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SOCIAL ATTITUDES TOWARDS PLANNED LIGNITE MINING – THE CASE OF SOUTH-WESTERN WIELKOPOLSKA REGION

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ABSTRACT: Lignite is a raw material considered a strategic fuel in the Polish energy sector. One of the prognostic lignite deposits is located in the south-western Wielkopolska (Krobia, Miejska Górka and Poniec communes). However, the perspective of exploitation causes concern to the local community. In this context, the paper aimed to identify the attitudes towards lignite mining in this area. In the research procedure aimed at statistical verification of factors differentiating these attitudes, a survey was conducted. The results of the study showed that the inhabitants of the analysed communes had indecisive attitudes, yet with a very clear tendency towards negative assessments of the subject issue. Farmers and rural residents were the most sceptical, while entrepreneurs, town dwellers and young people had the most conciliatory attitudes. Moreover, it has been proved that professional status, place of residence (town-village) and age can be considered as factors affecting these attitudes.

KEYWORDS: social attitudes, lignite, deposit exploitation, Wielkopolska

Introduction

Lignite opencast mining is an example of an investment that significantly interferes with the environment, transforming the landscape and changing the structure of the local economy. Poland, acquiring lignite in Konin, Turoszowskie and Bełchatów coalfields, is one of the world leaders in the exploitation of this raw material (following Germany, China, USA, Russia, Australia, Greece and Turkey). One of the prospective deposits, which, due to its parameters, boasts balance characteristics, is located in the south-western part of Wielkopolska region, in the communes of Krobia, Poniec and Miejska Górka. Due to the favourable environmental and economic conditions, as much as 85% of their area is used for agriculture. Therefore, the deposit is characterised by a high level of potential exploitation conflict in relation to the environment and a lack of social acceptance (Kasiński, Mazurek, and Piwocki, 2006). Despite this fact, these areas were classified as prognostic lignite deposits. In the analysed communes, lignite resources are estimated at approx. one billion tons. Therefore, it is potentially one of the richest lignite deposits in Poland (Wielkopolskie Biuro Planowania Przestrzennego, 2015).

The aim of this article is to identify the attitudes of the local communities of the three analysed communes towards lignite mining. The research material was obtained through a survey of the inhabitants of Krobia, Miejska Górka and Poniec communes. The research was conducted at the turn of 2018 and 2019. The obtained data were subjected to statistical analysis, which included, on the one hand, the proprietary method of quantifying respondents' attitudes based on synthetic indicators, and, on the other hand, a one-way analysis of variance to verify the factors influencing the identified attitudes.

The article begins with a review of the existing body of literature concerning the attitudes of residents towards investments negatively affecting the environment and living conditions, with particular emphasis on mining activities in rural areas. The empirical part encompasses the description of the spatial scope of the research, survey construction, and the sample. The description of the research results includes an analysis of the factors shaping the attitudes of the local community towards lignite mining.

Literature review

The issues of shaping and changing the attitudes of the local community in rural areas and the ones related to lignite mining may be analysed in various dimensions. In the Polish and international literature on the subject,

changes in rural areas related to mining activities, or more broadly industrial activities, are described, among others by Walkiewicz (2013). He emphasises the landscape aspects, forms of land use and development, impact on the natural environment or the structure of the local economy (see also Jawecki and Jawecka, 2011). In the international literature, the health impact of the mining industry is often raised (Hendryx, 2009; Hendryx et al., 2012; Boyles et al., 2017; Ishitiaq et al., 2018; Werner et al., 2018; von der Goltz and Barnwal, 2019) as well as the landscape changes (Hendrychova and Kabrna, 2016; Popelkova and Mulkova, 2018; Fagiewicz and Łowicki, 2019) and environmental pressure (Caballero Espejo et al., 2018; Nendel et al., 2018; Čech and Krokusová, 2017). Some researchers focus on the issues of further use and management of degraded areas (Sawicki and Łyszczarz, 2009; Kwiatkowska-Malina and Wyszomierska, 2014; Mańkowski et al., 2013; Rachwał et al., 2009). Research on the attitudes of rural residents is not so extensive. Perepeczko (2012) draws attention to the lack of broader research on the attitudes of residents concerning the natural environment, pointing to studies focused on partial and exiguous publications. An interesting study was presented by Bader (2010), identifying approximately 40 examples of socio-environmental conflicts related to the development of domestic mineral deposits in the period of 2004-2009. He also indicated that the key motivators for the attitudes of the local community are the fear of losing the possibility of satisfying needs with the use of specific elements of the environment, as well as the fear of deteriorating quality of life. Other researchers (e.g., Majewski, Fiszka Borzyszkowska and Florek (2018) or Kwiatkowska-Malina and Wyszomierska (2014)), focus on the ecological and economic dimension of social and environmental conflicts, which affect the shape of development policy created by the local authorities, as well as on the attitudes of the local community and people visiting the municipality, e.g. for tourist purposes. Nieć and Radwanek-Bąk (2009) argue that strong opposition from the local government authorities, local nature conservation activists or local lobbying, not always reasonably justified, may constitute a significant obstacle to the investment process.

The main issues related to mining that cause concerns of the local community in the areas previously used for agricultural purposes include: transformation of the landscape and topography, change of lithological, hydrological and soil conditions, which may limit the values of biodiversity and geodiversity (Sawicki and Łyszczarz, 2009; Sobczyk, Kowalska and Sobczyk, 2014; Uberman, Pietrzyk-Sokulska and Kulczycka, 2014; Majewski, Fiszka Borzyszkowska and Florek, 2018; Kucharska, 2018; Przybyszewski and Kruszyńska, 2019; Schackelton, 2020; Ofosu et al., 2020).

Temporary nuisances related to the emission of noise, vibrations, dust or road destruction or the occurrence of threats in the form of tremors, sinkholes, landslides are also addressed (Badera, 2010; Sobczyk, 2007; Jawecki and Jawecka, 2011). At the same time, activity in this area constitutes a significant source of the commune's income and the income of individual residents (lease or sale of land), it may influence the creation of jobs in emerging enterprises or modify the commune's economic profile. Moreover, it is worth mentioning that the effects of possible or existing exploitation of raw materials, not necessarily within rural areas, were the subject of analyses as early as in the 1980s when Kozłowski (1989) classified the deposits in terms of the negative effects of their exploitation. He divided the deposits into three classes: A – low-conflict deposits – can be mined without major problems, located outside the protected areas, away from residential estates, B – conflict deposits – can be mined after meeting specific environmental protection requirements, C – highly conflicting – impossible to exploit due to environmental hazards or the land use of the deposit itself or its surroundings. Currently, in addition to the protection of mineral resources, the environment, economic priorities and goals, and spatial development regulations, the social factor gained attention for determining the current or future exploitation of minerals (Nieć and Radwanek-Bąk, 2014; Sikorska-Maykowska, Walentek and Andrzejewska-Kubrak, 2017).

Resolving conflicts regarding the use of space, including the problem of social resistance to mining activities expressed in the NIMBA syndrome (characteristic of local communities), less often in the BANANA syndrome (typical for supra-local ecological organisations), are the main issues that should be addressed (NIMBY – Not In My Backyard, BANANA – Build Absolutely Nothing Anywhere Near Anything). Radwanek-Bąk (2010) even emphasises that mitigating conflicts and counteracting the syndromes mentioned above are indispensable conditions for the sustainable management of mineral resources. The tools mentioned as possible to use for this purpose are information campaigns, clarifying disputable issues, public consultations or broadly understood ecological education (Naworyta, 2010; Frączek, 2011). Both the purposefulness of taking these actions and their potential effectiveness must be analysed each time concerning individual social and spatial conditions. They should be preceded using social research tools to determine the state of knowledge and attitudes of the local community.

Lignite deposits of south-western Wielopolska

The Poniec-Krobia-Miejska Górka deposit was documented during geological works conducted at the turn of the 1960s and 1970s (Piwocki, 1979). The total area of the deposit is 106.2 sq. km, of which approximately 100 sq. km are the so-called balance resources. The Krobia-Poniec-Miejska Górka deposit is a multi-decay deposit consisting of five layers. The technological and chemical properties of lignite that characterise the deposit classify the raw material into the groups of energy coals. In the analysed communes, lignite deposits lie at a depth of 115-160 m, and their size is estimated at approximately one billion tons, which shows that it is potentially one of the richest lignite deposits in Poland. Therefore, the deposit located in south-western Wielkopolska has been classified as the so-called prognostic deposit.

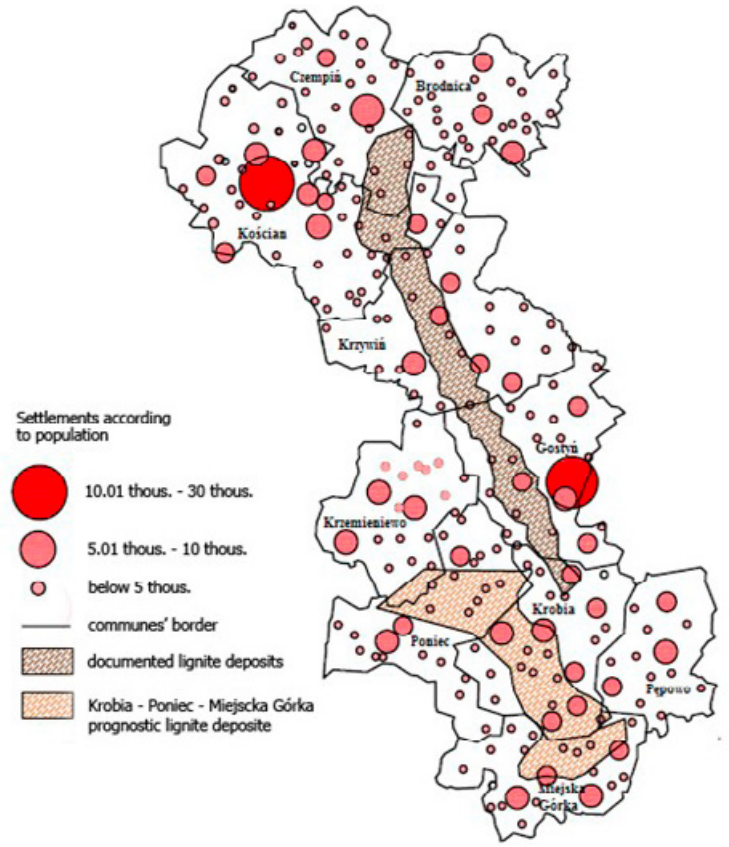

Figure 1. Documented and prognostic lignite deposits in Wielkopolska region

Source: author's work based on the report published by the Wielkopolska Spatial Planning Office (Wielkopolskie Biuro Planowania Przestrzennego, 2015).

These areas are adjacent to the documented deposits of lignite within the so-called Poznań Trench (a coal-bearing region about 130 km long, stretching from Czarnków and Szamotuły to Gostyń and Krobia) (figure 1).

In Wielkopolska region, the opencast mining plans that assumed converting thousands of hectares of first-class agricultural land in an area inhabited by over 150,000 people, with predominant employment in agriculture, faced mass protests not only from residents but also from entrepreneurs. Geologists estimated that a depression crater would cause groundwater to fall within a distance of 20-30 kilometres. This is more than in the case of the open pit in Bełchatów (the depression crater there was as long as 20 kilometres). There are 22 settlements in the Krobia-Poniec-Miejska Górka deposit (figure 2), which would be closed as a result of lignite mining (Sutowski, 2015).

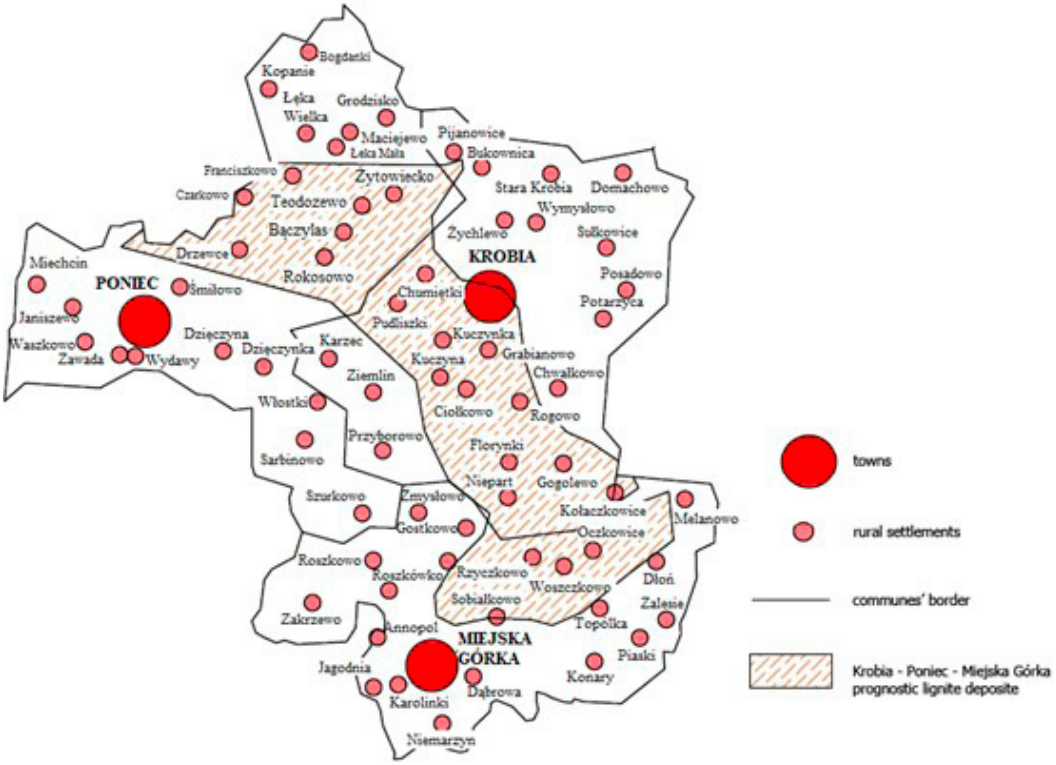

Figure 2. The prognostic lignite deposite in the Krobia, Poniec and Miejska Górka communes

Source: author's work based on the report published by the Wielkopolska Spatial Planning Office (Wielkopolskie Biuro Planowania Przestrzennego, 2015).

Local communities' attitudes towards lignite mining

The structure of the study and research sample

Public opinion research on the potential lignite mining was carried out with the use of a diagnostic survey method. The purpose of this method is to acquire knowledge about social phenomena as well as opinions and views of a specific community (Łobocki, 1984). In the survey, a paper questionnaire (PAPI technique) was used. The survey was conducted among the inhabitants of Krobia, Poniec and Miejska Górka communes, both in towns and in rural areas. The questionnaires were handed out to the respondents in person in two rounds – between December 2016 and February 2017 (285 questionnaires) and in the period from October 2018 to January 2019 (265 questionnaires).

In total, out of 550 distributed forms, 442 complete questionnaires were included in the final study. Most respondents lived in Krobia commune (43%), Miejska Górka (31%), and Poniec (27%). The population of the surveyed sample was dominated by inhabitants of rural areas (65%), women (52%), and people aged 31-50 (48%), which resulted from the dominant share of these demographic groups in the population of the three surveyed communes. More than one-third of the surveyed people are full-time employees (38%). Farmers were also well represented (27%). The share of retirees and disability pensioners among the respondents reached 10.5%. Entrepreneurs, students, and unemployed accounted for the smallest groups (8% each). The reason for such a high share of middle-aged adults, farmers and employees may be the fact that it is these people who are most familiar with the subject of the research problem, they appreciated the importance of researching the problem and therefore were more willing to answer.

The comparison of the structure of the studied sample with the structure of the population of the examined communes shows many similarities (table 1). The sample used in the study mirrors the population directly in terms of the inhabited commune, sex and place of residence understood as a town or rural area. More profound differences were identified in the case of the age structure due to the lack of control over the survey questionnaires – they were delivered to random households. Moreover, children and adolescents were excluded from the study, as evidenced by the below-proportional share of people from the youngest age group (in relation to the share of this group in the population). Nevertheless, it can be concluded that the structure of the surveyed inhabitants corresponded to the structure of the entire population in communes.

Table 1. The structure of the research sample vs population of the communes under analysis

Category and specification	Research sample		Population	
	number	%	number	%
Commune:				
Krobia	189	42.8	13 086	43.2
Miejska Górka	135	30.6	9 389	31.0
Poniec	118	26.7	7 849	25.9
Sex:				
Women	227	51.4	15 288	50.4
Men	215	48.6	15 036	49.6
Place of residence:				
Town	154	34.8	10 390	34.3
Rural area	288	65.2	19 934	65.7
Age:				
up to 30 years old	122	27.6	11 483	34.9
31-50 years old	214	48.4	8 730	26.5
over 50 years old	106	24.0	12 687	38.6

Source: author's work.

Research procedure

The survey results were subjected to statistical analysis, the aim of which was to quantify the attitudes of the local community towards the potential exploitation of lignite and to identify the factors shaping (differentiating) these attitudes. The research procedure resulted from the structural definition of attitude, according to which its final shape consists of 1) cognitive (knowledge, beliefs), 2) emotional-evaluating (emotions, evaluations), and 3) behavioural (action program) components (Brzeziński, 1980). Therefore, the identification of the attitudes of the local community towards the analysed phenomenon required, first of all, the selection of a set of questions relating to the above-mentioned components of the attitude, the calculation of a synthetic indicator, which is the resultant of the expressed beliefs, assessments and preferences, and finally the use of statistical tests checking whether a given factor influences the attitudes declared.

When analysing the attitudes of the local community, a set of questions was used based on the Likert attitude scale (see table 2). Through the content

of the questions, the respondents were expected to declare their opinions on the plans for the exploitation of lignite deposits in the municipalities of Krobia, Poniec and Miejska Górka. The respondents expressed their views on a five-point estimation scale, in which the variants of answers were evenly distributed along the continuum of attitudes, from extremely favourable to extremely negative (see Brzeziński, 1980; Mayntz, Holm and Hubner, 1985). The answers to individual questions were assigned points according to the set of assumptions. Five possible variants of the answer could be chosen in integers in the range [-2; +2]. Positive values were assigned to the categories of responses expressing an enthusiastic (positive) attitude, zero – to the category adequate to the passive (neutral/undecided) attitude, while negative values were assigned for responses showing a negative attitude towards the analysed issue.

Table 2. Set of questions and response evaluation scales applied in testing the respondents' attitudes

1. Do you agree with the statement that the communes where lignite mining is carried out are among the richest in Poland?				
strongly agree (+2)	agree (+1)	neutral (0)	disagree (-1)	strongly disagree (-2)
2. Do you agree with the statement that only public institutions and private companies benefit from lignite mining, not residents?				
strongly disagree (+2)	diagree (+1)	neutral (0)	agree (-1)	strongly agree (-2)
3. Do you agree with the statement that lignite contributes to a reduction in unemployment?				
strongly agree (+2)	agree (+1)	neutral (0)	disagree (-1)	strongly disagree (-2)
4. Do you agree with the statement that the economic benefits of lignite mining outweigh the environmental losses?				
strongly agree (+2)	agree (+1)	neutral (0)	disagree (-1)	strongly disagree (-2)
5. Would you consider changing your place of residence and moving to another commune/town due to lignite mining?				
strongly agree (+2)	agree (+1)	neutral (0)	disagree (-1)	strongly disagree (-2)
6. Would you consider changing your professional status or job (e.g., taking up a job in the mine or its offices) due to the planned mining investment in your neighbourhood?				
strongly agree (+2)	agree (+1)	neutral (0)	disagree (-1)	strongly disagree (-2)

Source: author's work.

In the next step of the research procedure, the respondents were divided into complementary groups, adopting the following socio-demographic division criteria:

- gender (female, male),
- age (up to 30 years old, 31-50 years old, over 50 years old),
- education (primary or no education, basic vocational, secondary, higher),
- professional status (full-time employee, entrepreneur, farmer, retired/pensioner, unemployed, student),
- place of residence (town, rural area),
- commune (Krobia, Miejska Górka, Poniec).

Then, the synthetic index A was calculated for the Likert Attitude Scale. For this purpose, each of the respondents was assigned an average number of points, calculated based on previously given answers. Similar averages were also calculated for pre-selected groups of respondents. The research procedure was limited to calculating the values resulting from the formulas:

$$A_j = \frac{2a + b - d - 2e}{r} \quad \text{– for } j\text{-th respondent,} \tag{1}$$

$$A_k = \frac{2 \times \sum_{i=1}^{r} a + 1 \times \sum_{i=1}^{r} b + (-1) \times \sum_{i=1}^{r} d + (-2) \times \sum_{i=1}^{r} e}{rn}$$

– for k-th respondent group, (2)

where:
a – number of extremely favourable responses,
b – number of moderately favourable responses,
d – number of moderately negative answers,
e – number of extremely negative answers,
i – question number,
r – number of questions used to test attitudes,
n – number of respondents in the k-th group.

The calculated A_k values made it possible to rank groups of respondents depending on the attitude (bias) towards the prospective lignite mining. Similarly to the method of calculating the synthetic index, three categories of attitudes (positive, negative, and neutral) were distinguished, and each category was assigned an equal part of the interval [-2; +2] (see figure 3).

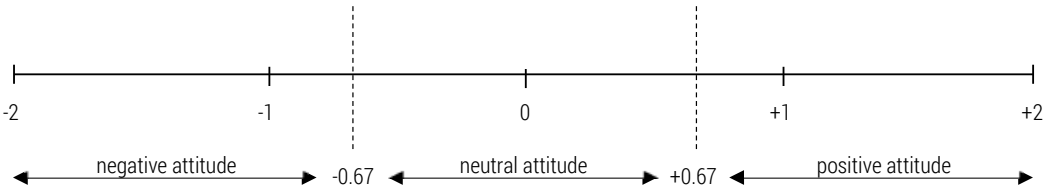

Figure 3. Dependence of the type of attitude on the value of the synthetic index
Source: author's work.

In the final part of the analysis, the one-way ANOVA was used to verify the differences between the synthetic indicators for individual groups of respondents. The essence of variance analysis is to divide the total variance into two components measuring the variability within and between the analysed groups. By comparing the variance between groups with the within-group variance, it can be determined whether the group means differed significantly from each other or not (McClave and Benson, 1988). Thus, the analysis of variance leads to the identification of factors differentiating the attitudes of the local community.

Factors influencing the attitudes of the local community towards lignite mining plans

Based on the analysis of synthetic indicators A_k for particular groups of respondents, it was found that these indicators fell within the range [-0.69; -0.06]. Therefore, they indicate the indecisive attitudes of the local community and reveal clear tendencies towards negative assessments of the analysed issue (figure 4, table 3).

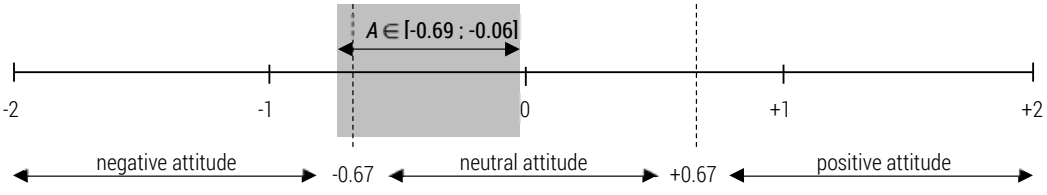

Figure 4. The area covered by the values of synthetic indicators A for individual groups of respondents
Source: author's work.

Table 3. A_k synthetic indicators ranking for individual groups of respondents

Group of respondents	value Ak
farmers	-0.692
rural residents	-0.675
31-50 years old	-0.649
full-time employees	-0.637
the inhabitants of Krobia commune	-0.606
the inhabitants of Miejska Górka commune	-0.597
secondary education	-0.594
retirees/pensioners	-0.589
men	-0.569
primary education and lack of education	-0.552
over 50 years old	-0.531
women	-0.531
basic vocational education	-0.515
the inhabitants of Poniec commune	-0.403
higher education	-0.390
unemployed	-0.389
students	-0.375
up to 30 years old	-0.360
city dwellers	-0.315
entrepreneurs	-0.063

Source: author's work.

Although the inhabitants were aware of the economic benefits of lignite mining in other communes, they feared the need to change their residence and workplace. The area of the open-pit mine could cover about 10,000 hectares, i.e., the area where 22 towns are located in Krobia, Poniec and Miejska Górka communes. The inhabitants expressed their doubts about the degradation of the natural environment and the collapse of agriculture. In their opinion, mining would destroy the surrounding crops, and local agriculture would not be restored to the previous state. A common effect of an open-pit mine is a lowering of the groundwater level, which could lead to the drying out of wells, rivers and soil in the mine's surroundings.

The obtained results showed that farmers and rural residents were the most sceptical of the lignite mining plans (in both cases the A_k value was lower than the -0.67 threshold, which indicates a negative attitude).

Rural residents are usually very resistant to change, which in this case may be aggravated by the fear of losing their property, deterioration of the environment and living conditions, uncertainty to compensation payments, the need to change jobs and even place of residence.

In turn, farmers perceive the threat to the functioning of their farms and production activities, resulting, for example, from lowering the groundwater level that usually accompanies open-pit mining. In the traditionally agricul-

tural area of southern Wielkopolska, the problem of the coexistence of mines and agricultural seems to be one of the key factors for the success of a potential investment.

Entrepreneurs were among the most enthusiastic groups of respondents (although still expressing views indicating a neutral attitude with a tendency for a negative one). This group was primarily aware of the financial benefits for communes where natural resources are exploited. Local entrepreneurs also saw an opportunity for their companies regarding the mine construction plans. They accepted the possibility of changing the profile of their activity and adapting to the changing market needs.

Moreover, among the groups of respondents with the lowest level of scepticism towards lignite mining plans were town dwellers (A_k = -0.32), people up to 30 years old (A_k = -0.36), students (A_k = -0.38), unemployed (A_k = -0.39) and people with higher education (A_k = -0.39). Young and educated town dwellers are in the group of people who absorb changes most easily and are able to take advantage of the opportunities that a potential investment would bring. However, it should be remembered that although these categories of respondents were the least sceptical, the level of non-acceptance of the analysed issue among their representatives was still significant.

Analysing indicators A_k in the groups complementary to the total of surveyed residents, the greatest difference in the attitude dimension can be noticed between the respondents separated based on their professional status (entrepreneurs -0.06 vs farmers -0.69), as well as the place of residence in the town-rural area (-0.32 vs -0.68) and the age of the respondents (up to 30 years old -0.36 vs 31-50 years old -0.65). The attitudes of the respondents distinguished on the basis of sex and education were much less diversified, as evidenced by the value of synthetic indicators within [-0.53; -0.57] in the first case and [-0.39; -0.59] in the second (table 3).

On this basis, it could be assumed that the attitudes of the local community of south-western Wielkopolska towards the potential exploitation of lignite depend to the greatest extent on the professional status and place of residence. The role of such factors as sex and education is less important. These hypotheses were verified based on the single-factor analysis of variance ANOVA (table 4).

The calculated F test statistics made it possible to assess the statistical significance of differences between the groups of respondents separated within the examined factors. In the light of the obtained results, it could be concluded that the factors differentiating the attitudes of the local community were primarily the place of residence (town – rural area) (p <0.000), professional status ($p \approx 0.001$) and the age of the respondents ($p \approx 0.03$). However, no statistically significant differences were found between the

declared opinions of the groups of respondents classified by gender or education ($p > 0.6$). The role of the commune, where the respondents live, as a factor differentiating attitudes, was noticeable, although the statistical significance of the differences could only be confirmed at the level of $\alpha = 0.1$.

Table 4. Results of single-factor variance analysis

Factor	Variants of answers	F	Value p
Sex	man, woman	0.228	0.63341
Age	up to 30 years old, 31-50 years old, over 50 years old	3.665	0.02714
Education	primary education and lack of education, basic vocational education, secondary education, higher education	0.548	0.64983
Professional status	full-time employee, entrepreneur, farmer, unemployed, retiree/pensioner, student	4.243	0.00105
Place of residence	town, rural area	19.329	0.00002
Commune	Krobia, Miejska Górka, Poniec	2.383	0.09458

Source: author's work.

Conclusions

In the light of the research results obtained, it was observed that the respondents' attitudes were dominated by "local" thinking and the fear of functional, environmental, and socio-economic changes caused by lignite mining. Therefore, the inhabitants of the analysed communes were cautious about the plans of lignite mining and mostly did not see the benefits for their households and entire communes. In particular, they were reluctant to the possible necessity to change their place of residence and professional status. Such attitudes were understandable considering the specificity of the region – its agricultural character, multi-generational traditions of farming and the indigenous local community.

The largest differences in attitudes could be observed within the groups of respondents distinguished on the basis of their professional status, place of residence (town – rural area), and age. The conducted analysis of variance statistically confirmed that it was these socio-demographic features that could be considered as factors shaping the attitudes of the local community towards the plans for lignite mining in the studied area.

The negative opinions on the potential exploitation of lignite, in particular those declared by farmers and those dwelling rural areas, can be explained by fears of environmental degradation and the liquidation of numerous

farms. A frequent effect of launching an opencast mine is a lowering of the groundwater level, which may lead to drying out of wells, rivers and soils within a radius of up to 50 kilometres from the mine. The reduction of agricultural activity would result in inhabitants suffering financial losses, and the necessity to expropriate the land for the mine would lead to the loss of a significant part of the property.

The inhabitants may have been concerned about the prospect of rising unemployment. Although the mine and its operation would generate new jobs, the new stands would be for external experts, not the local community. As a consequence of the deterioration of farming conditions, the losses could affect the local enterprises whose activities are mainly based on agriculture. An example is Heinz – a fruit and vegetable processing plant in Pudliszki (Krobia commune) or a sugar factory in Miejska Górka, which are currently an important link in the local labour market.

The identified attitudes of the local community prove that one of the significant problems of the potential investment will be to convince the inhabitants of the benefits that may result from the exploitation of lignite. At the same time, when planning the investment, in addition to activities and programs for the protection of the natural environment and landscape values, the economic interests of the inhabitants should be secured, including local farms and enterprises in particular. Without any conciliation action, the implementation of the investment could be considered against the will of the local community.

The contribution of the authors

Anna Bernaciak – 25% (conception; literature review).

Wojciech Kisiała – 25% (conception; analysis and interpretation of data).

Natalia Sołtysiak – 25% (acquisition of data; analysis and interpretation of data).

Katarzyna Suszyńska – 25% (conception; acquisition of data).

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