46	97 696,00	44,49	21,50	98 844,23	45,99	18,55
Outer service	77 421,69	25,83	15,56	84 480,27	29,24	17,06	76 907,30	35,38	16,90	90 028,81	41,76	16,91
Salaries payable	192 144,49	65,02	39,09	192 533,14	68,15	40,00	186 506,50	86,93	40,90	201 691,65	93,49	37,83
Social insurance and other provisions	52 475,74	17,68	10,65	54 239,88	19,15	11,24	49 541,70	22,56	10,90	54 608,07	25,16	10,22
Taxes and fees payable	13 481,39	4,53	2,74	12 943,77	4,56	2,68	10 570,50	4,81	2,30	13 519,33	6,12	2,53
Other generic costs	22 308,69	6,73	4,09	-4532,30	-1,30	-0,74	3437,30	1,57	0,80	16 848,37	7,43	3,08
Total	496 860,4	165,9	100	488 797,41	171,01	100	455 934,7	209,98	100	533 025,0	246,62	100
Chain dynamics ratios	1,00	1,00	-	0,98	1,03	-	0,93	1,23	-	1,17	1,17	-

Source: own study based on source documents of the researched mining enterprises.

Table 7. Total production costs in hard coal mining altogether in the years 2006–2009 (total value in thousands zlotys, value per ton of production in zł/t, the share in structure in %)

Years	2007			2008			2009		
	total value	value per ton	share	total value	value per ton	share	total value	value per ton	share
Amortization	1 509 408	14,96	8,60	1 488 080	16,00	8,51	1 713 200	22,47	8,57
Materials and energy use	3 485 513	34,56	19,86	3 445 073	37,05	19,72	3 880 070	50,89	19,41
Outer service	3 247 624	32,20	18,50	3 145 190	33,82	18,00	3 525 505	46,23	17,63
Salaries payable	6 559 435	65,03	37,37	6 737 437	72,44	38,55	7 875 906	103,29	39,39
Social insurance and other provisions	1 922 508	19,06	10,95	1 893 523	20,36	10,83	2 082 990	27,93	10,65
Taxes and fees payable	494 117	4,90	2,82	489 895	5,27	2,80	503 568	6,95	2,65
Other generic costs	332 117	3,29	1,89	278 438	2,99	1,59	218 093	4,47	1,70
Total	17 550 722	174,00	100	17 477 636	187,93	100	19 665 962	262,23	100
Chain dynamics ratios	1,01	1,03	-	0,99	1,08	-	1,13	1,18	-

Source: own study based on the data of the Ministry of Economy.

When analyzing the data presented in the tables above it is possible to state that the biggest cost expenses were salaries payable, materials and energy use and outer services in the examined mining enterprises (Turek, Skrzyński, Smoliński 2008, p. 597–604). The share in the structure of these costs was differentiated:

- salaries constitute from 29% in ZG1 to over 40% in ZG2 whilst mining industry average equals 39,39%,
- materials and energy use amounts from 13,0% in ZG2 to 22,3% of total costs in ZG1 (industry average is 19,41%),
- outer service constitute from 16,91% in ZG3 to 28% of total costs in ZG1 whilst mining industry average equals 17,63%.

In the analyzed combination a specific position appears to be for ZG1 enterprise which at the same time is characteristic for the lowest salaries share in total costs and the biggest share of materials and energy use and outer services. It is also worth noting that the presented structure of generic costs in the whole examined period is relatively stable and the changes among separate positions do not exceed 3%.

In order to complete the costs analysis in examined enterprises of Upper-Silesia Coal Basin (GZW) there is a costs structure presented in the table 8 including the classification of fixed and floating costs (Wnuk 2002, p. 25).

Table 8. Fixed and floating costs in the examined hard coal mining enterprises and in total hard coal mining industry in the years 2006–2009, (in %)

Enterprise	2006		2007		2008		2009	
	fixed	floating	fixed	floating	fixed	floating	fixed	floating
ZG1	48,73	51,27	48,15	51,85	50,44	49,56	50,53	49,47
ZG2	65,02	34,98	65,71	34,29	62,96	37,04	63,00	37,00
ZG3	62,41	37,59	59,10	40,90	57,75	42,25	59,51	40,49
Total mining industry	59,72	40,28	60,50	29,50	61,02	38,98	61,62	28,28

Source: own study.

According to the data included in the table 8 in the whole examined period ZG2, ZG3 and total hard coal mining industry were dominated by fixed costs which constituted over 60% of total costs. In ZG1, the share of these costs in the total structure was also high; however, it did not have a dominant feature. Such a high rank of high costs stiffens the costs structure in hard coal mining and moreover, it results from a very high level of workforce costs. Consequently, it hinders undertaking activities regarding the area of costs management oriented at performance efficiency improvement.

In the last stage of research there were changes in separate generic costs positions determined in the examined coal enterprises in the years 2006–2009. The result of this stage is enclosed in the table 9.

Table 9. The dynamics of generic costs in ZG1-ZG3 and total hard coal mining industry in the years 2006–2009

Years	ZG1	ZG2	ZG3	TM
Amortization				
2007/2006	1,01	1,22	1,06	0,99
2008/2007	0,74	1,42	1,14	1,17
2009/2008	1,12	0,94	1,54	0,99
Materials and energy use				
2007/2006	1,04	1,06	1,08	1,01
2008/2007	0,92	1,15	0,88	1,09
2009/2008	1,09	1,05	1,23	1,03
Outer services				
2007/2006	1,03	1,02	1,09	0,97
2008/2007	0,91	1,55	1,19	1,13
2009/2008	1,12	1,10	1,09	0,99
Salaries				
2007/2006	1,09	1,03	1,00	1,03
2008/2007	1,17	1,15	0,97	1,16
2009/2008	1,11	1,14	1,08	1,01
Social insurance				
2007/2006	0,87	0,98	1,03	0,99
2008/2007	0,92	1,07	0,91	1,10
2009/2008	1,14	1,15	1,10	1,02
Taxes and fees				
2007/2006	1,06	0,97	0,96	0,99
2008/2007	0,79	1,02	0,82	1,03
2009/2008	1,05	1,13	1,28	1,05

Source: own study.

In the examined period costs of amortization were changing in selected enterprises in a very varied way. A significant increase of these costs occurred in 2008 in enterprise ZG2 and in 2009 in enterprise ZG3. The costs of materials and energy use decreased only in ZG1 in 2008 and in ZG3 in 2009. It was caused by the extraction diminishment and the numbers of meters decrease in the scope of working passages. In the remaining periods they were rising in all examined enterprises and in the whole hard coal mining industry. It resulted from the elec-

tricity price rise and higher expenditures on walls reinforcement as well as on orogeny gluing and bracing in walls under exploitation (the increase of steel and smelting materials prices).

The outer services costs were considerably rising too, and besides 2008, they were going up from 3 to 55% in ZG1. The main reasons for outer services costs increase in this period appear to be mainly the expenditures rise on drilling-mining works in accordance with the expansion of their scope and railway transport costs increase. The escalation of this position was also affected by the increase of obligatory measurements services price, devices legalization and certificates, property security services, geodesic, cartographic and geological services, inventories storing services.

The level of salaries costs was systematically growing as well. In the years 2007–2008 it was possible to stop the increase of social insurance costs. A similar tendency was observed in taxes and fees costs. The primary causes of this increase are the rise of property tax rates and environment protection fees.

Summing up the results of conducted analysis and costs assessment in the examined enterprises of GZW in the years 2006–2009, unit production costs were changing in accordance with a tendency specific for the whole hard coal mining industry in Poland. However, the exemplary mining enterprises currently constitute an integral part of coal corporations using uniform prices policy and coherent management system. The reasons for unit production cost increase in these enterprises were above all:

- salaries rise in 2008,
- considerable production diminishment and hard coal sale,
- high share of fixed costs in unit production cost,
- inflation increase, especially in the years 2008–2009.

Nevertheless, the above-mentioned circumstances are not the individual conditions of examined mining enterprises. They stem from external factors – independent from analyzed enterprises. When assuming their elimination or impact decrease then the unit production costs would certainly be possible to decrease. The following individual determinants of examined mining enterprises in favor of the possibilities extension in this matter are:

- significantly lower level of unit production costs than in the total hard coal mining industry in the researched period,
- lower pace of unit production cost increase in the whole researched period,
- decreasing share of fixed costs in majority of the examined enterprises,
- considerable surplus of unused production capabilities,
- low level of natural and technical threats,
- the best infrastructural equipment in GZW enterprises,
- very good parameters of deposits possessed.

Considering the above, in case of unfavorable impact of general-economy determinants limitation (salaries rise, demand decrease) and using individual

production, infrastructural and economic potential it would be possible to increase production efficiency substantially in the examined hard coal enterprises. The range of possibilities in the matter are presented in the next part of this study.

The possibilities of efficiency improvement of mining enterprises in the context of swot analysis

The possibilities of improving efficiency in Polish mining enterprises were considered in the context of SWOT analysis. In the first part of sources identification for efficiency growth the analysis was related to the strengths and weaknesses of examined mining enterprises that individually constitute efficiency determinants. Next, the perspectives of efficiency increase were researched considering external opportunities and threats generated by closer and further environment of examined mining enterprises.

Among current pro-effective internal determinants of examined mining enterprises there are certainly to be indicated: the low level and increase pace of unit production costs in comparison to the Polish hard coal mining industry. Such determinants, connected with potential negotiations with trade unions in order to stop the pace of salaries rise and creation of motivating system dependent on the work effects, may become vital sources of efficiency increase in Polish hard coal mining (Włodarz 2007, p. 200 and Sierpińska, Niedbała 2003, p. 123). In the strategic perspective, as a consequence of financial results improvement, it may be also possible to increase funds for developmental investments (Sierpińska, Kustra 2005, pp. 105–115).

Another strength of examined mining enterprises also are big deposits of energetic coal of high quality parameters and workers experience and qualifications. A low level of natural and technical threats is also important as in the hard coal mining a significant impact is put on achieved financial results. The important internal determinant affecting performance efficiency is also relatively modern infrastructure of examined enterprises. Additional potential factor determining efficiency improvement may be management rationalization of energetic resources thanks to controlling introduction as well as the system of managing energy from various sources. The advantage of mining enterprises hereby presented also becomes a high potential of basic production cells and extended offer of products enabling sale diversification.

In the future, the above-mentioned internal strengths may be reinforced in the production area due to:

- simplification of enterprises model regarding, among others, numbers of mine pitheads and levels decrease and total lengths decrease of working passages,
- modification of motivating system directed at its connection with economic effects (Jonek-Kowalska 2009, pp. 171–178),

- extension of services passed to external companies and obtaining benefits from outsourcing,
- introducing new solutions regarding logistics and transport allowing to achieve effects of scale,
- finding methods of long-term exploitation planning (Magda, Woźny, Głodzik, Jasiewicz 2007, pp. 34–37),
- implementing modern methods of cost management (Sierpińska, Kustra 2006, pp. 229–239).

In relation to the above, in Polish hard coal mining in chosen mining enterprises many external determinants that favor efficiency improvement may be found. Nevertheless, there are many weaknesses to be identified on the basis of conducted analysis and production costs evaluation. Economic conditions should be considered as the most important. Total costs are dominated by fixed costs that hinder flexible cost management. The biggest share of salaries costs in total costs structure combined with a strong position of trade unions limit the possibilities of implementing pro-effective motivating system. The rising level of production costs in time and a visible salaries rise deteriorate performance efficiency of mining enterprises. This on the other hand, unfavorably affects development chances of mining as it limits own internal sources of investment funding. However, obtaining external sources is burdened with high financial costs.

In the examined mining enterprises the additional obstruction becomes subordinated to integrated policy of mining corporation because in its frames earnings and losses of single mining enterprises are compensated. As a consequence, profitable enterprises provide for the ones which bear a loss. The following among the least important weaknesses should be indicated:

- deterioration of geological-mining conditions and increase of natural threats,
- undertaking production having a negative influence on environment (Famielec, Stepień 2005, p. 43; Szczypta 2006, pp. 331–337),
- exploitation of some deposits under urbanized areas,
- necessity of fixing mining damages.

The activity efficiency of mining enterprises is also strongly affected by external determinants considered in the context of opportunities and threats. The market of hard coal is international and therefore the industry is prone to changes taking place on global markets of energetic resources.

Currently, the biggest threat to existence and financial results in mining are restrictions regarding carbon dioxide emission that limit the significance of hard coal in satisfying energetic needs of the country. As a result of implemented limits the role of alternative, competitive in comparison to coal, energy sources is growing (Malko, Wojciechowski 2007, pp. 13–17). External obstructions also include the deficiency in railway transport and transport costs rise which increase the costs of hard coal purchase. The dependence of extraction performance pos-

sibilities on the projects of spatial use and the prospect of imposing duty on hard and coking coal become the additional potential threats to mining enterprises efficiency.

The barriers identified above may be reduced by opportunities that also lie in external environment. Among them the following are worth mentioning: a gradual development of pure coal technologies and holding the position of hard coal as the strategic source in country energy balance which allows to continue extraction and sales optimization (Turek 2007, pp. 27–42). However, technology progress is not less important enabling the extraction concentration increase and efficiency improvement (Turek 2008, pp. 10–15). Other important external determinants are: the development of industrial waste usage, new technologies of work safety and environment protection, and innovative activities regarding methane use (Turek 2007, pp. 45–58).

Conclusion

In relation to the research problem presented in the introduction of this article it should be stated that on the basis of the mining costs analysis and evaluation it is possible to identify actions partially oriented at improving the efficiency of Polish mining enterprises. This evaluation enables indicating critical cost areas needing adjustment of proper management tools. In Polish enterprises these areas are salaries and outer services. The costs analysis and assessment may be therefore used in the process of determining internal strengths and weaknesses of mining enterprises in the area of efficiency. However, using it does not enable the identification of opportunities and threats to performance efficiency existing in the environment of the researched industry. This identification requires an individual analysis of particular segments in the environment. Thus, an argument stated in the introduction claiming that the analysis and evaluation of mining costs combined with monitoring of the industry and general-economic environment allows to determine actions oriented at improving efficiency in mining enterprises is true.

According to these considerations there are many harmful internal conditions influencing in a negative way the real and potential activity efficiency levels in Polish hard coal mining industry. They stem mainly from the unfavorable cost structure dominated by salaries and fixed costs. The increase of production costs and decreasing level of production and sale are also distressing. However, this does not mean that the fate of mining enterprises is sealed. There are many individual advantages characterizing particular mining enterprises.

The enterprises presented in this article represent three different coal corporations and are characterized by the lower than average in mining industry production costs. Therefore, they are the evidence that hard coal production may be

effective when using the potential of individual powers existing inside the best mining enterprises. These strengths enabled by specific conditions determined in the article and existent in the external environment constitute the basis of a permanent improvement of mining enterprises efficiency.

As a summary in the figure 1 the prioritizing of chances and threats as well as strengths and weaknesses of Polish mining enterprises is presented.

Figure 2. The prioritizing of chances and threats as well as strengths and weaknesses of Polish mining enterprises is presented

STRENGTHS	WEAKNESSES
Existence of mining enterprises with beneficial internal conditions enabling achieving higher than average mining efficiency Possibility to create a pro-effective salary system Realization of development investment thanks to efficiency improvement and strengthening own internal sources of funding	High share of workforce costs in general cost structure High share of fixed costs in total costs Lack of sources of funding development investments
OPPORTUNITIES	THREATS
Maintaining the position of hard coal as the strategic resource in country energy balance Development of pure coal technologies Technical development in mining and related industries	Restrictions concerning carbon dioxide emission Vulnerability to changes on the world resources market Increase of importance of alternative sources of energy

Source: own study.

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