

## DELIMITATION AND ANALYSIS OF AREAS SUITABLE FOR THE LOCATION OF ECONOMIC ACTIVITY IN THE WIELICZKA DISTRICT

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### Summary

The aim of this research was an attempt at selecting areas suitable for economic activity in the Wieliczka district (*powiat*) that would meet specific exclusion criteria and then to carry out an analysis of their investment attractiveness. Economic activity in this study includes investment objects that could negatively impact the environment and human health. A spatial database consisted of 39 thematic layers divided into 12 groups. Digital maps were taken from the Digital Library of Małopolska. Spatial delimitation was carried out with the use of Geographic Information System (GIS) and the MapInfo Professional 8 software. The analysis allowed to choose two areas suitable for economic activity in the Gdów and Wieliczka municipalities. The results of the study suggest that economic activity can be located in the selected area because it equipped with rich investment infrastructure enhancing its attractiveness for investors.

### Keywords

delimitation of areas • location of economic activity • Geographic Information System (GIS) • the Wieliczka district

### 1. Introduction

Spatial management, including spatial planning and land development, is a condition of normal development of territorial units and rational use and development of geographic space. Spatial management encompasses wide range of problems and ideas related to socio-economic human activity regarding space [Bajerowski 2003]. As a basic territorial system space can be identified with geography, geodesy, economy, economics, natural environment and society. The space quality can be described by means of measurable features, such as topography or soil quality, and by unmeasurable traits, such as aesthetics of the environment [Domański 2013].

The necessity of taking decision and solving planning and engineering problems concerns issues of spatial management on a national, regional and local level. The decision making process regarding the choice of best possible location is a difficult task, all the more when the planned objects are investments of possible significant impact on

the environment, specified in the Journal of Laws (Dziennik Ustaw) of 2013, item 1235 as amended [Rozporządzenie Rady... 2010]. The right solution to the location problem in this regard is conditioned by a desirable state of spatial management. According to the Spatial Planning and Land Development Act it is about ensuring spatial order, or such land development that would constitute a harmonious whole and meet the functional, socio-economic, environmental, cultural and structural and aesthetic determinants and requirements [Ustawa... 2003]. Spatial order is an indispensable element of sustainable development [Bański 2008]. Spatial delimitation is aimed to establish boundaries of particular areas. The essence of delimitation in this case consists in using selected exclusion criteria and identifying areas that meet these criteria and are suitable for location of economic activity.

'Suitability' means possibilities of fulfilling specific functions in properly selected areas. It will be determined by the direction of changes for its alternative development and consideration for ecology and human health.

The task can be accomplished by a widely used Geographic Information System (GIS), or digital system consisting of hardware, software and procedures, designed to aid collecting, managing, edition, analysing, modelling and visualizing spatial data to solve complicated planning and organizational problems [Cowen 1997].

The goal of the study was an attempt at choosing areas suitable for economic activity in the Wieliczka district. Economic activity in this study includes, among other things, investment objects – production and service ones – that could negatively impact the environment. Thanks to using GIS software, based on the chosen exclusion criteria, it would be possible to delimit these areas. The indicated areas would be subjected to an analysis of their investment attractiveness for the development of economic activity in these areas.

## 2. Research subject and methods

The area of research covered Wieliczka district, located in central part of the Małopolskie voivodeship and bordering directly on the Bochnia, Kraków and Myślenice districts. Geographically the area is situated within two regions: Northern Subcarpathia (Vistula Lowland, Bocheńskie Foothills) and Outer Western Carpathians (Wielickie Foothills). Mountain slopes and valley hillsides are covered with Quaternary deposits of various mineralogical composition [POŚPW 2013–2016]. The geology of the area confirms it is located within the Carpathian Foredeep and Carpathian Flysch Belt. The district has a rich hydrographic network, consisting of the Vistula and Raba basins and of high natural values [POŚPW 2013–2016]. Within the district there are Natura 2000 areas with the most valuable one – Niepołomice Forest. The total area of protected lands is 137.7 ha (without Natura 2000). Nature reserves take up 34.4 ha, and there are 66 nature monuments in the area [POŚPW 2013–2016]. The Wieliczka District, apart from natural and landscape values, has rich historical and cultural heritage, such as Wieliczka Salt Mine or a renaissance Royal Castle in Niepołomice.

The area was defined as problematic due to its high natural and landscape diversity. The choice of optimal location for economic activity must overcome many problems

resulting from, among other things, existing legal framework with regard to environmental protection and human health. A main factor considerably influencing the environmental quality and the standard of living of local community is the air quality. The optimal location should not contradict the adopted criteria in order to eliminate its potential impact on the environment. The prospect of rational and effective use of the environment would be one of the most important factors of socio-economic development, and an indicator of sustainable development.

Owing to spatial character of factors determining suitability of areas a GIS software was used together with collected spatial data in the form of thematic maps. The available source data for the Wieliczka district in the Małopolskie voivodeship was used in the study. The database was set up in MapInfo Professional 8 software based on the collected data. It consisted of thematic layers, divided according to the subject matter into 12 groups (Table 1). Each thematic layer contained only one kind of information. The developed model of database took into consideration various types of raster data. The data was acquired from the Digital Library of Małopolska.

**Table 1.** Database of spatial data

No.	Spatial Database	
1	Environmental protection	National parks, protection zones of national parks, landscape parks, protection zones of landscape parks, natural reserves, areas of protected landscape, core areas of Econet, special areas of conservation (SAC) of Natura 2000, special protection areas (SPA) of Natura 2000
2	Soil and forest resources	Forests, soils of I-III quality class, soils of IV quality class
3	Natural resources	Rivers
4	Protection and management of mineral deposits and groundwater	Main groundwater reservoirs, areas of high natural values, significant common minerals, common minerals of the highest quality, crude oil and natural gas, zinc and lead deposits, bituminous coal deposits
5	Communication links	Roads, railways, airports
6	Transport	Transport corridors of European, international and regional (I and II) importance
7	Technical infrastructure	Existing electricity systems, planned elements of electricity system, gas mains system, other existing transmission systems
8	Hydrological and flood control infrastructure	Existing large water retention reservoirs and the ones under construction, planned small retention reservoirs, flood protection reservoirs
9	Cultural heritage	Cultural resources
10	Historical monuments	Objects listed in the register of immobile monuments, major archaeological sites
11	Municipal waste management	Locations of municipal waste management plants, areas of impact of these plants
12	Administrative map	Border of the Wieliczka district, borders of communes

Source: author's study

At the beginning criteria of delimitation were chosen. The resource of descriptive information – metadata, or data describing data sets about the Wieliczka district – were defined by criteria characterized as elements excluding some areas from further search for locations (Table 2). Spatial delimitation based on these elements allows for the identification of areas suitable for location of investments that could negatively impact the environment (nature and men).

**Table 2.** Exclusion criteria

No.	Exclusion Criterion	Exclusion Elements
1	Spatial Development Plan for the Małopolskie voivodeship	Technical, municipal infrastructure
2	Environmental Protection Law	High natural values, significant common minerals, common minerals of the highest quality, crude oil and natural gas deposits, zinc and lead deposits, bituminous coal deposits, forests (deciduous and coniferous), national parks with their protection zones, landscape parks with their protection zones, nature reserves and their protection zones, core areas of Econet, special areas of conservation (SAC) of Natura 2000, special protection areas (SPA) of Natura 2000, soils of I–III and IV quality class
3	Nature Conservation Act	High natural values, significant common minerals, common minerals of the highest quality, crude oil and natural gas deposits, zinc and lead deposits, bituminous coal deposits, forests (deciduous and coniferous), national parks with their protection zones, landscape parks with their protection zones, nature reserves and their protection zones, core areas of Econet, special areas of conservation (SAC) of Natura 2000, special protection areas (SPA) of Natura 2000
4	Water Law	Rivers and main groundwater reservoirs
5	Forest Act	High natural values, forests (deciduous and coniferous), national parks with their protection zones, landscape parks with their protection zones, nature reserves and their protection zones, core areas of Econet, special areas of conservation (SAC) of Natura 2000, special protection areas (SPA) of Natura 2000
6	Health Resorts, Health Resort Areas, Health Resort Medical Care and Health Resort Communes Act	High natural values, forests (deciduous and coniferous)
7	Minister of Environment Regulation on requirements to be fulfilled by hydro-geological and geo-engineering documentation	Geological barrier

Source: author's study

The exclusion criterion refers to the legal framework concerning mainly environmental protection and human health. The legal factors are highly significant in plan-

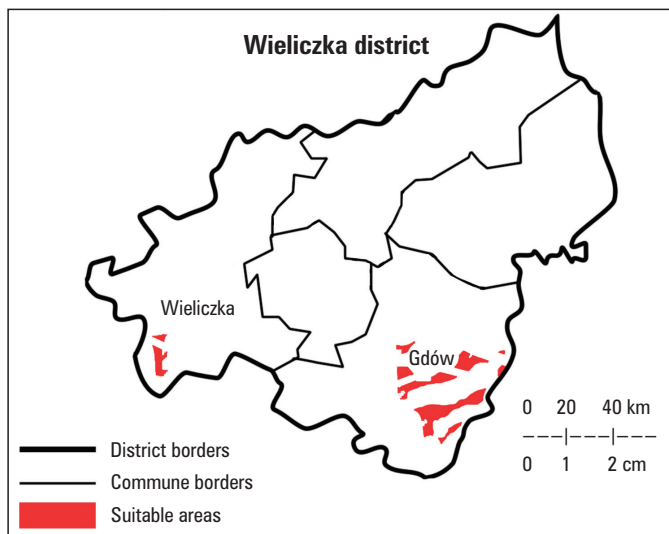
ning investments that may potentially affect the environment. Correctly chosen and properly applied exclusion factors will indicate the areas to be excluded from the study. The exclusion criteria comply with the legal regulations defined in the following acts: Environmental Protection Law; Nature Conservation Act; Water Law; Forest Act; Health Resorts, Health Resort Areas, Health Resort Medical Care and Health Resort Communes Act; Minister of Environment Regulation on requirements to be fulfilled by hydro-geological and geo-engineering documentation.

The attempt was made at spatial delimitation that used discriminant function (exclusion criteria). The work consisted in placing thematic layers on each other to obtain locations of area clusters suitable for economic activity. The procedure was carried out until the final result map was obtained. The identified areas could not contradict any of the adopted exclusion criteria. The analysis allowed to delimit and identify areas suitable for locating economic activity in the Wieliczka district.

The optimal area locations were analysed with respect to locating economic activity there.

### 3. Results

The definitive choice of location was a result of joining thematic layers with the use of discriminant function, which allowed for spatial analysis of all gathered data, and finally for creation of result layer in the map form. The final result map was generated (Figure 1).



Source: author's study

**Fig. 1.** Areas suitable for locating economic activity in the Wieliczka district

Two locations of area clusters suitable for economic activity in the Wieliczka district were identified. The greatest concentration of these areas was in the Gdów commune, and the smallest within the Wieliczka commune. The areas are mainly uplands of the Wieliczka district. The selected areas cover thematic layers that do not contradict the exclusion criteria. The exclusion elements include layers with the following thematic scopes: environmental protection, soil and forest resources, natural resources, protection and management of mineral deposits and groundwater, communication links, transport, technical infrastructure, hydrological and flood control infrastructure, cultural heritage, historical monuments, municipal waste management. It was evident that other lowland communes (Niepołomice, Biskupice, Kłaj) cannot be a place for economic activity and were defined as unsuitable areas.

Geographical conditions of the chosen areas suitable for location of economic activity, situated within the Gdów commune include: flatland (the central part of the commune) and upland (south-eastern and eastern part of the commune) parts of the area. The Gdów commune from the west borders on the Dobczyce commune, from the east on the Bochnia commune, from the south on the Łapanów commune, and from the north on Kłaj and Biskupice communes. Gdów is the largest commune of the Wieliczka district taking up 108 km<sup>2</sup> [OIGG 2013]. The forests take around 10% of the commune area. Surface water are the Raba river, streams, artificial ponds, pools and gravel excavations filled with groundwater [OIGG 2013]. The commune area are: arable lands (soils of III quality class – 70% of arable lands, II quality class – 12%, IV quality class – 35%) [OIGG 2013] and grasslands (III class – 40% of the grasslands, IV class – 35%) [OIGG 2013]. There are two working sewage treatment plants, technical and municipal infrastructure are very well developed, and waste is moved outside the commune. The Gdów commune has also a rich cultural and historical heritage [OIGG 2013].

The geographic conditions of areas suitable for economic activity identified in the commune of Wieliczka cover its south-western part. These are upland areas with diversified land relief [OIGG 2013]. The Wieliczka commune has the following administrative neighbours: from the north – Kraków and the communes of Świątniki Górne, Siepraw, Dobczyce, Biskupice, Niepołomice, and it takes up the area of 100.1 km<sup>2</sup> [SRGW 2007]. Land relief of the north part of the commune is not diversified, but its southern part is highly varied and intersected by numerous watercourses, ravines and wooded valleys. The main form of land use in the commune is agricultural one (arable lands, undeveloped green areas). The forests take up about 8% of the commune [SRGW 2007]. In the western part of the commune there is a landfill in Barycza, located on the border with Kraków. The main attraction of the commune is the Wieliczka Salt Mine.

Additionally, the selected communes: Gdów and Wieliczka are characterized by high investment attractiveness. They offer quite a good opportunity for the economic development.

The Gdów commune is located close to Kraków agglomeration and to important communication routes: Myślenice–Bochnia and Kraków–Wieliczka–Limanowa. The location of the commune at the centre of crossing voivodships roads may increase the

economic attractiveness of the region. When choosing an optimal location for investment quality of existing roads is also taken into account. The Gdów commune spares no effort to modernize their own roads and those managed by the district and voivodeship authorities [OIGG 2013]. The diversity of land relief can potentially affect the economic and tourist attractiveness of the commune [OIGG 2013]. The Gdów commune has also a solid territorial base to take actions leading to development of its economic potential – Special Economic Zone of the Kraków Technology Park – Subzone Gdów. The commune shows its readiness for foreign policies, economic infrastructure development and creation of new economic entities [OIGG 2013]. It possesses also many natural, cultural and aesthetic values.

The Wieliczka commune borders on Kraków and on southern motorway bypass [SRGW 2007]. It has very favourable communication links and is one of the best communicated communes in the Małopolskie voivodeship [SRGW 2007]. The Wieliczka commune is distinguished by a very well developed economic activity zone – The Wieliczka Economic Activity Zone. The area can be potentially a very attractive place for businessmen to make their investments related to production or services [SRGW 2007]. The proximity of the agglomeration of Kraków, good transport communication with the city and attractive landscape of the commune can positively contribute to the attractiveness of the area with respect to the development of housing construction [SRGW 2007].

The study confirmed that economic activity can be located in the indicated areas. The areas, with regard to the communes of Gdów and Wieliczka, have a rich investment infrastructure, which proves their economic attractiveness and of their potential for development in this respect.

#### 4. Conclusions

By using Geographic Information System it was possible to define areas suitable for locating economic activity in the Wieliczka district. In the process of delimitation the selection of spatial features proved a crucial issue. The selection must always be made depending on the goal of delimitation and on the availability of research material. As a result of including in the analysis specific exclusion criteria two optimal location for economic activity were obtained within the Gdów and Wieliczka communes. The communes can be optimal places for stimulating business activity. The character of the Gdów commune, its location and its well developed infrastructure network are sign of advanced development of their economic zone. The Wieliczka commune has an active agricultural and tourist economy. It confirms that economic activity can be located in the selected areas.

It should be pointed out that only data available for the Małopolskie voivodeship were taken into account in the study. In case of precise location of investment objects the results presented above should be supplemented with data available for specific communes and a character of the located object (planned investment) should be taken into account. The analysis needs to include detailed data on land and building register

and be adjusted to accurate directions contained in spatial development plans of studied communes. Moreover, a detailed analysis and assessment of environmental impact of planned investments should be carried out.

The results of the study showed that Geographic Information System can be a very effective tool in spatial analyses regarding the selection of optimal locations, making the process easier and faster. Well chosen spatial features and proper definition of exclusion criteria are conditions of correct delimitation of areas where optimal locations can be found.

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