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Dataset for the model of a municipality competitiveness in relation to the geothermal resources exploitation in Poland

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ABSTRACT

This dataset corresponds with the manuscript "The impact of geothermal resources on the competitiveness of municipalities: evidence from Poland" [1]. In the paper, the geothermal resources are assumed as a local competitive advantage for the municipalities that exploit them. In order to examine the relation between the exploitation of the geothermal resources and local competitiveness we determine a model of municipality competitiveness in Poland. Concept of the local competitiveness is referred to place-based measures (Lovering [2], Mytelka and Farinelli [3], Plummer and Taylor [4], Kitson *et al.* [5]) and it is related to the management of local resources (Malecki [6], Turok [7]). Literature review suggests that the local competitiveness is best reflected in the indicators of economic welfare and sustainability (Meyer-Stamer [8], Audretsch *et al.* [9]). Therefore, we use an expert method to build the model of a municipality competitiveness indicators on the example of Poland. Throughout the Analytical Hierarchy Process (AHP) method engaged experts select the 24 indicators of local competitiveness. This method serves in situations of a problem complexity (Kamenetzky [10], Saaty [11]) and as a multicriteria method in the regional studies (Dinc et al. [12]). Aggregation of the AHP selected indicators yields a synthetic competitiveness index for each of the

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municipalities that we examine. This index constitutes the model dependent variable in the related research article. This procedure of building municipality competitiveness model sets an example of approaching a complex phenomenon such as the local competitiveness definition. The versatility of this method enables its application into related research cases.

Specifications table

Subject	Renewable Energy, Sustainability and the Environment
Specific subject area	Social sciences in the context of renewable energy exploitation. Development of the local competitiveness concept determined by the endogenous indicators.
Type of data	Table Figure
How data were acquired	The data applied in the research addresses two constrains of the research problems: the construction of a local competitiveness model and the geothermal resource parameters of the exploitation. Socioeconomic indicators data to build the local competitiveness model are collected from the Local Bank Data, the largest in Poland database of information on the socio-economic, demographic, social and environmental condition describing voivodships, poviats and municipalities as entities of the social and administrative organization of the state. It is developed and maintained by the Central Statistical Office in Poland. We acquire the data for 11 geothermal municipalities and for 55 benchmark municipalities, i.e. 63 municipalities in total. The set of the raw data is collected for the years 1999-2017. This data serves to build the 24 socioeconomic indicators for each of the 63 municipalities in the given period. These indicators are further aggregated to a synthetic index using the Analytical Hierarchy Process (AHP) method by using the *Super Decision* software. The geothermal exploitation data in the geothermal municipalities is a primary data obtained directly from the local geothermal plants. It is represented in the GJ units and due to the restrictions of the data providers and its non-public character is kept unpublished.
Data format	Raw Filtered Aggregated Analysed
Parameters for data collection	The raw data contains 3024 records that are further used to build 24 socioeconomic indicators for 63 municipalities for the time frame 1999-2017 years. The raw data is collected from one source, the Local Data Bank. The procedure of the AHP determines the indicators model including the weight assessment for each model component. As a result, we obtain a synthetic index of competitiveness for each municipality. The essence of the APH method is an expert questionnaire. The biggest constrain about the AHP method is the experts selection and building a questionnaire that assures the consistency of replies. The method requires a number of experts to determine the local competitiveness data model. We reached personally to the experts' group and monitored the process of filling each AHP questionnaire. The geothermal exploitation data constitutes a primary collected data, and since it is restricted information, offered by the courtesy of the geothermal enterprises, it had to be processed anonymously in the model.

(*continued on next page*)

Description of data collection	We asked the regional economics experts to assess the indicators that represent the competitiveness of a municipality, on the example of Poland. Furthermore, using AHP method questionnaire we approached a larger group of experts (the batch of 20 persons) to establish the hierarchy among the competitiveness indicators yielding a weights model. The AHP experts constitute a mixed group of theorists (regional economists) and practitioners (geothermal municipalities' representatives). Geothermal data for the geothermal GJ units production variable is collected directly from the local geothermal enterprises and constitute a primary data. The data about the geothermal recreational centres is advised from the same geothermal entities and supplemented from a dedicated website (www.termalni.pl).
Data source location	Country: Poland Local Data Bank https://bdl.stat.gov.pl/BDL/start http://termalni.pl Geothermal enterprises: Geotermia Mazowiecka SA, Geotermia Uniejów LLC, Geotermia Poddębice LLC, Geotermia Podhalańska SA, Bukowina Geothermal Society LLC, Geotermia Grudziądz LLC, Geotermia Pyrzyce LLC, Geotermia Stargard LLC.
Data accessibility	Repository: Mendeley Data Kurek, Katarzyna A., Heijman, W., van Ophem, J., Gędek, S., & Strojny, J. (2020), "Dataset for the model of municipality competitiveness in relation to the geothermal resources exploitation in Poland.", Mendeley Data, V2, http://dx.doi.org/10.17632/zfndmn3f55.2
Related research article	Kurek, K. A., Heijman, W., van Ophem, J., Gędek, S., & Strojny, J. (2020). The impact of geothermal resources on the competitiveness of municipalities: evidence from Poland. *Renewable Energy, 151*, 1230-1239.] https://doi.org/10.1016/j.renene.2019.11.126

Value of the Data

- The dataset proposes a conceptualization of local competitiveness that is unobserved in existing literature. Since the local competitiveness definitions vary among scholars, we provide an approach that bases in the local experts and local data assessment. Our approach presents a method to develop a single measure of the local competitiveness i.e. the competitiveness index.
- The development of the index allows for a transparent comparison and analysis of the competitiveness level for the selected municipalities.
- The data selected for describing the local competitiveness phenomenon represents a spectrum of municipality performance measures. The socioeconomic indicators grouped in six categories of: demographic dynamics, local economy references, state of public finances, tourism activities, infrastructure development and level of life standards illustrate a complex and practical overview of a municipality competitive condition.
- The choice of the socioeconomic data is determined by the availably of the data in the Polish Central Statistical Office database.
- Moreover, the group of experts has indicated the data structure of the local competitiveness model. It is additionally justifying the choice of the socioeconomic indicators that refer to the local competitiveness concept.
- The data in such set is available for any municipality in Poland; therefore the model is replicable for other, related studies and disciplines. It allows observing the competitiveness indicators for an examined municipality as well as for comparisons of municipalities. The selection of socioeconomic indicators can be as well adjusted to examine regional or national competitiveness, not limited to Poland. Moreover, application of the proposed data and competitiveness index serves for any other research that requires local competitiveness measures.
- The given dataset reveals relevant simplicity in collection procedure and broad availabilities for interpretation. It is as well a non-costs generating method because the raw data in case

of the Central Statistical Office in Poland on this level of availability is free of charge and located online.

- This type of data composition is not found in the existing literature or in the data repositories. Yet, we conceptualise a new research problem using available and affordable sources. As a result, we deliver a comprehensive model of local competitiveness. This data can be used in any research projects related to the concept of competitiveness on the municipalities level.
- The additional value of this data is the uncommon approach i.e. the use of the Analytical Hierarchy Process in the development of the local competitiveness model, a method taken from the management sciences and project appraisal. Moreover, we introduce the role of benchmarking to the local competitiveness measuring procedure.

1. Data Description

The main assumption about the geothermal resources impact on local competitiveness in Poland (Kurek *et al.* [1] requires appropriate data. Hence, the data selection is a decision making process. It mainly concerns the dataset that is available and comparable at the given level and in the same time reflects on the competitiveness performance. In case of our research problem, the dataset had to reflect on the local competitiveness indicators on a municipality level. We operationalize the problem of local competitiveness by the help of experts using the Analytical Hierarchy Process (AHP). Based on a hierarchical structure, this method developed by Saaty [11] serves for managing qualitative and quantitative multi-criteria elements involving in a decision-making behaviour. The decision about the structure of the data model boils down to the pairwise comparisons delivering the matrix of experts answers. The model of 24 socioeconomic indicators determining the local competitiveness is included in the example of the AHP expert questionnaire in the Figure 2 below. The raw data extracted from the Local Data Bank online source that served to design the socioeconomic indicators model is available in the data repository, accessible by the dedicated data article (Kurek [13]). The data in the Local Data Bank allows for collection of systematized values in the selected sections. Therefore, a risk of unclassified data or sources is eliminated. Included in the Figure 2, the matrix of 24 diagnostic socioeconomic indicators grouped in six categories and related four subcategories is determined by the experts. It sizes municipality competitiveness on the level of local demographic structure, entrepreneurship, condition of public finance, expansion of local infrastructure and level of life measures. The period of data collection regards to years 1999-2017, since the year 1999 brought the administrate reform in Poland that introduced a *poviat* unit. The poviat is a superior administrative area to a municipality in Poland, and two control variables of the main model in the related research article refer to the data collected on the poviats levels (Table 1 at Kurek *et al.* [1]). The same source of the Local Data Bank was used for these poviat variables.

Since the related research article (Kurek *et al.* [1]) aims to compare the local competitiveness index among the municipalities that use the geothermal resources and municipalities without the geothermal activities, the selection of Polish municipalities refers to 11 geothermal municipalities in Poland and additional 55 municipalities that were matched according to the benchmark principle (Strojny [14]). Therefore, each of the geothermal municipality receives a group of five benchmark municipalities. The condition of the benchmarks selection required: the same administrative classification of a municipality, location within the same poviat, comparable size of inhabitants and economic profile. The data for the benchmarked municipalities is as well sourced in the same Local Data Bank database, and it is presented in the dataset (Kurek [13]). The selection of the geothermal locations is limited to the municipalities that exploit the geothermal resources for a minimum of 5 years and captured in the Table 2 at Kurek *et al.* [1]. Therefore, the socioeconomic data is collected for the selection of 63 municipalities. The following Figure 1 presents the map of geothermal activities in Poland with the location of the geothermal municipalities.

The Analytical Hierarchy Process experts comparisons in pairs yield weights assessment for each of the indicators (Table 4 at Kurek *et al.* [1]). This procedure of generating the weights is

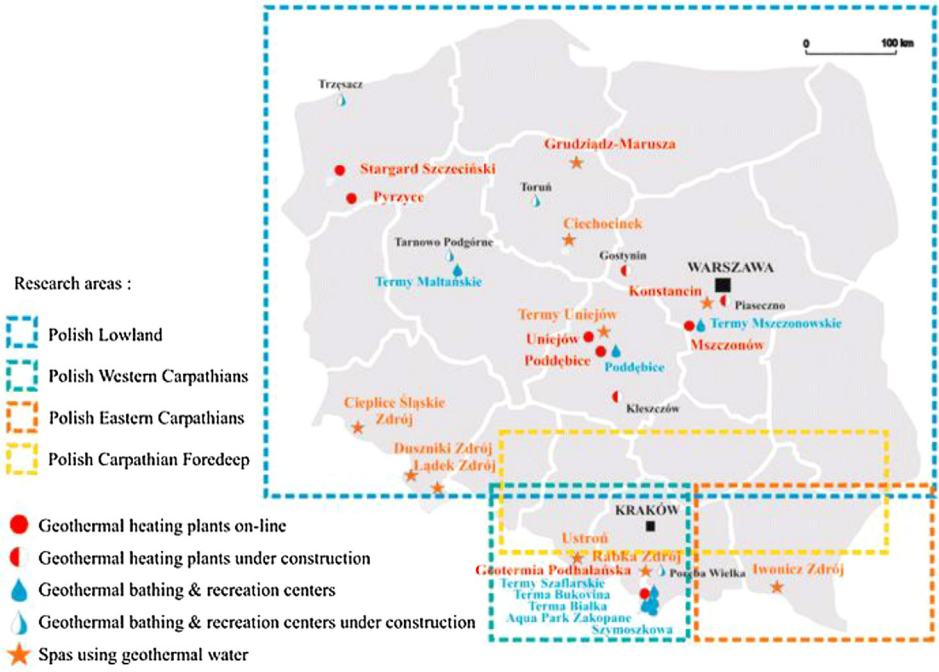

Figure 1. The map of geothermal activities in Poland including the geothermal bathing and recreational centers (Górecki *et al.* [15]).

possible by using a specially designed questionnaire, which is further distributed to experts (Figure 2). Each decision maker fills in questionnaire and then all the individual expert judgments are converted into the group judgments (for each one of the pair comparison) using their geometrical average. The scale ranges from 1 to 9, where 1 implies that the two elements are the same or are equally important. On the other hand, 9 implies that one element is extremely more important than the other one in a pairwise matrix. The pairwise scale and the importance value attributed to each number are explained in the Figure 2.

By the aggregation procedure (Formula 2 at Kurek *et al.* [1]) the indicators weighted by the AHP method generate the synthetic local competitiveness index. This procedure repeats for each of the examined municipalities. As a result of the aggregation computations, each of the geothermal municipalities and the benchmark municipalities receive the competitiveness index (*CI*), a singular indicator of competitiveness for each of the observed years 1999-2017. The *CI* places in the 0-1 range, where 1 represents the highest score of the municipality competitiveness throughout the observed time period. The *CI* determines the level of the municipality competitiveness and is used to build the dependent (y) and the independent model variable (x3) in the description of model variables in the Table 1 at Kurek *et al.* [1]. Furthermore, the other independent model variables x4 and x5 are sourced in the Local Data Bank, whereas the variables x1 and x2 are obtained directly from the listed in the Table 2 at Kurek *et al.* [1] geothermal enterprises. These two have a non-public character. The scores of the local competitiveness indexes for the observation of selected geothermal municipalities and the assembled score for the benchmark municipalities are presented in the Table 5 at Kurek *et al.* [1].

This selection of the local competitiveness data on the example of Polish municipalities is originally presented in our study. Nevertheless, it is not limited to the subject of the related research article. It as well reveals a potential of application into analysis that require definition of a local competitiveness in Poland.

2. Experimental Design, Materials, and Methods

The Analytical Hierarchy Process tool i.e. the questionnaire distributed to the 20 experts is elaborated by the dedicated software *Super Decisions* (version 3.2). The attention is paid to the important element of the AHP analysis i.e. the Consistency Ratio (CR) coefficient that verifies the internal consistency of experts' judgements in pairs (Saaty [16]). The acceptable CR score should be lower than 0.10 to justify the outcomes of the experts judgements. It therefore indicates the significance of the responces.

The example of the questionnaire distributed among the experts is presented as the Figure 2. It starts with the introduction section that is meant to explain the tool, and purpose of acquiring an expert opinion. The experts were approached beforehand the questionnaires distribution and invited to participate in the AHP research. The local competitiveness indicators matrix that is to be assessed by the experts initiates the questionnaire. Thereafter, the questionnaire is designed in seven sections that each contains the corresponding decisive problem related to the local competitiveness model structure represented by the Table 3 at Kurek *et al.* [1]. The experts evaluate each of the section giving a judgement to each pair of given indicators. The method generates the weights model (Table 4 at Kurek *et al.* [1]) for each of the socioeconomic indicators that are set to describe the local competitiveness (Table 3 at Kurek *et al.* [1]). This AHP questionnaire is not presented in the accompanying research article.

Figure 2: Expert questionnaire: Defining indicators of local competitiveness.

Introduction: A part of the Analytical Hierarchy Process method is this expert questionnaire. We believe that you are an expert in the field of regional economics and that is why your answers are crucial for the study. Based on the experts' answers, we set a hierarchy of indicators that, according to respondents, reflect the potential of local competitiveness and should be taken into account when investigating the impact of the geothermal resources. Six categories have been identified representing the general level of a municipality competitiveness in Poland. Each group consists of four building indicators (subcategories). These indicators are based on a data collected from the Central Statistical Office in Poland (https://stat.gov.pl). The table of municipality competitiveness indicators represents the indicators model based in the six competitiveness categories with four indicators each. Below, tables 1-7 are the matrixes of competitiveness' indicators questions allowing to assess your opinion. We kindly ask you to answer each of them according to a nine-point scale (the Saaty scale). In the Legend section attached to the table of municipality competitiveness indicators you find instructions for answering the 1-9 scale. Answering every question is a choice between two indicators. Please specify in the given pairs which indicator is more important or equal from your point of view on the local competitiveness. Your contribution to this study is very valuable and we thank you in advance for your cooperation.

INDICATORS OF MUNICIPALITY COMPETITIVENESS Model of the synthetic competitiveness indicator (CI) *categories*					
Population (C_p)	Economy (C_e)	Local government (C_g)	Tourism (C_t)	Infrastructure (C_i)	Level of life (C_l)
subcategories					
Internal migration/ 10.000 inhabitants (C_p1)	% of employed inhabitants (C_e1)	Own municipality income/inhabitant (C_g1)	Polish tourists accommodated/1000 inhabitants (C_t1)	Industrial and domestic water consumption /inhabitant (C_i1)	Out-Patient health care facilities/10.000 inhabitants (C_l1)
Natural increase/ 10.000 inhabitants (C_p2)	No of private economic activities (C_e2)	Municipality investment expenses/ inhabitant (C_g2)	Foreign tourists accommodated/1000 inhabitants (C_t2)	Cubic volume of delivered buildings / inhabitant (C_i2)	Environmental protection investment/inhabitant (C_l2)
% of population in productive age (C_p3)	No of national commercial companies (C_e3)	PIT income/ employed inhabitant (C_g3)	Tourism accommodation establishments/1000 inhabitants (C_t3)	Km of water-supply and sanitation network/inhabitant (C_i3)	Primary and lower secondary education expenses/pupil (C_l3)
Birth rate (C_p4)	No of commercial companies with foreign capital (C_e4)	Budget deficit/ inhabitant (C_g4)	Overnights spent (C_t4)	Residential water system connections /inhabitant (C_i4)	% of population connected to wastewater treatment plants (C_l4)

LEGEND
1 – Both criteria have the same impact on the choice
3 – One criterion is slightly more important than the other
5 – One criterion is more important than the other, but the advantage is at an average level
7 – One criterion is clearly more important than the other
9 – One criterion is much more important than the other

1. Which dimensions of the endogenous potential of a municipality is the most important from the point of view of its competitiveness?
(mark the value of your choice)

Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
Population (C_p)	9	7	5	3	1	3	5	7	9	**Economy (C_e)**
Population (C_p)	9	7	5	3	1	3	5	7	9	**Local government (C_g)**
Population (C_p)	9	7	5	3	1	3	5	7	9	**Tourism (C_t)**
Population (C_p)	9	7	5	3	1	3	5	7	9	**Infrastructure (C_i)**
Population (C_p)	9	7	5	3	1	3	5	7	9	**Level of life (C_l)**
Economy (C_e)	9	7	5	3	1	3	5	7	9	**Local government (C_g)**
Economy (C_e)	9	7	5	3	1	3	5	7	9	**Tourism (C_t)**
Economy (C_e)	9	7	5	3	1	3	5	7	9	**Infrastructure (C_i)**
Economy (C_e)	9	7	5	3	1	3	5	7	9	**Level of life (C_l)**
Local government (C_g)	9	7	5	3	1	3	5	7	9	**Tourism (C_t)**
Local government (C_g)	9	7	5	3	1	3	5	7	9	**Infrastructure (C_i)**
Local government (C_g)	9	7	5	3	1	3	5	7	9	**Level of life (C_l)**
Tourism (C_t)	9	7	5	3	1	3	5	7	9	**Infrastructure (C_i)**
Tourism (C_t)	9	7	5	3	1	3	5	7	9	**Level of life (C_l)**
Infrastructure (C_i)	9	7	5	3	1	3	5	7	9	**Level of life (C_l)**

(*continued on next page*)

2. Which social potential parameters (dimension: Population) are the most important from the point of the municipalities' competitiveness?
(mark the value of your choice)

Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
Internal migration/ 10.000 inhabitants (C_p1)	9	7	5	3	1	3	5	7	9	Natural increase/ 10.000 inhabitants (C_p2)
Internal migration/ 10.000 inhabitants (C_p1)	9	7	5	3	1	3	5	7	9	The percentage of population in productive age (C_p3)
Internal migration/ 10.000 inhabitants (C_p1)	9	7	5	3	1	3	5	7	9	Birth rate (C_p4)
Natural increase/ 10.000 inhabitants (C_p2)	9	7	5	3	1	3	5	7	9	The percentage of population in productive age (C_p3)
Natural increase/ 10.000 inhabitants (C_p2)	9	7	5	3	1	3	5	7	9	Birth rate (C_p4)
The percentage of population in productive age (C_p3)	9	7	5	3	1	3	5	7	9	Birth rate (C_p4)

3. Which parameters of the economic potential (dimension: Economy) are the most important from the point of the municipalities' competitiveness?
(mark the value of your choice)

Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
The percentage of employed inhabitants (C_e1)	9	7	5	3	1	3	5	7	9	No of private economic activities (C_e2)
The percentage of employed inhabitants (C_e1)	9	7	5	3	1	3	5	7	9	No of national commercial companies (C_e3)
The percentage of employed inhabitants (C_e1)	9	7	5	3	1	3	5	7	9	No of commercial companies with foreign capital (C_e4)
No of private economic activities (C_e2)	9	7	5	3	1	3	5	7	9	No of national commercial companies (C_e3)

(*continued on next page*)

No of private economic activities (C_e2)	9	7	5	3	1	3	5	7	9	No of commercial companies with foreign capital (C_e4)
No of national commercial companies (C_e3)	9	7	5	3	1	3	5	7	9	No of commercial companies with foreign capital (C_e4)
4. Which parameters of the institutional capacity of local government (dimension: Local government) are the most important from the point of the municipalities' competitiveness? (mark the value of your choice**)**										
Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
Own municipality income/inhabitant (C_g1)	9	7	5	3	1	3	5	7	9	Municipality investment expenses/ inhabitant (C_g2)
Own municipality income/inhabitant (C_g1)	9	7	5	3	1	3	5	7	9	PIT income/ employed inhabitant (C_g3)
Own municipality income/inhabitant (C_g1)	9	7	5	3	1	3	5	7	9	Budget deficit (C_g4)
Municipality investment expenses/ inhabitant (C_g2)	9	7	5	3	1	3	5	7	9	PIT income/ employed inhabitant (C_g3)
Municipality investment expenses/ inhabitant (C_g2)	9	7	5	3	1	3	5	7	9	Budget deficit (C_g4)
PIT income/ employed inhabitanC_g3)	9	7	5	3	1	3	5	7	9	Budget deficit (C_g4)
5. Which tourism potential parameters (dimensions: Tourism) are the most important from the point of the municipalities' competitiveness? (mark the value of your choice)										
Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**

(*continued on next page*)

Polish tourists accommodated/1000 inhabitants (C_t1)	9	7	5	3	1	3	5	7	9	Foreign tourists accommodated/1000 inhabitants (C_t2)
Polish tourists accommodated/1000 inhabitants (C_t1)	9	7	5	3	1	3	5	7	9	Tourism accommodation establishments/1000 inhabitants (C_t3)
Polish tourists accommodated/1000 inhabitants (C_t1)	9	7	5	3	1	3	5	7	9	Overnights spent (C_t4)
Foreign tourists accommodated/1000 inhabitants (C_t2)	9	7	5	3	1	3	5	7	9	Tourism accommodation establishments/1000 inhabitants (C_t3)
Foreign tourists accommodated/1000 inhabitants (C_t2)	9	7	5	3	1	3	5	7	9	Overnights spent (C_t4)
Tourism accommodation establishments/1000 inhabitants (C_t3)	9	7	5	3	1	3	5	7	9	Overnights spent (C_t4)
6. Which infrastructure potential parameters (dimensions: Infrastructure) are the most important from the point of municipalities' competitiveness? (mark the value of your choice)										
Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
Industrial and domestic water consumption /inhabitant (C_i1)	9	7	5	3	1	3	5	7	9	Cubic volume of delivered buildings / inhabitant (C_i2)

(*continued on next page*)

Industrial and domestic water consumption /inhabitant (C_i1)	9	7	5	3	1	3	5	7	9	Km of water-supply and sanitation network/inhabitant (C_i3)
Industrial and domestic water consumption /inhabitant (C_i1)	9	7	5	3	1	3	5	7	9	Residential water system connections /inhabitant (C_i4)
Cubic volume of delivered buildings / inhabitant (C_i2)	9	7	5	3	1	3	5	7	9	Km of water-supply and sanitation network/inhabitant (C_i3)
Cubic volume of delivered buildings / inhabitant (C_i2)	9	7	5	3	1	3	5	7	9	Residential water system connections /inhabitant (C_i4)
Km of water-supply and sanitation network/inhabitant (C_i3)	9	7	5	3	1	3	5	7	9	Residential water system connections /inhabitant (C_i4)

(*continued on next page*)

7. Which level of life increase potential parameters (dimensions: Level of Life) are the most important from the point of the municipalities' competitiveness?
(mark the value of your choice)

Factor	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Factor**
Out-Patient health care facilities/10.000 inhabitants (C_I1)	9	7	5	3	1	3	5	7	9	Environmental protection investment/inhabitant (C_I2)
Out-Patient health care facilities/10.000 inhabitants (C_I1)	9	7	5	3	1	3	5	7	9	Primary and lower secondary education expenses/pupil (C_I3)
Out-Patient health care facilities/10.000 inhabitants (C_I1)	9	7	5	3	1	3	5	7	9	Population connected to wastewater treatment plants (C_I4)
Environmental protection investment/inhabitant (C_I2)	9	7	5	3	1	3	5	7	9	Primary and lower secondary education expenses/pupil (C_I3)
Environmental protection investment/inhabitant (C_I2)	9	7	5	3	1	3	5	7	9	Population connected to wastewater treatment plants (C_I4)
Primary and lower secondary education expenses/pupil (C_I3)	9	7	5	3	1	3	5	7	9	Population connected to wastewater treatment plants (C_I4)

Thank you for completing the questionnaire!

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The data selection and model is consulted with the regional economics experts of the Rzeszów University of Technology in Poland, the Department of Economy.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.105687.

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