

MICHAŁ TOMASZ DMITRUK ^{1*}**ANALYSIS OF THE OBJECTIVES AND THE LEVEL OF IMPLEMENTATION
OF THE SPATIAL DEVELOPMENT PLAN OF THE CENTRAL COAL REGION
– THE LUBLIN COAL BASIN (CRW-LZW)**

One of the ways to reduce greenhouse gas emissions to the atmosphere is to minimise the production of fossil fuels energy, which, among others, can be achieved through gradual closure of hard and brown coal mines. However, such transformation comes with economic and social problems as well as structural changes. This article is a case study based on the objectives of the Spatial Development Plan for the Central Coal Region (CRW) – Lublin Coal Basin (LZW), developed as a consequence of the discovery of significant hard coal deposits in the north-eastern part of the Lublin voivodeship in the 1960's. In retrospect, it can be observed that the overly ambitious objectives of the CRW-LZW urban plan were implemented only to a limited extent.

This article aims to compare the original urban planning objectives with the current development of the industrial district and to indicate the cause for such a significant limitation of the realisation of the originally planned investment. Also, the article endeavours to simultaneously emphasize which factors should be specially considered, when planning such large-scope investments, that also broadly influence demographic and urban structure of the region and the way it is functioning.

The analysis was carried out in the context of economic difficulties and the political crisis at the turn of the 1970s and 1980s, the changes in the country's political and economic system, as well as the principles of the socio-economic concept of sustainable development implemented at the end of the 20th century, and the currently prevailing circular economy. The characteristics and analysis of the adopted design solutions were carried out, the assessment of the extent to which the planned investment was completed and what factors influenced its current condition. The collected data is summarized and compared in a table. The conclusions may prove helpful in establishing the direction of Lublin Coal Basin the development in the coming years. The described solutions and experiences may constitute the theoretical basis for accurate forecasting of the scope of similar investments in the future.

Keywords: mining, transformation, spatial planning, urban planning, Lublin region

¹ LUBLIN UNIVERSITY OF TECHNOLOGY, 38D NADBYSTRZYCKA STR., 20-618 LUBLIN, POLAND

* Corresponding author: m.dmitruk@pollub.pl



© 2021. The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (CC BY-NC 4.0, <https://creativecommons.org/licenses/by-nc/4.0/deed.en>) which permits the use, redistribution of the material in any medium or format, transforming and building upon the material, provided that the article is properly cited, the use is noncommercial, and no modifications or adaptations are made.

1. Introduction

Agenda 2030, the resolution adopted by all member states of the United Nations, is a very important initiative that defines the path of development for the world by defining 17 Sustainable Development Goals. These objectives relate to key notions such as poverty, hunger, health, education, gender equality, climate change, sustainable development, peace, justice, as well as supporting partnership to achieve those goals.

The premise of sustainable development is to cease of the natural environment degradation, protect resources, and use them rationally by increasing efficiency via new technologies, the use of renewable energy sources, etc. The implementation of climate protection and sustainable development objectives is associated with the reduction of energy production from non-renewable energy resources, and this leads to multifaceted changes affecting individual industrial regions and their infrastructure. These changes include not only technical but also social infrastructure [2].

The development of the region or even the location of one production plant, from the point of view of a given industry, is closely related and planned in parallel with the development of the socio-technical infrastructure; districts, cities, services, housing, education, communication, etc. Likewise, the reverse process is used to limit production leading to liquidation or technological changes that are taking place across the region. Transformation of the economy, including the production of energy from fossil fuels, mainly coal and gas, to energy from renewable sources causes many problems related to the limitation of extraction or adaptation (new “clean” technologies) and, finally, closure of mines [1] – the last stage of mining activity. Therefore, efforts should be made to reduce its negative impact on the environment. These problems, however, are not solely limited to environmental issues, but also address economic, legal, and social issues (workers and communities involved). More importantly, these negative consequences may occur simultaneously with the mining activity and be prevalent many years after its completion [14]. European countries taking up this challenge, in line with the Agenda 2030 resolution, have problems similar to this one as well as challenges of their own [17].

Descriptions of examples, strategies and problems related to mine withdrawal and closure can be found, for example, in Germany, Norway and the Czech Republic [9,10,25]. Germany has extensive experience in the production of hard coal and its liquidation, ranging from the coal industry’s development after World War II to 1958, when there was a slow decline in mining and employment. It is worth noting that the withdrawal and elimination of coal production was not caused by the need to protect the environment, but for economic reasons, including the reduction of energy production from non-renewable resources. The decline in own production was replaced by cheaper imported coal and oil. Redundant workers have retired, moved to other industries, or were retrained. The experiences and conclusions from this transformation in Germany are presented in [25]. However, the German example shows that the complexity of the challenges that such transformation brings can be overcome if municipal, regional, and national authorities and institutions work together in a polycentric approach [6].

According to the analysed literature, most European countries have similar experiences. The slowdown in transformation (and economic diversification) is also influenced by the phenomenon of government subsidies for productive coal mining. It is caused by the joint resistance of mining companies, politicians, and trade unions. It leads to persistent attempts to modernize old structures instead of turning to new economic opportunities. The capacity for economic reorientation differs according to an EU country and the given country’s region.

Phasing out coal-based energy would pose a greater challenge for some regions than others. For example, the countries most affected by job loss are Bulgaria, Czech Republic, Germany, Greece, Hungary, Poland, Romania, Slovakia, Slovenia, and Spain where some mining regions already have high levels of unemployment [17]. The report also identifies several regions that would be well-suited to producing renewable energy. For example, coal regions in Hungary, the Czech Republic and Poland, they are characterized by high wind availability. Several coal regions in Spain, Greece and Bulgaria are particularly well prepared to generate solar energy. Research conducted in Poland [6] also reports on the necessity and methods of reaching a compromise, in accordance with the idea of CSR (corporate social responsibility), between a stable mining industry, acquiring other utility values from mining, and the decommissioning process and the minimization and elimination of impacts harmful to the environment.

Spatial development plans are involved in economic plans for development or change in individual regions. For various reasons, their implementation usually follows or is delayed in relation to the development of production. The transformation of the political and economic system was a factor unique for the countries of Central and Eastern Europe. An interesting example in Poland is the Lublin Coal Basin (LZW), which is the subject of the analysis presented in this article.

The process of LZW development was hampered by the difficulties of economic regression of the decline of the political system in Poland and the 1989 change of the economic system, followed by the implementation of the socio-economic concept of sustainable development. It is a one-of-a-kind case, and it has affected the infrastructure and urbanization process of the entire region. Expected development according to the economic plan from 1979 Central Coal Region – Lublin Coal Basin (CRW-LZW) has been stopped, and therefore, the assumptions of the plan, its current implementation and future projects are especially interesting to analyse.

The aim of this article is to compare the original urban planning objectives with the current scale of development of the industrial district and to indicate the reasons for such significant limitation of the planned investment. The research was carried out based on literature, a query of archival materials and a developed SWOT matrix. The objectives for the planned development, the current condition of the investment, and related infrastructure were compared. A broader economic context has also been outlined, which is currently contributing to the gradual phasing out of the work of mines in the Lublin region and the final limitation of the development of the basin and accompanying urban centres. The presented and described scope of the development of the CRW-LZW Spatial Plan, extended with knowledge about the actual factors influencing its final shape, may constitute the theoretical basis for accurate forecasting of the scope of similar investments in the future.

2. Basic objectives of Lublin Coal Basin spatial development plan

Historical overview. In the economic planning of the Polish Peoples Republic (PRL) era (1952-1989), the country's industrialisation was critical. Industrial development constituted a significant element of successive post-war economic plans being at the same time the measurement of the country's development, which was often presented as a success of a centrally planned economy. The evaluation of the Spatial Development Plan of the CRW-LZW was intended for September 1979, however prior to that, broad research was conducted, and resolutions were adopted, which influenced the location decisions.

The research conducted by geologist professor Jan Samsonowicz and his team in the 1950s gave grounds to believe that in the Lublin region, under Jurassic and Cretaceous rocks there are deposits of hard coal [13], just as in Volhynia. This hypothesis was confirmed through geological research by Józef Porzycki from the Institute of Geology of the Upper Silesian Branch in Sosnowiec in the 1960s [26] In 1971, detailed documentation of the coal deposit “Łęczna” was prepared, which marked the beginning for the organisation of LZW and gave a basis to include the investment in the 5th five-year plan [31] (1976-1980).

During the term of the plan, the demand for coal was constantly on the rise, which was caused by the increased energy consumption of developing industrial production. At that time, electricity production increase of 26% turned out to be insufficient, which resulted in cuts of energy supply to manufacturing plants [15]. Due to growing economic hardship, surplus goods, such as coal, were exported. As for the government’s decision, the national stocks of coal reserves were decreased. In 1979, the shortage of this natural resource eventually caused multi-industry production stagnation and transport disruptions [15]. Therefore, the investment in the development of the CRW-LZW gained strategic importance for the functioning of the state [11]. Consequently, a significant reduction in investment outlays, adopted in the 5th five-year plan, did not slow down the works on the development of the Lublin mining industry.

In 1977, two years before the development of the plan, according to *Resolution no. 58/77 of the Council of Ministers of April 15, 1977 on the construction of a pilot-mining mine in the LZW* [29], a document containing technical and economic assumptions for the construction of an industrial district was developed. It also specifies the location of the mining area in the following municipalities:

- in Lublin Voivodeship: Łęczna town and municipality and municipalities Ludwin, Milejów, Spiczyn, Puchaczów;
- in the former Chełm Voivodeship (presently Lublin Voivodeship) – municipalities: Cyców, Siedliszcze, Urszulin, Wierzbica.

In Sept. 1979, Lublin Spatial Planning Bureau¹, developed the Spatial Development Plan of the CRW-LZW. This document was adopted as the basis for the construction of the industrial district, setting directions for the development of technical infrastructure, housing and service facilities, as well as recreational areas for the coming years.

Legal basis. The spatial development plan of the CRW-LZW was developed as a result of the arrangements contained in Resolution of the Council of Ministers no. 34/79 on the comprehensive development of the CRW – LZW (23 February 1979). According to the resolution guidelines, the subject of the development was supposed to be an urban project of the consecution and gradual development of the industrial district, together with the essential technical infrastructure and residential quarters. In pursuance of the directive from a letter from the Ministry of Administration of Local Economic and Environmental Protection [22], the task of development of the plan was entrusted to Lublin Spatial Planning Bureau. Some tasks related to the development of the project was given to the Institute of Environmental Development in Warsaw. The individual elements of the plan regarding environmental issues, in particular, were also consulted with the aforementioned Institute. Substantive basis for the development of the plan were the findings

¹ The members of design team were: Romuald Dylewski, MA – General Plan Designer, Maria Maciejewska, MA, Tadeusz Chmielewski, MA, Bolesław Kubicz, Arch. Teresa Maruszczak, MSc and Eng. arch. Stanisław Król.

agreed in a meeting² of the Ministry and the designers, representatives of the departments of interest and local authorities. The arrangements were made based on the analytical and design study, developed in the years 1974-1978 by the Spatial Planning Office in Lublin and Chełm, the Institute of Environmental Management, the Office of Mining Studies and Projects in Katowice, the Central Geology Office in Warsaw, Maria Curie-Skłodowska University in Lublin, the Institute of Cultivation, Fertilisation and Soil Science in Puławy and other smaller research units. The planning study was subject to a substantive assessment by a specially appointed Commission for the Assessment of the Spatial Development Plan CRW-LZW on July 12-13, 1979 [28, p. 10], which positively assessed the solutions adopted in the plan.

Local conditions. The concept of the development of the Central Coal Region, introducing new economic and industrial functions in the region, was an average of many factors conditioning the agreed solutions, e.g.: local conditions, the existing functions of the area and the state of investment, environmental conditions, prospective population program, and social, economic, functional and spatial requirements [28, p. 41].

The plan emphasised many aspects related to the specificity of the place. Primarily, it was observed that the planned location of LZW has a peripheral location to communication hubs and larger housing units, which caused certain difficulties related to the transport of the raw material and organisation of the workforce. It was noted that the original use of the LZW was mostly agricultural. It was proposed that the region's agricultural function should be reserved, being a crucial branch of the economy and the region and ensuring the production of food for the developing and planned urban areas. Emphasis was placed on the development of reparation plans guaranteeing the maintenance of the said function in the event of mining damage, with particular stress on preserving the continuity of the Wieprz-Krzna irrigation canal.

It was also observed that the area of the planned project is located in the Łęczyńsko – Włodawskie lake district, a place of unique natural beauty, at the same time being leisure areas frequented by residents. It was therefore proposed that the reservation and maintenance of the recreational values of the area was the priority. Due to the sensitivity of water conditions in the mining area, attention was drawn to the need to carry it out following specific operation methods in particular conditions, preventing changes and degradation in the natural environment.

Initial objectives of the plan. The fundamental initial objective in the development of the plan was to maintain and expand functional relationships with Lublin, which was to have a role of a central hub of the planned agglomeration, at the same time ensuring the region's adequate saturation with service and production functions, facilitating the coal basin. It was also where educational institutions and specialist university courses were planned to train specialists to fill mining-related professions. Chełm was designated as the second most significant urban centre. The plan also deliberated the creation as well as the development of smaller settlement units of an urban nature located nearer to the mines and being a residential base for the workers. The role of the urban centres in Lublin and Chełm was to minimise the intermittent difficulties with access to the services typical for newly created towns. The new urban centres were supposed to offer a high living standard, which would compensate the miners for challenging work conditions. It was also presumed that the directional development of the LZW would not be limited only to the construction of new mining plants but also will promote the development of related industries. The plan assumed the necessity of gradual implementation of the investment, result-

² Held on January 22-27, 1979.

ing from the need for the expansion of urban and transport infrastructure. Due to the ongoing geological research, the direction of the development of the basin was not clearly estimated and the order of exploitation of the deposits has not been established. For that reason, a certain flexibility of planning solutions, dependant on the development of mining strategy, was established.

However, the rapid development of local municipalities was also presumed without a specific annual staging of the investment. Based on the research stating that in the Lublin, Polesie and Zamość regions, there are reserves of hard coal of approximately 74 milliard tons, the plan also predicted the possibility of broadening the mining outside the LZW area. According to the research carried out in 1978, the deposits were to be located at a depth of approx. 1500 m [28, p. 24]. The project particularly noted that it was impossible to evaluate the degree of Lublin Coal Basin's development precisely, as it was impossible to predict the future economic conditions or direction of the advancement of mining technologies. Therefore, the plan's recommendations are rather general. The entire spatial structure of the Central Coal Region was planned as open to area development while maintaining the principles of particular respect for the natural and cultural environment (Fig. 1). The plan estimated the following fundamental parameters of the development of LZW between 1979 and 1995:

- The construction 6 or 7 mines [12, p. 11], on the area of 7 coal deposits shown in Fig. 1;
- The designated mining area of 240 km² was to provide 25 million tons of coal until 1995, at the same time ensuring the possibility of future development;

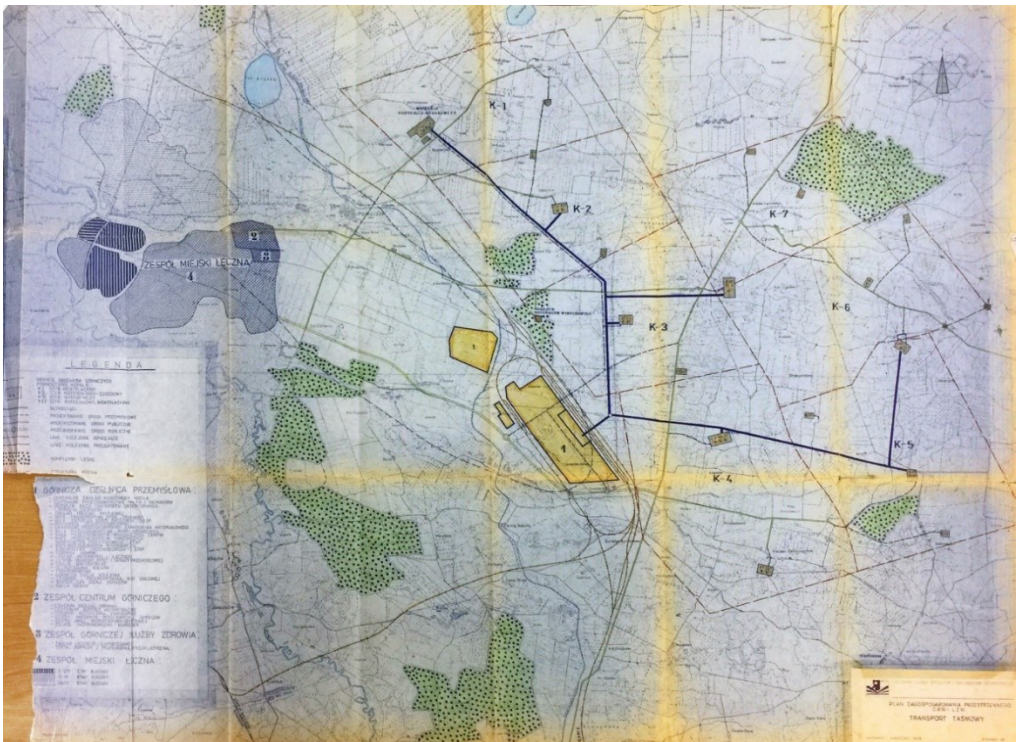


Fig. 1. A sketch from the Spatial Development Plan of the CRW-LZW from 1979

- There were to be 40 thousand people employed in mining and 180 thousand directly linked to the mining industry. Thus, intensive development of local urban centres and attractive living conditions were planned, encouraging people to settle in the region [28, p. 14].

3. The functioning of mines

Transportation. As indicated in the introductory parts of the study, the peripheral location of the area covered by the plan required the design of appropriate communication infrastructure. The export of coal was planned mainly by rail, to the west and the north. For this purpose, a dedicated railway line was to be built, connecting the basin with the national railway junction in the vicinity of Lubartów.

The primary recipients of coal from the Lublin Coal Basin were the Warsaw District, the Koziernice Power Plant, and northern and eastern Poland. It was also emphasised that the construction of the abovementioned railway is the factor determining the commencement of coal mining in 1985-1995. In addition to the mass export of coal by rail, it was also planned to be exported by road in all available directions, as well as by suburban rail. The road communication linking the LZW area with the rest of the country is based on two interregional roads that intersect in Lublin: direction Zamość-Lublin-Warsaw, and direction Białystok-Lublin-Krakow.

It was also assumed that the system of main roads existing at that time, after necessary modernisation, would transfer the traffic expected in the operation of the mine. Due to the insufficient number of connections between individual municipalities and the Central Coal Region area itself, the expansion of regional road networks was also planned. According to the Spatial Development Plans of the City of Lublin from 1959 and 1968 it was planned to build roads surrounding the Lublin city complex, adapted to heavy wheeled transport faster. Their purpose was to enable collision-free transportation of coal without burdening the city with additional car traffic. The solution to the issue of coal transport from the mine postulated in the plan was the construction of the Lublin Water Canal, which would connect the mine areas with the river Wieprz, and then the coal was floated down the Vistula, towards Warsaw. It was pointed out that this solution would be particularly profitable in the case of locating a new coal-fired power plant near the lower reaches of the river Wieprz. The program provided for the Lublin Canal construction in 1991-2000 as an element of the international system of inland waterways. Its implementation was indicated as one of the essential elements in the economic assessment of the entire project.

Energy demand. The plan ultimately assumed the construction of a power plant using the waste coal from the Lublin Coal Basin. Until its implementation, the operation of the mine was to be made possible thanks to the transmission of electricity from the national grid. The location of the power plant was proposed in three variants:

- in the area of the lower Wieprz “Luszawa”;
- in the vicinity of the industrial and storage district of CRW, Wola Korybutowa;
- or north of Chełm, Ruda-Huta.

The plan did not indicate the location of the power plant, making it dependent on the determination of the location of the production commencement and on ministerial decisions that were to be made in 1980.

4. Population and housing

One of the fundamental challenges of implementing the CRW-LZW plan was an inadequate measure of the population inhabiting 9 municipalities territorially linked to the industrial district. The area was mainly agricultural, extensively populated with farm architecture. In 1979 the region was inhabited by only 59,000 people, which equated to barely one-third of the planned employment in the newly founded mining industry. The area within which the industrial centre/capital was planned had the lowest population density of the central-east macroregion. The average density of the population was merely 53 people per km².

A necessary condition for the successful implementation of the investment project of such scale was to encourage the people to settle in the newly established towns. The primary encouragement factor was the urbanistic and architectural quality of the new towns as well as the guarantee of employment and attractive recreational areas. The critical element of the plan, which was also crucial to ensure efficient operation of the planned mines, was housing. A significant part of the plans' records was devoted to this issue. The authors pointed out that to ensure the estimated number of workers in the LZW, an adequate residential base in the convenient commute to a workplace (max 30 minutes' commute) should be guaranteed. It was also noted that the planned new cities, located in satellite locations around the industrial district, must not deviate from the architectural and functional standards of larger urban centres. Therefore, it was suggested that the architectural and spatial solutions of residential buildings and the apartments themselves were to be solved according to the highest normative standards³ or even apply for deviations from the norm in order to ensure a higher functional standard [28, part 1, p. 16]. Comprehensive construction of new towns and their equipment was to follow the then accepted models of social life. The plan assumed that housing for 155,000 [28, part 1, p. 43] people involved in mining should be provided, of which 125,000 people should live in newly constructed cities, while 30,000 were to occupy the surrounding rural areas. The town of Łęczna was to be the most intensively developed local urban centre, with an anticipated number of inhabitants of 70,000, with a potential for further growth. As L. Kolanowski writes, Łęczna was to constitute [3]: "a modern for the 20th and 21st centuries hub of settlement concentration for the mining crews of the Lublin Coal Basin. The New Town of Białka was to reach approximately 70,000 inhabitants, Puchaczów 5,000 and Milejów 5-7,000. The entire urban complex of Łęczna, together with the surrounding municipalities, was designed with dynamic development in mind due to the intense level of investment, ecological and landscape values of the location, near the Wieprz and Świnka river valleys, optimal terrain conditions, not affecting soil values or coal deposits, optimal sanitary conditions from potential sources of air pollution, as well as flexibility in terms of possible directions of development (Fig. 2).

The following assumptions were adopted for the implementation of the cities [28, p. 148-149]:

1. regarding ecology:

- providing residents with direct access to the natural environment in the vicinity of cities;
- noise protection (insulation of main communication routes with screens or green belts);
- raising the air purity rigours.

³ In accordance with: Regulation No. 10 of the Minister of Local Economy and Environmental Protection of January 20, 1974 on the establishment of a technical standard for the design of multi-family apartments and residential buildings for non-agricultural people, "Dziennik Budownictwa" 1974.

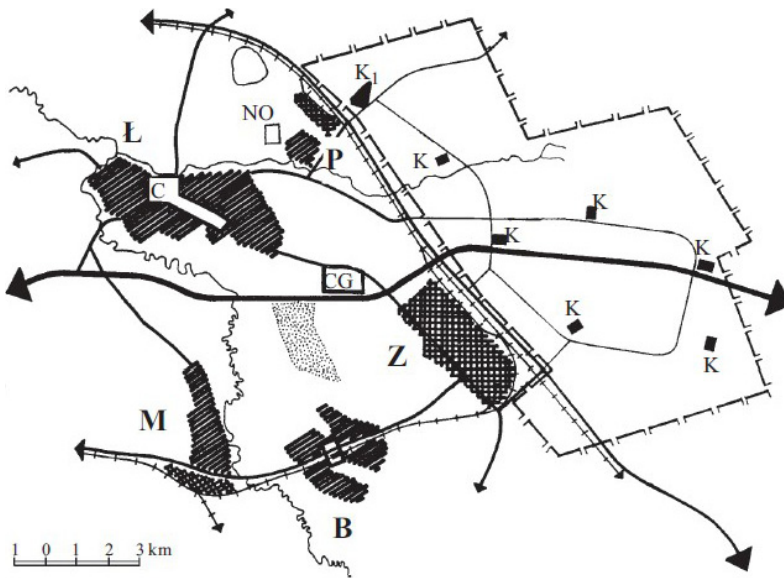


Fig. 2. Sketch showing the scope of development of CRW-LZW cities. Ł – Łęczna, P – Puchaczów, K1 – Bogdanka pilot mine, K – planned mines, Z – industrial and warehouse district of Zawadów, M – Miejów, B – Nowe Miasto Białka. Source [10]

2. regarding apartments:

- providing the usable space standard higher than the national average;
- planning for most multi-family buildings to be no higher than 4 storeys;
- a wide choice of forms and types of apartments;
- a higher percentage of single-family houses;
- the preparation of urban and architectural designs of high quality housing estates;
- the diligence of the construction of the buildings will be ensured.

3. regarding services:

- application of the service saturation norm at the upper limit;
- localisation of the complete program of primary and secondary services
- in newly established cities;
- location of higher-level services (e.g., higher education) in the main cities (Lublin, Chełm);
- ensuring easy access to services in urban layouts.

The plan also included a detailed description of the development of individual planned urban centres, including recommendations for recreational areas, the method, in which the complex functioned and its equipment. Additional efforts were also recommended to protect the natural environment and preserve cultural values.

The implementation of the city complexes was to be progressed in an exceptionally short time. By 1985, the number of inhabitants of Łęczna was to reach 30,000. Until 1990, urban complexes in Łęczna and Białka were to develop at the same time, reaching a population of 50-60,000 and 20,000, respectively [28, p. 156].

5. Recreation and nature protection

Recreation areas. The provisions of the plan also highlighted the need to provide people associated with mining with access to appropriate recreational spaces due to the harmful working conditions. The Łęczyńsko-Włodawskie lake district was considered the crucial recreational area for the residents. The tourist traffic capacity of the abovementioned area was estimated at 60,000 people – the amount insufficient for the needs of the planned urban development. For this reason, it was postulated that the plans of future housing estates should include any attractive landscape areas with a recreational potential, such as natural gorges, forests or river valleys, to plan recreation areas for residents.

Nature protection. Throughout the Central Coal Region area, a zone of increased protection of natural values was adopted, emphasising the western part, as it would be exposed to more significant pollution due to the location of the industrial complex in Zawadów. Due to the shortage of forests in the region and the expected deterioration of the climate conditions by industrial activity, it was proposed that new forests should be planted in suitable areas that were also of no or little value for the development of agriculture. Insulating plantings around industrial zones were also planned. However, it was emphasised that there are no plans to locate vastly heavy industries within the CRW, except for medium-heavy coal enrichment plants and heating plants.

The waters in the vicinity of the LZW were to be particularly protected. The protection and improvement of water purity was noted as an element of the national strategy. The necessity to locate the sewage treatment plant in the upper Wieprz river area was stressed, and the measures to protect against the penetration of pollutants into the groundwater were indicated. It was also observed that the intake of water from Wieprz for the needs of the mine and developing cities would not meet the demand, and the intake of groundwater may deepen the depression crater. Due to the above, the construction of a storage reservoir in the vicinity of Izbica was planned. The necessity to establish a special institution, controlling the state of water resources in the area was also mentioned.

6. The actual state of the implemented objectives of the plan

More than forty years after the development and adoption of the Plan of Spatial Development of Central Coal Region – Lublin Coal Basin, the assessment of the scope of implementation of the adopted solutions can be attempted. It can be seen that the plan was implemented only to a small extent. By analysing the provisions of the project, it can be concluded that the investment project exceeded the possibilities of implementation already at the time of its announcement. Even now, when the economy is much healthier than that of the communist era⁴, it is hard to observe such bold investment plans as proposed in the document under examination.

It should also be noted that in the period from the year of the announcement of the examined plan, to present significant political and cultural changes have taken place in the country and the world. The economic difficulties of the People's Republic of Poland resulted in the suspension of the construction of other mines in the LZW [30]. In 1989, Poland's political and economic system changed, which resulted in a shift in the management of the investment (decentralisa-

⁴ Especially compared to the 1980s, during the political and economic crisis as well as numerous social turmoils.

tion) [28], which led to the privatisation of the Bogdanka mine [12, p. 13]. It was an extremely difficult period for the mine's operation. In those years, it managed to achieve only 50% of the assumed production capacity, and the price of coal sold was only 30% of the production costs [12, p. 44]. The current global socio-economic concepts, in particular sustainable development and circular economy, assume a reduction in the consumption of non-renewable resources and reduction in CO₂ emissions. The new energy policy of the European Union [23], of which Poland is a member, has been implemented for over a dozen years, assuming a complete withdrawal from the use of coal in the energy sector by 2030 [24], which also contributed to the reduction of mining plans. The development of modern technologies of obtaining energy, focused mainly on renewable sources, has also become a common alternative to fossil fuels. Bearing in mind the abovementioned issues and the collected information, an attempt was made to perform a comparative analysis of the planned objectives with their implementation today (2021). Data are summarised in Table 1-5, broken down into individual domains.

TABLE 1

Comparison of the scope of implementation of planned assumptions with the actual state, regarding the level and area of coal extraction

No	Planned investments	Scope of implementation	Notes
1	The construction of 6 or 7 mines on the reserves K 1-7	One mine (Bogdanka) with three mining fields was completed [21]	Bogdanka is located on the site of the first pilot mine (on the Puchaczów V deposit)
2	CRW-LZW Basin estimated area – 240 km ²	The mine covers an area of approx. 72 km ² (30% of the planned area)	LW Bogdanka holds a license to extract coal from deposits K-6 and K-7 (not yet developed).
3	The planned target annual coal production was 25 million tons of coal.	Current production – 8.8 million tonnes/year. Planned 9.7 million tonnes/year until 2025 [19]	—

TABLE 2

Comparison of the scope of implementation of planned assumptions with the actual state, regarding urban development

No	Planned investments	Scope of implementation	Notes
1	2	3	4
1	The development of the town of Łęczna to the size of approx. 70,000 residents, with the prospect of further development.	The town of Łęczna currently has approx. 19,000 residents	In 1975, before the development of the LZW, the population of Łęczna was only about 2,700 [20]. In terms of area, the town adopted the direction of development as planned, but only the first stage of development was completed (Samsonowicz, Niepodległości and Bobrowniki districts). Stage II and III (areas 2,3,4) shown in Fig. 2 were never started. Administrative. Borders of the town of Łęczna seem to had been adjusted to the development directions set out in the plan. As the analyses show, multi-familyhousing was the primary type of development intended to provide LZW's employees' housing.

TABLE 2. Continued

1	2	3	4
2	The construction of the New Town of Bialka planned to house 70,000 residents.	The investment was never commenced.	The village of Bialka currently has approx. 360 inhabitants
3	Development of the Puchaczów commune to approx. 5000 inhabitants	The municipality has reached approx. 5500 inhabitants.	As a municipality closest to the mine, it developed spontaneously, through private construction investments, without planned urban planning activities.
4	Construction of the mining town of Wierzbica, 30-35,000 residents.	Was not completed	Wierzbica village's population is currently approximately 300
5	The development of the town of Rejowiec to the size of approx. 20,000 residents	The city has a population of around 2,000	The city is currently not associated with mining.
6	Construction of the industrial storage district Zawadów	Was not completed	Only one small railway depot was built.
7	Nominating Lublin and Chełm regional urban centres.	They were and are important urban centres in the region.	The economy of these cities is not currently focused on servicing mining investments. In 1999, after the administrative reform, Chełm lost the voivodship status and stopped being the centre servicing the LZW

TABLE 3

Comparison of the scope of implementation of planned assumptions with the actual state, regarding transportation

No	Planned investments	Scope of implementation	Notes
1	A railroad connecting the mines with Lublin and the rest of the country.	A railroad was built for the Bogdanka mine.	The route leads to the southeast, where the industrial and storage district of Zawadów and the New Town of Bialka were planned. The line then wraps towards the west, connecting the mine with Lublin.
2	A network of suburban railways linking mining towns and transporting coal in the region.	Was not completed	As the towns were not constructed, the construction of the suburban railway was abandoned.
3	An express road connecting Łęczna with Zawadów industrial and storage district.	Was not completed	Because the industrial and storage district was not constructed.
4	Lublin bypass, designed to enable collision-free road transport of coal, not burdening the municipal infrastructure.	Was completed	The bypass was not opened until 2014.
5	Lublin Water Canal, enabling coal transport by water.	Was not completed	Coal is not floated by inland waterways.

TABLE 4

Comparison of the scope of implementation of planned assumptions with the actual state, regarding employment

No	Planned investments	Scope of implementation	Notes
1	Planned employment of 40,000 people working in mining and 180,000 in professions functionally related to mining.	The estimated numbers were not reached.	Lubelski Węgiel Bogdanka S.A. currently employs nearly 5,000 staff.

TABLE 5

Comparison of the scope of implementation of planned assumptions with the actual state, regarding infrastructure, education and environment

No	Planned investments	Scope of implementation	Notes
1	The power plant in the lower area of the River Wieprz	Was not completed	No works were commenced due to the failure to implement the Lublin Water Canal.
2	Preparation of higher education for professional training of mining workers.	Completed to a small extent	In 1976, at the Faculty of Mechanical Engineering of the Lublin University of Technology a new field of study was introduced – “Mining and Geology” with a specialisation in “Mining and drilling machines and equipment”. The course is not currently offered by the University. At the Maria Curie-Skłodowska University in Lublin, there is the Faculty of Earth Sciences and Spatial Management, to some extent related to mining activities in the Lublin region.
3	Construction of a water storage reservoir in Izbica	Was not completed	—
4	The establishment of a special institution managing and control-ling the state of water resources in the area.	Was not established	—
5	Conducting compensation, insulation and afforestation plantings.	Was completed to some extent	In the municipality of Łęczna, numerous actions for afforestation of unused areas were carried out “as a voluntary act”, e.g. forests near Puchaczów.
6	Providing access to green areas near newly localised housing estates.	Realised in the area of the J. Samsonowicz in Łęczna. Not implemented in the case of the Niepodległości and Bobrowniki housing estates.	In the urban plan of the J. Samsonowicz’s estate in Łęczna, extensive multi-family housing with numerous plantings of greenery and inter-block squares was planned. The estate is located in the vicinity of a natural ravine and along the Świnka river valley. The plan of the newer housing estates: Niepodległości and Bobrowniki do not put so much emphasis on green spaces, and the infrastructure more intense.

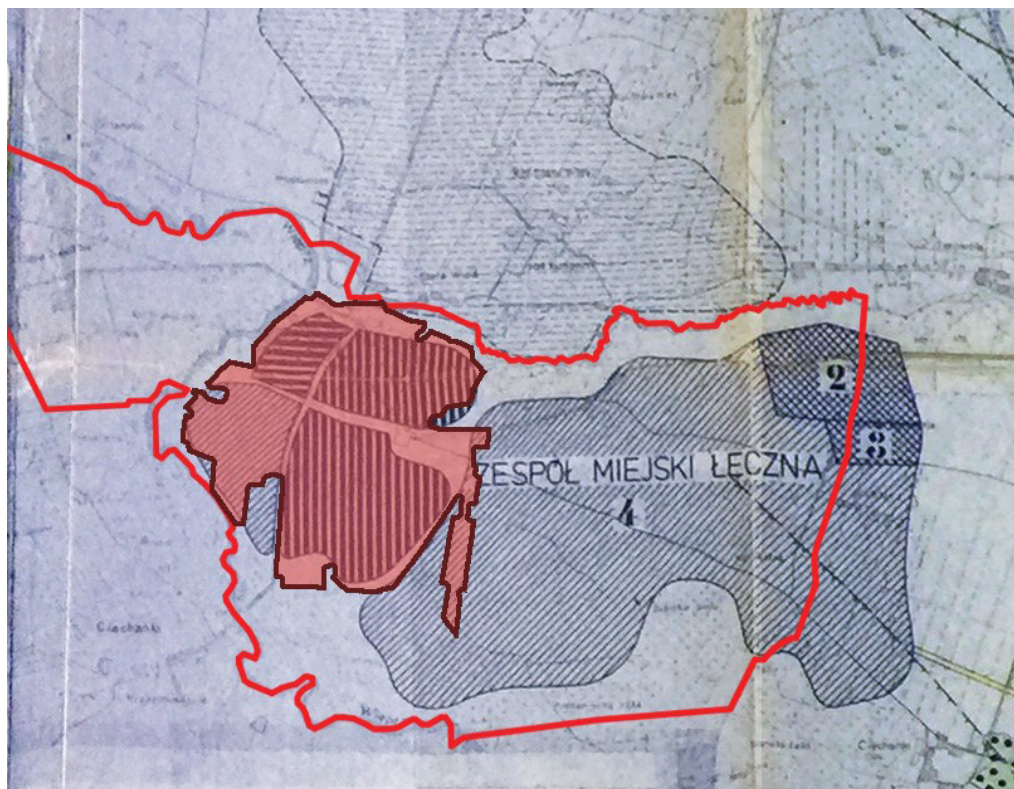


Fig. 3. The area of the actual development of the city of Łęczna against the planned scope and administrative boundaries. Own study based on an outline from the Spatial Development Plan of the CRW – LZW from 1979

Based on the collected information and the comparison posted in Tables 1-5, an analysis of the planning assumptions was made, defining four categories of strategic factors: strengths, weaknesses, opportunities and threats (SWOT). The analysed data are presented in Table 6.

Points 3 and 6 are especially important threats for further implementing the plan and, consequently, coal mining development in the Lublin region. As Tajduś and Tokarski [8] point out, based on the data on unexploited deposits in Poland, it is possible to locate new mines, but due to the directions adopted in the energy policy of Poland and the European Union, it seems to be an unpopular and unlikely decision. The conclusion that can be drawn is the necessity to adopt a strategy of exiting the market, exhausting the currently exploited deposits and closing mines. The growth strategy of LW Bogdanka, however, appears to take a slightly different direction. In the document [18] published by the company on December 16, 2020, it can be read that it is planned to flexibly adjust the mine's operating profile to environmental requirements and diversify activities in building a *Green New Deal* [16].

The planned way to keep the company in the position of a regional leader and ensure profitability and efficiency of production at the same time is to expand the areas of activity beyond its core purpose, but without giving up coal mining until 2040. Therefore, it can be assumed that

TABLE 6

SWOT analysis of plan assumptions

Strengths of the planning assumptions	Weaknesses of the planning assumptions
<ol style="list-style-type: none"> 1. Flexible planning solutions, enabling a change of concept in line with the change of external conditions; 2. Complementarity of the proposed solutions, relating to many issues related to the planned coal extraction; 3. Strong emphasis on creating favourable living conditions for the future inhabitants of the region; 4. Strong emphasis on pro-ecological solutions and minimising interference with the natural landscape. 	<ol style="list-style-type: none"> 1. Failure to take into account the economic and political situation of the country in the plan (the investment exceeded the implementation possibilities); 2. Lack of detailed geotechnical studies of the deposit, and thus no specific investment locations planned [12, p. 9]; 3. Lack of precise phasing of the investment implementation; 4. Lack of a clearly defined character of the industrial district.
Opportunities for further implementation	Threats for further implementation of the plan
<ol style="list-style-type: none"> 1. Operation of Lubelski Węgiel Bogdanka as the largest employer in the region; 2. Slowly but the steadily increasing tonnage of mined coal annually; 3. Development of modern mining techniques enabling faster and safer extraction of coal; 4. Obtaining by the company LW Bogdanka a concession for the extraction of coal in two further fields; 5. Unblocking and starting the previously closed Stefanów shaft. 	<ol style="list-style-type: none"> 1. Technical difficulties resulting from the geological structure of the area [7, p. 186] 2. Plans to reduce the use of non-renewable resources in the energy sector; 3. Plans to abandon the use of hard coal in the energy sector by 2030 [23] (with a possible shift to 2035 or even 2050). 4. Popularisation of new global socio-economic concepts, in particular, sustainable development and circular economy; 5. The decline in the importance of mining in the country's economy; 6. Hard coal is not currently the important export it was at the time of the plan.

the company is aware of the aforementioned threats, however, it intends to use the remaining time and technological possibilities to adjust the business profile to the market realities. This will most likely fail to implement the objectives of the urban plan examined in this article and the region's development strategy will have to be revised.

7. Conclusions and summary

The analysis of the objectives of the Spatial Development Plan of the Central Coal Region of the Lublin Coal Basin and the degree of its implementation shows how difficult it is to plan this type of investment. Planning such a large urban development project, almost completely changing the region's character, especially in a difficult economic situation of the state as it was at the turn of the 1970s and 1980s, turned out to be an investment beyond the possibilities of implementation. Many factors can be considered as the reasons for the inability to fully

implement the objective of the plan. These were economic issues which, due to the insufficient amount of investment funds, prevented the comprehensive implementation of the plan, as well as political and social difficulties⁵, the deteriorating demographic situation, the inability to provide a sufficient number of qualified workers, and many other logistical and organisational problems of the time. After the political transformation and a significant improvement of the economic situation, the development of modern, automated mining techniques impacted the development of the mine, which limited the need to develop housing and service facilities on the scale that was initially planned. In addition, numerous restrictions imposed by the European Union legislation relating to the extraction and share of hard coal in the energy sector, as well as the development of ecological energy generation techniques also affected the level of use of the Lublin Coal Basin resources.

Comparing the data from the plan with the current development level, it can be estimated that only 25% of the objectives were met. In comparison, coal production is maintained at 35% of the planned level. However, it should be emphasised that the operating mines of LW Bogdanka are the one region's most significant business cooperative and investor, employer and a constantly developing coal mining plant with a strong position on the domestic market. This can be considered an indirect success of the plan. It should be assumed that the pace of the development of urban centres in the LZW will largely depend on the economic situation of LW Bogdanka S.A., at least until the emergence of other factors that could affect their further development. However, even though the planned objective were implemented only partially, they left a significant legacy in the region and still largely influence the directions of its development.

In the present situation, the CRW-LZW development plan requires a thorough revision. It becomes obvious that in the current political and economic conditions, its further implementation is unrealistic and unjustified. Therefore, attempts should be made to amend the plan, using the existing infrastructure and housing facilities, and adapting to new possibilities and technological achievements. There is a need to outline the directions of the region's development, in the event of the final shutdown of the mines. This article is the first stage of research – an assessment of the factual condition. In the second stage, it is planned to outline scenarios for the use and development of the existing infrastructure. Revitalization of post-mining areas, the use of heaps as areas for photovoltaic installations, or recreational areas (skiing, motocross tracks, motor-glider starting fields) may contribute to the enrichment of the tourist offer of the region, and at least partial environmental compensation for mining damages. Polish experiences may be interesting in the context of similar problems in post-communist countries (both in the mining industry and others).

References

- [1] A. Frejowski, J. Bondaruk, A. Duda, Wyzwania i szanse dla terenów po wyeksploatowanych kopalniach węgla: od czarnej do zielonej energii. *Energies* **14**, 1385 (2021). DOI: <https://doi.org/10.3390/en14051385>
- [2] H. Gerbelová, A. Spisto, S. Giaccaria, Regional Energy Transition: An Analytical Approach to the Slovakian Coal Regio. *Energies* **14**, 110 (2021). DOI: <https://doi.org/10.3390/en14010110>
- [3] L. Kolanowski, Rozwój przestrzenny Łęcznej, jako ośrodka Lubelskiego Zagłębia Węglowego. *Annales Universitatis Mariae Curie-Skłodowska, Lublin* **73**, Sectio B (2018). DOI: <https://doi.org/10.17951/b.2018.73.0.29-47>

⁵ Strikes, the introduction of martial law, the deterioration of relations with Western Europe and, ultimately, the political change of 1989.

- [4] L. Lehotský, M. Černík, Brown coal mining in the Czech Republic – lessons on the coal phase-out. *International Issues & Slovak Foreign Policy Affairs* **28**, (3/4) (2019). <https://www.jstor.org/stable/26905905>, accessed 25.02.2021
- [5] P. Oei, H. Brauers, P. Herpich, Lessons from Germany's hard coal mining phase-out: policies and transition from 1950 to 2018. *Climate Policy* **20** (8), 963-979 (2020). DOI: <https://doi.org/10.1080/14693062.2019.1688636>
- [6] E. Pietrzyk-Sokulska, R. Uberman, J. Kulczycka, The impact of mining on the environment in Poland – myths and reality. *Mineral Resources Management* **31** (1) (2015). DOI: <https://doi.org/10.1515/gospo-2015-0009>
- [7] E. Sermet, J. Górecki, Podstawowe kryteria możliwości podziemnego zgazowania węgla w Lubelskim Zagłębiu Węglowym. *Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energii Polskiej Akademii Nauk* nr **83/2012**, (2012). ISSN 2080-0819.
- [8] A. Tajduś, A. Tokarski, Risks related to energy policy of Poland until 2040 (EPP 2040). *Archives of Mining Sciences* **65** (4), 877-899 (2020). DOI: <https://doi.org/10.24425/ams.2020.135183>
- [9] K. Van de Loo, Social engineering for coal mine closures – a world bank report, the international research deficit and reflections from a German perspective. *Mining Report* **155** (4) (2019).
- [10] B. Brylak-Szymczak, A. Link, M. Żurkowska, M. Osmulka, E. Mazurek, R. Dylewski, Łączna. Nowe polskie miasto. Przyszłość, perspektywy. Rada Miejska w Łęcznej, Łęczna (1994).
- [11] A. Frużyński, *Zarys dziejów górnictwa węgla kamiennego w Polsce*. Muzeum Górnictwa Węglowego, Zabrze (2012). ISBN 978-83-935614-4-5
- [12] J. Kicki, B. Kozek, J. Jarosz, A. Dyczko (Ed.), 30 lat górnictwa węglowego na Lubelszczyźnie 1975-2005, *Lubelski Węgiel „Bogdanka” Spółka Akcyjna*, (2006). ISBN: 83-917727-3-X
- [13] A. Zdanowski, *Atlas Geologiczny Lubelskiego Zagłębia Węglowego*, Państwowy Instytut Geologiczny, Warszawa, (1999). OCLC: 45743965
- [14] A. Harat, Z. Adamczyk, A. Klupa, Economic and environmental aspects of the liquidation of coal mines, *Proceeding of Conference: 17th International Multidisciplinary Scientific Geo Conference SGEM 2017*, 29 June – 5 July, (2017). DOI: <https://doi.org/10.5593/sgem2017/54/S23.035>, ISSN 1314-2704
- [15] J. Kaliński, Z. Landau, *Gospodarka Polski w XX wieku*. Wyd. 2 zmienione. Polskie Wydawnictwo Ekonomiczne, Warszawa, (2003). ISBN: 83-208-1428-6
- [16] *A Green New Deal*. Joined-up policies to solve the triple crunch of the credit crisis, climate change and high oil prices, New Economics Foundation, Londyn, (2008). <https://neweconomics.org/2008/07/green-new-deal>, accessed: 23.11.2021
- [17] *EU coal regions: opportunities and challenges ahead*. <https://ec.europa.eu/jrc/en/news/eu-coal-regions-opportunities-and-challenges-ahead>, accessed 25.07.2021
- [18] *Kluczowe elementy Strategii rozwoju LW Bogdanka S.A. Obszar Wydobywanie Grupy ENEA do 2030 roku (perspektywa do 2040 roku)*. <https://ri.lw.com.pl/o-firmie-strategia>, accessed 25.07.2021
- [19] https://www.lw.com.pl/pl,2,aktualnosci,d264,kontynuacja_i_transformacja_nowa_strategia_lw_bogdanka_do_2030_r.html, accessed 25.07.2021
- [20] <https://leczna.pl/leczna/leczna-w-liczbach>, accessed 25.07.2021
- [21] Letter from the President of the Management Board of Lubelski Węgiel Bogdanka, No. 227.PR.076.28.14.2021.1388.
- [22] Letter of the Undersecretary of State No. UAN.1-LZW-20/79 of March 16, 1979.
- [23] Directive (EU) 2018/2001 of the European Parliament and of the Council of December 11, 2018, on the promotion of the use of energy from renewable sources, (2018).
- [24] P. Czyżak, M. Hetmański, 2030 – Analiza dot. Granicznego roku odejścia od węgla w energetyce w Europie i Polsce. *Instrat Policy Paper 01/2020*, (2020). ISBN: 978-83-946738-3-3
- [25] C. Kemfert, M. Fishedick, K. Bausch, Phasing out coal in the German energy sector interdependencies, challenges and potential solutions. *German Institute for Economic Research (DIW Berlin)*, (2019). https://www.ecologic.eu/sites/default/files/publication/2019/3537-kohlereader_englisch-final.pdf, accessed 23.11.2021
- [26] J. Porzycki, *Lubelskie Zagłębie Węglowe*. [In:] *Przewodnik 42 Zjazdu Polskiego Towarzystwa Geologicznego* Lublin, Wydawnictwo Geologiczne, (1970).
- [27] J. Stochlak, K. Zarębski, *Rozwój badań hydrogeologicznych w Centralnym Rejonie Węglowym LZW w okresie 1964-1981*. Instytut Kształtowania Środowiska Lublin, GIG Oddz. Terenowy Lublin

- [28] Spatial Development Plan of the Central Coal Region of the Lublin Coal Basin.
- [29] Resolution of the Council of Ministers no. 58/77 on the construction of a pilot-mining mine in the LZW, (1977).
- [30] Resolution of the Council of Ministers no. 34/88 on the suspension of the construction of the k-2 mine in Stefanów, (1988).
- [31] Resolution of the Sejm of the Polish People's Republic of December 18, 1976 on the five-year national socio-economic plan for the years 1976-1980. Journal of Laws of 1976 no. 39, item 226.
- [32] Resolution of the Council of Ministers no. 7/89 on suspension of financing the construction of the Bogdanka mine from central funds, (1989).
- [33] Regulation No. 10 of the Minister of Local Economy and Environmental Protection of January 20, 1974, on the establishment of a technical standard for the design of multi-family dwellings and residential buildings for non-agricultural people, „Dziennik Budownictwa“ (1974).