Degradation of urban space as a negative effect of mine closures

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Abstract. The article presents one of the social aspects of mine closure, which concerns degraded urban space. One of the post-industrial districts of Wałbrzych: Sobięcin was selected as a case study, in which the general condition of the buildings was assessed. The closure of mines is the last stage of mining activity, the result of which should be a permanent minimization of the negative consequences of the impact of the mining industry. The closure of mining enterprises has environmental, social and economic consequences. The liquidation of the Wałbrzych coal mines in the 1990s resulted in a rapid de-industrialization of the region and did not provide the means to contain the domino effect it caused. At that time, economic and social changes began in Wałbrzych, and unorganized and intense changes took place in the city space. Liquidation processes in the mining industry have led, among others, to the physical and aesthetic degradation of residential buildings and other facilities. The purpose of this article is to assess the general condition of buildings located in an area affected by the negative consequences of mine closures. To achieve this goal, an inventory of the technical condition of the buildings was made. The external elements of the building were assessed by means of a field interview: the facade, door and window joinery and roof covering. The inventory process was supported by drone flights. The collected data was used for graphic and tabular studies, summarizing the condition of buildings and the degree of degradation of urban space.

1. Introduction

The political transformation and the beginning of a free market economy in Poland have shown the problem of unprofitability and the need to restructure the hard coal mining industry [1]. Wałbrzych, which is part of the Lower Silesian Coal Basin, has been associated with coal mining for centuries and was the economic center of the region [2]. The complicated geological structure of the Basin determined both high exploitation costs and dangerous mining conditions, which threatened the life and health of miners [3]. The development of Wałbrzych Basin was also negatively affected by its location and large distance from other industrial and urban centers, as well as insufficient access to water and land routes that would enable the transport of the extracted coal [4]. The decision to stop mining and completely close the mines in the Wałbrzych region was officially dictated by economic reasons, and the basis for the liquidation of the coal industry in the Lower Silesian Coal Basin was the Resolution No. 1 of the Council of Ministers of October 23, 1990 [5,6].

The almost simultaneous closure of all hard coal mines in Wałbrzych: KWK Victoria, KWK Wałbrzych (formerly Chrobry) and KWK Thorez (formerly Julia) caused rapid de-industrialization...
and the beginning of economic and social changes in the city. The enormous scale of social problems was related primarily to the reduction in the income of the inhabitants, caused by a significant increase in unemployment in the region, which contributed to the increase in crime, mendicancy and alcoholism. Liquidation processes in the mining industry have also led to decapitalization and physical and aesthetic degradation of the housing substance and other facilities [7, 8].

Wałbrzych is one of the cities that have been given the status of a special intervention area and have been selected for the pilot of the revitalization program implemented by the Ministry of Development [7]. The program is designed to develop model solutions that will serve as an example of good practice for cities that implement or plan the revitalization process [9]. As part of the program, degraded areas and areas in need of revitalization have been designated [10-12]. The delimitation process was preceded by detailed urban analyzes aimed at diagnosing the social, economic, environmental, and spatial-functional condition [9].

The aim of this article is to present one of the negative effects of the liquidation of Wałbrzych mines in the social aspect, concerning the deterioration of the quality of infrastructure and degraded urban space. One of the post-industrial districts of Wałbrzych - Sobięcin was selected as a case study, in which the general condition of the buildings was assessed. The diagnosis is based on an original methodology based on a field interview. The collected data was used for graphic and tabular studies, summarizing the condition of buildings and the degree of degradation of urban space.

2. Literature review

The urban space is constantly changing. This process can be seen as beneficial when it is associated with economic progress and urban development [13], but also negative when the area is in a crisis state caused by interacting socio-economic factors [14]. Mass closures of workplaces, related to the economic crisis caused by the economic transformation that took place at the end of the 20th century, meant that to this day many Polish cities are struggling with the problem of a dilapidated and neglected urban space. For several years, the authorities of these cities have been working to rebuild degraded areas and overcome the socio-economic crisis [15, 16].

2.1. Revitalization of degraded area

Pursuant to the Revitalization Act [17], a degraded area is one that is in a crisis state due to the concentration of negative social phenomena, in particular unemployment, poverty, crime, high number of inhabitants with special needs (...), low level of education or social capital, as well as insufficient level of participation in public and cultural life, and its designation must be additionally supported by appropriate economic, environmental, spatial-functional or technical reasons. A degraded area, which is characterized by a particular concentration of negative phenomena, may be designated as an area of revitalization [17].

Until recently, there was no legal definition of revitalization in Poland, therefore the conceptual scope of this term was wide, but most often it referred to activities carried out in the existing urbanized space [18-20]. According to the Act introduced in 2015, revitalization should be understood as the process of recovering degraded areas from the crisis state. The Act defines the key legal regulations enabling the implementation of the revitalization process. Among other things, the Act introduced the obligation to establish a Revitalization Committee representing various stakeholder groups. The committee is an element of active social participation with a consultative and advisory function, and its task is to ensure communication and cooperation with the commune authorities [17].

Revitalization activities involve, among others, on the renovation and reconstruction of damaged urban infrastructure, and their main goal is, above all, to rebuild the bad image of degraded areas and overcome the socio-economic crisis [19]. According to [21], revitalization activities affect the surroundings of the revitalization area in three aspects:

- spot, relating directly to the objects subjected to revitalization,
- local, concerning the spatial zone in which these objects are located,
• general, concerning the area of the entire settlement unit in which the revitalization was carried out.

In the paper [22] it is emphasized that revitalization also includes complex problems related to environmental protection and development. In addition, remedial actions should be multidimensional and include spatial, economic, social and cultural aspects, so that revitalization is carried out effectively, as measured by social acceptance and the intensity of using a new form of spatial development [21].

The redevelopment of post-industrial facilities is a challenge for regions where industrial decommissioning processes have taken place. However, given the fact that the post-industrial heritage constitutes a certain social identity of the region, every effort should be made to strive for the most effective forms of protection of this heritage. Such activities are part of the concept of revitalization [23].

There are many examples of revitalized post-industrial urban spaces in the literature. The article [24] describes the process of revitalizing the complex of facilities of the former Łódź Power Plant, which led to the creation of a space with important cultural, artistic and educational functions. In [25] the author gives an example of the revitalized space of the former tram fleet repair shops in Glasgow. There, the post-industrial buildings were converted into the seat of the Tramway, which is one of the most popular Scottish cultural institutions. Another paper [26] describes good examples of revitalization activities that took place in Warsaw [26]. In Wałbrzych, a number of revitalization activities were also undertaken, the main being the protection of the post-industrial mining heritage and the creation of the Old Mine complex, operating on the site of the closed Thorez Coal Mine (former Julia). The post-mining infrastructure was adapted there for educational and cultural purposes [27].

2.2. Liquidation of Wałbrzych mines

For centuries, Wałbrzych has been an industrial center in which not only mining, but also metallurgy, coke and textile industry and porcelain production functioned [5]. The economy of the region, from the beginning of the 19th century to the 1990s, was based mainly on hard coal mining [15]. Wałbrzych was then a leading center of heavy industry in Lower Silesia [7]. The liquidation of the mines in Wałbrzych led to the closure of many other workplaces, both directly and indirectly related to the mining industry. The liquidation of, among others, CHP plants, coking plants and steel mills, led to the collapse of the city, both in economic and social terms [2].

As a result of rapid deindustrialization, Wałbrzych began to experience socio-economic problems on a huge scale. The negative phenomena related to the liquidation of the mining industry were related primarily to the increase in unemployment and the reduction of residents' incomes [7]. According to the study of the Institute of Urban Development (IRM) entitled "Initial concept of a pilot program for the city of Wałbrzych in the field of revitalization", the loss of approx. 20,000 workplaces in the coal industry, caused a sharp increase in unemployment. The percentage of the unemployed was the highest in 2002 (29.1%) and remained at a similar level to 2004. In 2005, a decrease in the number of unemployed was observed, which was mainly due to their reaching retirement age and the creation of new workplaces from the Wałbrzych Special Economic Zone. A significant number of people in search of employment emigrated abroad. According to estimates, migration movements contributed to the reduction of the city's population by 17.5 thousand inhabitants within 20 years. Wałbrzych is described as one of the fastest "shrinking cities" in Poland [9, 28].

According to the IRM study, the process of city shrinkage is multifaceted and includes:

• demographic aspect (reduction in the number of inhabitants),
• social aspect (family problems manifested, among others, by an increased scale of divorces, weakening of family ties and an increase in pathological behavior),
• economic aspect (limiting the city's income base),
• degradation of buildings (according to [29], the condition of 42% of municipal buildings in Wałbrzych is described as poor and bad, and an additional 17% requires demolition).
The closure of mining plants is associated with the abandonment of land and industrial facilities. Then unorganized and intense changes occur in the urban structure, which can be divided into three groups concerning:

- space - post-industrial areas usually occupying large areas, contributing to the transformation of the topography and the natural environment and negatively affecting the neighboring areas,
- infrastructure - post-mining remains, such as buildings, structures, shafts, heaps or installations that constitute a problem in the context of giving them new value and function,
- waste - landfill sites that contribute to surface pollution and its spread, and limit the possibility of management and reclamation of some areas [15, 30].

The abandonment of post-industrial objects and failure to provide them with adequate protection leads to their slow destruction, which results in permanent degradation and loss of elements of the heritage of a given region [27]. The Wałbrzych region is constantly struggling with socio-economic problems resulting from an improperly conducted mine liquidation process [31]. That is why it is so important to carry out revitalization activities that are designed to protect them from oblivion and destruction, and to give them a new function [23].

In 2004, coordinated revitalization activities began in Wałbrzych, aimed at comprehensive socio-economic and spatial renewal of degraded areas. The municipal government then adopted the "Local Program for the Revitalization of the City of Wałbrzych for the years 2004-2006 and subsequent years" [32].

As part of the Local Revitalization Program for 2008-2015, revitalization activities focused mainly on the Śródmieście area. At that time, a total of 59 projects were implemented there, which included the revitalization of housing, urban areas and social infrastructure, as well as 9 projects of a social nature [33, 34].

The Wałbrzych Commune was one of the first in the country to adopt a revitalization program based on the Revitalization Act introduced in 2015. In 2016 the Municipal Revitalization Program for the City of Wałbrzych for 2016-2025 was adopted. The program covers six revitalization sub-areas: Biały Kamięń, Stary Zdrój, Śródmieście and Sobięcin [35]. After the adoption of this program, in January 2017, the Wałbrzych City Council adopted Resolution [36] on the adoption of the Regulations specifying the rules for determining the composition and rules of operation of the Revitalization Committee. On April 11, 2017, the President of the City of Wałbrzych appointed 13 members of the Revitalization Committee [37]. The committee's task is to ensure the cooperation of stakeholders with municipal authorities in the field of regeneration activities. In May 2017, the Mayor of the City of Wałbrzych appointed 11 members of the Revitalization Committee for the second term of office [34, 38].

Wałbrzych, like Łódź and Bytom, were covered by the Ministry of Development pilot program, under which, among others, good practices, standards and activities as well as sample and model studies documenting the proper coordination of planning and revitalization activities have been developed [34].

3. Study area
The research area included one of the post-industrial districts of Wałbrzych - Sobięcin. It covers an area of 181 hectares and is inhabited by 6284 people [9]. Originally, Sobięcin was an independent town. It was incorporated into Wałbrzych after 1945. The research was carried out within the newly designated urban unit by the Wałbrzych City Hall for the purposes of revitalization activities. Two degraded inhabited sub-areas have been distinguished within this unit: Central and West Sobięcin.

According to the studies of the Municipal Office [9], Central Sobięcin is mainly residential and service areas, which are located along 1 Maja Street and are surrounded by wasteland, post-mining areas and a complex of operating coking plants. The condition of most housing development is described as bad, which is caused, among others, by long-term impact of coking plants and mining
damage. This sub-area has a diversified spatial structure, which results from the industrial nature of the surrounding areas. In its southern part there is a spatially homogeneous housing estate. West Sobięcin is located near Zachodnia Street, where a complex of multi-family residential buildings is located.

Within the Sobięcin unit a fragment of the area recognized as post-industrial degraded can be found. It is a small fragment of the adjacent area of a closed coal mine, constituting a complex of facilities for the Gwarek shaft and the no longer existing adit. Directly adjacent to Sobięcin is another post-industrial degraded area and it is the area of an inactive coal mine, located along 1 Maja Street, between Kolejarska and Dworcowa Streets [9].

The City Hall in Wałbrzych has designated sub-areas for revitalization. Pursuant to the Act on Revitalization in force, the revitalization process may cover an area not exceeding 20% of the commune's area, inhabited by no more than 30% of its inhabitants. Therefore, in Sobięcin, the degraded inhabited sub-area of Central Sobięcin was designated as the revitalization area.

The figure below (Fig. 1) shows a map illustrating: the border of the Sobięcin urban unit, the borders of the degraded inhabited sub-areas Central and West Sobięcin and the borders of the degraded post-industrial sub-areas (the topographic map is the base).

![Map of Sobięcin district showing degraded inhabited and postindustrial areas](image)

**Figure 1.** A map showing the degraded inhabited and postindustrial area in Sobięcin district (Source: own work using data from the BDOT10k and PRG databases and studies of the City Hall in Wałbrzych)

4. Materials and methods

   The general condition of the buildings was assessed as a result of an inventory of the technical condition through a field interview, which was carried out in May 2021. The external elements of the building were assessed: facade, door and window joinery and roof covering. The inventory process was supported by photographic documentation from drone flights.
The object class “buildings” was obtained from the Database of Topographic Objects (BDOT10k). Address points were obtained from the database of the State Register of Borders (PRG). Building cards were created on their basis and supplemented during the field interview. The table below (Table 1) presents the proposed building sheet. It consists of three parts to be assessed, each of them relating to a specific external element. Each element was assessed based on several criteria, which were assigned points corresponding to the scale of observed damage. A zero-one score was used for most criteria. In three cases, which represent significant damage to the building, 0 or 2 points were given.

### Table 1. Proposed building sheet (Source: own work)

| Street name and house number | Facade condition | | |
|-----------------------------|------------------|---|---|
| | Crack | Do not occur/Occur | 0/1 |
| | Damage and surface defects | Do not occur/Occur | 0/1 |
| | Deeper damage and cavities | Do not occur/Occur | 0/2 |
| | In need for insulation or painting | No/Yes | 0/1 |
| | Microbial contamination | Does not occur/Occurs | 0/1 |

| Door and window joinery condition | |
|-----------------------------------|---|
| Missed/Broken | No/Yes | 0/2 |
| In need for replacement | No/Yes | 0/1 |

| Roof covering condition | |
|-------------------------|---|
| Damage and losses of roofing | Do not occur/Occur | 0/1 |
| Microbial contamination | Does not occur/Occurs | 0/1 |
| In need for replacement | No/Yes | 0/2 |

The summed points were used to classify the general condition of the buildings. It was decided to use a five-point grading scale, in which the sum of the points given corresponds to a specific class (Table 2).

### Table 2. Classification of the general condition of the buildings (Source: own study)

| Summed points | Classification of the buildings |
|---------------|--------------------------------|
| 0-1 | no visible signs of deterioration |
| 2-3 | slight signs of deterioration |
| 4-7 | clear signs of degradation |
| 8-10 | significant signs of degradation |
| 11-13 | impossible to use and pose a threat |

There are 774 buildings in the study area, of which 635 were inventoried. It was decided to exclude garages and farms from the inventory, due to the fact that most of them are located on fenced private
properties. Additionally, the adopted assessment criteria would not be correct for these buildings. Table 3 presents the number of buildings in the area of inventory, distinguished by their type.

Table 3. Number of buildings in the area of inventory (Source: own study)

| Type of buildings                                      | Number of buildings subject to inventory |
|--------------------------------------------------------|-----------------------------------------|
| Single-family residential buildings                     | 278                                     |
| Two-apartment buildings                                 | 1                                       |
| Buildings with three or more apartments                 | 295                                     |
| Collective residence buildings                          | 3                                       |
| Hotel buildings                                         | 1                                       |
| Office buildings                                        | 6                                       |
| Commercial and service buildings                        | 6                                       |
| Garage buildings                                        | 35                                      |
| Industrial buildings                                    | 13                                      |
| Tanks, silos, and storage buildings                     | 13                                      |
| Buildings of museums and libraries                     | 1                                       |
| Buildings of schools and research institutions           | 11                                      |
| Buildings of hospitals and medical care facilities      | 4                                       |
| Farm buildings                                          | 104                                     |
| Buildings intended for religious worship and religious activities | 3                                       |
| Sum                                                    | 774 635                                 |

5. Results

Based on the inventory, it is stated that in the Sobiecin district, there are:
- 211 (33.2%) buildings with no visible signs of deterioration;
- 180 (28.3%) buildings with slight signs of deterioration;
- 207 (32.6%) buildings with clear signs of degradation;
- 32 (5.0%) buildings with significant signs of degradation;
- 5 (0.9%) buildings that are impossible to use and pose a threat. What is presented in the chart below (Fig. 2). Table 4 presents the assessment of the condition of buildings, distinguished by their type.
**Figure 2.** A chart showing the assessment of the condition of buildings (Source: own work)

**Table 4.** The assessment of the condition of buildings (Source: own work)

| Type of buildings                          | General condition of buildings (number of buildings) |
|-------------------------------------------|-----------------------------------------------------|
|                                           | no visible signs of deterioration | slight signs of deterioration | clear signs of degradation | significant signs of degradation | impossible to use and poses a threat |
| Single-family residential buildings        | 145                                  | 97                              | 35                          | 0                              | 1                                    |
| Two-apartment buildings                    | 0                                    | 0                               | 1                           | 0                              | 0                                    |
| Buildings with three or more apartments    | 40                                   | 70                              | 158                         | 26                             | 1                                    |
| Collective residence buildings             | 0                                    | 2                               | 1                           | 0                              | 0                                    |
| Hotel buildings                           | 1                                    | 0                               | 0                           | 0                              | 0                                    |
| Office buildings                          | 3                                    | 2                               | 1                           | 0                              | 0                                    |
| Commercial and service buildings           | 3                                    | 1                               | 2                           | 0                              | 0                                    |
| Industrial buildings                       | 7                                    | 2                               | 2                           | 1                              | 1                                    |
| Tanks, silos, and storage buildings        | 2                                    | 5                               | 2                           | 3                              | 1                                    |
| Buildings of museums and libraries        | 0                                    | 0                               | 1                           | 0                              | 0                                    |
| Buildings of schools and research institutions | 9                                  | 0                               | 1                           | 1                              | 0                                    |
| Buildings of hospitals and medical care facilities | 0                              | 1                               | 2                           | 1                              | 0                                    |
| Buildings intended for religious worship and religious activities | 1 | 0 | 1 | 0 | 1 |

| Sum                                       | 211                                  | 180                              | 207                         | 32                             | 5                                    |
6. Discussion

Interpreting the obtained results, it could be concluded that the degree of degradation of urban space is not significant, as the vast majority of inventoried buildings (61.5%) have no visible or small signs of deterioration. However, it should be borne in mind that the inventory was carried out in the entire urban unit and included the area not recognized as degraded by the City Hall, in which single-family residential buildings that are privately owned predominate. There are 278 single-family residential buildings in the inventoried area, which constitutes 43.8% of all buildings whose overall condition has been assessed. The chart (Fig. 3) presents the structure of the general classification of the condition of single-family residential buildings. It shows that 242 of these buildings have no visible or small signs of deterioration, accounting for over 87% of all single-family residential buildings.

![Assessment of the condition of single-family residential buildings in Sobięcin district (Wałbrzych)](chart1.png)

**Figure 3.** Assessment of the condition of single-family residential buildings (Source: own work)

It is important to note that as many as 159 multi-family residential buildings (consisting of those with three or more apartments and collective residence) show clear signs of degradation (Fig. 4). An additional 26 of them show significant signs of deterioration. They account for over 62% of all multi-family residential buildings.

![Assessment of the condition of multi-family residential buildings in Sobięcin district (Wałbrzych)](chart2.png)

**Figure 4.** Assessment of the condition of multi-family residential buildings (Source: own work)
In the analyzed area, almost 1/3 of industrial and storage buildings are heavily degraded. Four of the 26 buildings bear clear signs of degradation, another four – significant signs, and two of them are impossible to use and pose a threat.

There are also three buildings whose function is religious worship. One of them shows no signs of deterioration (Roman Catholic church), the other one shows clear signs of degradation (the cemetery chapel), while the third one is an abandoned Evangelical church and is impossible for use (Fig. 8).

The conducted field interview allowed to notice that the scale of the degradation of buildings is huge and reflects the crisis in the area. Most of the buildings in Sobiścin have cracked and damaged facades with stains and microbial contamination. In many buildings, doors and windows are missing. There are also buildings that are either in liquidation or in danger of collapsing. Figures 5-8 show the scale of degradation of buildings located in the post-industrial part of Wałbrzych. The photographs below show examples of damage to selected buildings.

Figure 5. Multi-family residential building with damaged and cracked facade with microbiological contamination
(Source: private archive)

Figure 6. Multi-family residential building with missing windows and defects in the facade
(Source: private archive)

7. Summary
Wałbrzych is still struggling with the socio-economic problems caused by the rapid de-industrialization of the region. The closure of the mines resulted in the closure of many other workplaces with a domino effect. In the social aspect, it led to unemployment and forced many families to break up due to economic emigration, which in turn contributed to an increase in emotional, family and educational problems, thus contributing to an increase in the number of divorces, alcoholism, crime and living in extreme poverty in the region. In the economic aspect, the outflow of people of working age from the region resulted in a reduction in the city's income, which contributed to the lack of funds for investments, e.g. in the renovation of degraded housing. There have been unorganized and intense changes in the aspect of urban space. The urban landscape is full of abandoned and devastated post-industrial facilities, and the housing development is degraded due to underinvestment, long-term impact of the mining and coke industry and pathological social behavior.
Revitalization activities should be carried out in a comprehensive manner and ensure that the entire space is restored to good condition. The comprehensive nature of revitalization should cover not only the technical condition of the facilities, but also a broad social, cultural and environmental aspect. Wałbrzych is one of the cities selected for the pilot of the revitalization program implemented by the Ministry of Development. The program is designed to develop model solutions that will serve as an example of good practice for cities that implement or plan the revitalization process. Many revitalization activities in the city have already been completed, however, Sobięcin is characterized by an extremely advanced degradation of the urban space, therefore bringing it to good condition will make the revitalization process both long and requiring significant financial outlays.

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[36] Uchwała nr XXXV/438/2017 Rady Miejskiej Wałbrzycha z dnia 12 stycznia 2017 r. w sprawie przyjęcia Regulaminu określającego zasady wyznaczania składu oraz zasady działania Komitetu Rewitalizacji

[37] Zarządzenie nr 269/2017 Prezydenta Miasta Wałbrzycha z dnia 11 kwietnia 2017 r. w sprawie wyznaczenia składu Komitetu Rewitalizacji

[38] Zarządzenie nr 290/2021 Prezydenta Miasta Wałbrzycha z dnia 17 maja 2021 r. w sprawie wyznaczenia składu Komitetu Rewitalizacji