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TRENDS IN THE LEVEL OF THE COMPONENTS OF THE ENVIRONMENTAL SUSTAINABLE DEVELOPMENT'S ORDER IN RURAL AREAS IN YEARS 2005-2015

Abstract: The aim of the elaboration is presenting the dynamics and the ways of changes in the level of the chosen environmental order's parameters in the context of implementation of sustainable development in the rural areas of Wielkopolska in the years 2005-2015. The research proceedings consisted of three stages: choosing the factors describing the thematic areas of the environmental order, analysis of the dynamics of particular components of the environmental order and constructing a ranking of the counties . The results of the research indicated that the largest development in implementing the sustainable development in the range of the chosen five components of the environmental sustainable development's order was made in the Koło county. The demanded direction and the rate of the changes characterized the Kępno, Złotów, Pleszew and Międzychód counties, however, none of those counties was the pioneer in reference to the studied factors. The analysis also enabled selecting the areas in which the actions related with the idea of sustainable development should be intensified. In the Gniezno, Gostyń, Czarnków-Trzcianka, Kalisz and Chodzież counties the unfavorable trends were observed.

Key words: sustainable development, environmental domain, rural area, Wielkopolskie voivodeship, dynamics

INTRODUCTION

The sustainable development in an interdisciplinary and complex approach which allows for a system solution of the problems from various areas and helps to provide a long-term and constant increase. The most relevant aspects of the sustainable development are: harmonization of the social-economic development with the natural environment, rational use of the environmental resources, lack of the actions leading to the irreversible changes in the environment, the necessity to self-limit of the units and societies, the increase and maintenance of the high quality of life (of the current and future generations), limiting the unfavorable influence of the human activity on the environment and on shaping the appropriate proportions between the ecological, social and economic dimensions (Roszkowska, Karwowska 2014). Those aspects result from two constitutive ideas of the sustainable development, which are the satisfaction of the basic needs and the limitation of the resources. The measurement of the progress in pursuit and achievement of sustainable development is the integral part of the EU Sustainable Development Strategy. In Poland there is lack of a separate country sustainable development strategy, however, in various strategic documents in the long-term perspective the social-economic aims and the directions of the actions according to the constant and sustainable development were determined (Dolata 2015), taking into consideration the social, economic and ecological cohesion, which became the basis for selection of the factors monitoring their implementation.

However, implementation of the idea of sustainable development is a complex process in practice (Abele, Gútpinter, Koenig, Kruszka, Sum 2010). Its' prime element is the measurement of the actual condition and the ability to assess if it is characterized by the durability or not. In order to make such an assessment, the factors of sustainable development are used (Dobrzańska 2009). They constitute an information-diagnostic tool facilitating the assessment and managing the social,

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economic and environmental spheres on the local, regional and national levels[6]. The factors of sustainable development are the signal informing about the current condition, they allow to measure the changes. In monitoring of the effectiveness of the undertaken actions, one factor should be especially important, namely the progress made by the regions in the process of striving for the determined aims or its' lack. Therefore, in determining the tendencies describing the direction of those changes (development) the trends, which additionally may indicate the distance devising the particular areas from the reaching the expected condition, turn out to be necessary. Observation of the factors and trends allows to react on the emerging problem situation before it gets stronger.

This assumption and the need to monitor the components of the sustainable development and the problems connected with that became the basic premises of this elaboration. Those issues take on special significance in reference to the rural areas which in Poland occupy over 93% of the country area and culminate various valuable natural public goods, fulfilling the basic environmental functions for the whole country (Dolata, Jaworska 2018). Thus, the aim of this research is to present the dynamics and the direction of the changes in the level of chosen parameters of the environmental order in the context of implementing the conception of the sustainable development in the rural areas of Wielkopolska in years 2005 – 2015.

The difficulties which in reality take place in the process of implementing the concept of sustainable development imply unceasing necessity to take actions contributing to the development of the education and practice in this range. In Polish literature the issues connected with the level of sustainability were presented m. al. by Poskrobko (2010, 2011, 2012), Borys (2002) and by Piontek (2002). The important elaboration on sustainable development with the central theme related to use and protection of the natural environment is the Burchard-Dziubińska, Rzeńca and Drzazga's monograph (2014). The issues connected with the environment's protection are also considered separately by other authors. The problems of participation in sustainable development which concernr the rural areas were presented m. al. by Adamowicz (2000, 2006) and Stanny and Czarnecki (2010), Dolata (2015), and the regional recognition of the ratio analysis of the environmental order was used by Przybyłowski and Kałaska (2013) and Becla (2011).

According to M. Stanny, the methodology used to determine the level of sustainable development is still disappointing, and the concept of its' measurement are far from satisfactory (2011). The attempt to evaluate the level of the sustainable development was taken also by: Kusterka (2005), Roszkowska and Karwowska (2014) and Sokolowska and Filipowicz-Chomko (2015). Florczak reviewed the factors used in the record and monitoring of implementing the rules of the sustainable development, taking into account its' social-economic and ecological aspects, simultaneously approximating the practical problems connected with the measurement of the eco-development (2008). Furthermore, the economic aspects of the sustainable development were presented m. al. by Bal-Domańska and Wilk (2001).

OBJECTIVE, MATERIALS AND METHODOLOGY

In order to meet the objective, the empirical ex post analysis (2005-2015) of the value of the factors describing the environmental order was used, using the selected methods of the descriptive statistics dedicated to the analysis of the dynamics of the economic phenomena: one of the basic indexes of the dynamics: $i_{\frac{n}{0}} = {}^{y_n}/_{y_0}$, where y_0 means the value in the base year, yn means the

[6] The factors of sustainable development, they take into account 7 key fields: (1) the climate changes and pure energy, (2) sustainable transport, (3) diversified consumption and production, (4) protection and management of the ntural resources, (5) public healt, (6) cial integration, demography and migration, (7) challenges connected with the global poverty and sustainable development (The CSO factors of sustainable development). The current set of factors in the conception made by EU contains over 130 factors (Sustainable development in the European Union 2015).

value in the researched year, the chain dynamics indexes: $i_{\frac{n}{n-1}} = {}^{y_n}/_{y_{n-1}}$ allowing to evaluate the changes of the researched phenomenon between the highlighted periods (years) and the mid-term rate of changes (T), which enables evaluating the changes in the whole period covered by observation. It has been calculated using the geometric mean:: $T = (\overline{y_g} - 1) \times 100$, gdzie $\overline{y_g} = \sqrt[n-1]{\prod_{i=2}^{n} \frac{y_i}{y_{i-1}}}$.

The basic source of the data was the internet database shared by the Central Statistical Office in Warsaw – Local Data Bank (BDL, 2017). According to CSO classification the environmental order embraces the following thematic areas[7]: climate changes (3 factors), energy (4 factors), protection of air (4 factors), marine ecosystems (1 factor), freshwater resources (3 factors), land use (3 factors), biodiversity (2 factors), waste management (4 factors). However, in relation to the rural areas on the levels of communes (NTS5) in the BDL there is no particular statistical data essential to construct various factors, not only in the range of the environmental order, but also in the remaining orders.

The spatial range of the research embraced the rural areas of Wielkopolska (sum of the rural communes and the rural areas separated from the urban-rural communes).

The research proceedings consisted of three stages. In the first one, having made an overview of the components describing the thematic areas of the environmental order and taking into consideration the substantive and statistical reasons, five factors were chosen for the research, including two stimulants: woodiness (% of the forests in the general area) and the participation of the population using the services of the sewage treatment plant in the general population (in %) and three destimulants: water usage (in m^3/person), mixed waste (in kg/ person) and electric energy usage (in kWh/person). The second stage of the research embraced the analysis of the dynamics of the particular components of the environmental order. The last, third stage was based on constructing a ranking of counties. In order to do this, an ordering of the counties according to the average change rate value of each of the factors was made, and then points from 1 to 31 were assigned to them, when founded that the largest amount of points concerns the most beneficial changes, meaning the lowest in the case of destimulants and the highest in the case of the stimulants.

RESULTS OF THE STUDY

Wielkopolska is located in the western part of Poland, occupying the area of 29826 km^2 (9,5% of the country's area), of which 94,9% are the areas located outside of the administrative borders of the cities (28305 km^2, which is 9,7% of the general rural areas in Poland)[8]. 3475 000 inhabitants live in this area (9% of the country's population). Wielkopolska consists of 35 counties (including 4 cities with country rights) and 226 communes (19 urban ones, 90 urban-rural ones, 117 rural ones). The number of the people in the rural areas is 1568 thousands, which is 45,1% of the general inhabitants and 10,3% of the rural areas' inhabitants in Poland. Compared to the 2005, the population status of the rural communes and part of the urban-rural communes of the voivodship increased by 8,4% (in comparison to population increase in Wielkopolska by o 3,1%). The differential industry, agriculture, well developed services and still expanded infrastructure create favorable conditions for the Wielkopolska voivodship's development. Thanks to that, it has the dominant significance on the economic map of Poland. The region potential's further development, according to the adopted Development Strategy for the Wielkopolska Region is to be based on m.

[7] The actual factor are divided according to four orders: the social order, economic order, environmental order and institutional-political order. Each of orders embraces the areas to which appropriate factors were ascribed ((BDL, CSO 2017).

[8] CSO: condition for the year 2015.

al. improvement of the environmental condition and rational management of the natural resources (Environmental protection program for Wielkopolska region 2012). It is consistent with the actions aiming implementation of the rules of the sustainable development.

The landscape of Wielkopolska is dominated by extensive, flat tracts of fields and large forest complexes (Environmental protection program for Wielkopolska Region 2012), however, their arrangement is quite uneven. In 2015 the woodiness rate shaped on the level of 25,7%, wherein in the relations to the rural areas it was higher and it was 26,3%. Compared to the 2005, the woodiness of the rural areas increased barely by 0,29 of the percentage point. Despite the fact that the analysis of the value of this factor in particular years indicated the expected changes' direction, the rate of those changes was relatively low. The annual average rate of the increase in Wielkopolska amounted to 100,11 compared to th100,24 for the general Poland rural areas (Tab.1). The highest values were noticed in the Koło county (100,48). In case of six counties the relative increments of the rate was characterized by the falling trend. Such situation demands mindfulness at least for two reasons. Firstly, in order to reach the woodiness rate 30% in 2020 according to the adopted strategy of Energy Security and the Environment, such rate of the increase is too slow (Directions of development of the rural areas 2010)[9]. Secondly, the forests are the integral element of the natural environment, they have a beneficial effect on shaping the climate, water balance, preservation of the biological potential of the species, they counteract the soil erosion processes. They play an important production and social functions (Factors of Poland sustainable development 2011).

The functioning of so-called sustainable landscape is also connected with appropriate water resources management. Water plays a special role in the processes which take place in the ecosystems, constituting indispensable for their functioning abiotic environment element. It is a very precious, specific, renewable raw material and simultaneously it is scarce, without any substitute, and its' resources are subject to season and annual fluctuations. Water plays various roles in the economic activity, thus, it is important to use it rationally and economically (The factor of green economy in Poland 2017), which is determined mainly by the production intensiveness and the level and patterns of individual consumption. As a result of the increasing investment expenditures favorable to the water economy, the water consumption for needs of the national economy and population per one person in the years 2005-2015 systematically decreased, both for Poland and for the voivodship. In case of the rural areas, a reverse trend has been observed. The average annual rate of the changes amounted respectively 102,45 and 100,31 (Tab.1). The exploitation of the water resources has been developing in undesirable direction, and however it might be explained mainly by increasing industry demand and watering the agricultural and forest lands, it demands special observation. The most important relative increase took place in the following counties: Czarnków-Trzcianka county (107,91) and Chodzież county (105,91), and the lowest the lowest in Wągrowiec county (97,82) and Nowy Tomyśl county (97,14). Ultimately, the unit factor of the water consumption in the voivodship in 2015 reached the level of 107,3m^3/person.

One of the easily recognizable issues of the country is unregulated matter of the water and sewage management and the waste management, what results in visible, large environment pollution. Thus, the important action in the matter of sustainable development is the protection of the water resources from degradation and pollution caused by the sewage. Although the amount and the quality of water (in relation to surface and underground waters) for the voivodship's economy is disappointing, they are expected to improve due to the actions taken for pollution limitation, m. al. from the agricultural sources and the improvement of the sanitation state of the rural areas. The evaluation of the progress in this range, where the factor showing the percentage of population

[9] The increase of the forest areas also allows to realize other important mission which is fight against water and wind erosion (The factors of Poland's sustainable development 2015).

using the sewage treatment plant was useful, is positive. In 2015 it reached 44,3%, increasing each year by 6,67% (Tab.1).

Table 1. The dynamics of selected factors of the environmental order of the rural areas in years 2005-2015 (average annual rate of changes)

Specification	Forest cover	Mixed waste collected	Consumption of water	Beneficiary of sewage treatment plants	Consumption electric energy
POLSKA	100,24	104,23	102,45	106,86	101,17
WIELKOPOLSKIE	100,11	105,74	100,31	106,67	100,57
chodzieski	99,96	113,75	105,91	106,05	101,15
czarnkowsko-trzcianecki	100,09	112,17	107,91	105,43	100,70
gnieźnieński	99,99	104,71	100,68	104,12	100,56
gostyński	99,94	106,37	102,11	108,49	100,81
grodziski	100,00	104,40	103,76	102,83	99,73
jarociński	100,22	109,78	101,85	105,18	100,02
kaliski	100,06	110,96	100,92	105,10	101,23
kępiński	100,16	106,07	99,54	110,27	100,22
kolski	100,48	101,49	97,69	104,79	96,98
koniński	100,31	108,57	101,27	105,18	100,13
kościański	100,03	104,31	101,52	106,05	100,46
krotoszyński	100,04	117,46	98,79	106,41	99,72
leszczyński	99,98	105,56	100,83	113,20	100,56
międzychodzki	100,07	102,35	101,25	109,74	100,46
nowotomyski	100,05	111,12	94,28	109,61	100,93
obornicki	100,06	112,00	104,44	116,51	100,68
ostrowski	100,09	110,92	96,84	108,30	101,68
ostrzeszowski	100,06	114,06	99,60	107,58	100,06
pilski	100,19	100,65	103,37	104,75	101,04
pleszewski	100,32	103,87	100,86	107,47	100,60
poznański	100,10	102,52	100,62	104,73	100,81
rawicki	99,96	116,85	99,19	116,07	99,97
słupecki	100,15	101,18	102,31	101,77	100,07
szamotulski	100,07	107,33	99,17	105,86	100,34
średzki	99,98	102,21	99,54	105,71	100,73
śremski	100,00	115,76	94,95	107,08	100,88
turecki	100,17	110,33	99,02	102,41	101,17
wągrowiecki	100,16	103,05	96,97	103,91	100,40
wolsztyński	100,02	102,93	101,05	110,41	100,10
wrzesiński	100,02	101,17	100,17	110,74	101,13
złotowski	100,26	102,91	99,89	106,25	100,53

Source: calculations and the author's study based on Local Data Bank CSO, 2017.

Simultaneously it should be emphasized that the trend showing the system transformations of wastewater treatment was growing in all of the researched subareas, and the situation is the most preferable in the following counties: Leszno county (121, 22) and Oborniki county (127,59). Undoubtedly, it is the effect of development of the sewage collection and treatment systems. It embraced the exploitation of new sewage treatment plants, development of water supply and sewage network and also exclusion of the outdated and inefficient objects from use, modernization of the existing treatment plants and investing in equipment reducing the pollution load in the

sewage. Moreover, The amount of biological sewage treatment plants and of the treatment plants with increased biogen removal has grown [10].

When evaluating the level of environmental order of sustainable development, the municipal waste and their limitation are very significant. The value of the factor showing the amount of produced waste in kilograms per one person annually in the rural areas generally increased both in Poland and in the Wielkopolska voivodship – annual average respectively: 4,23% and 5,74% (Tab.1). It is a negative phenomenon, however, simultaneously it is inevitable. The perfect condition would be the limitation of waste amount by half, compared to the current state, which in 2015 was 142,3 and 195,4 kg. The increasing consumerism, combined with inefficient solution of the waste management leads to constant increase of the described factor (The factors of the green economy in Poland 2017). Additionally, the analysis of the phenomenon dynamics in the cross-section of the counties indicated its' diversity: from 100,65 in the Piła county and 101,17 in the Września county to 115,76 in Ostrzeszów county and 116,85 in the Rawicz county. Therefore, the values of the factors indicated that in each of the studied subarea the amount of the collected mixed waste successively increased. In the light of such unfavorable processes in waste management, the special attention should be paid to the actions minimizing waste generation and maximizing their management, and to limitation to the necessary minimum the waste storage in the environment. Noteworthy is the fact that the dynamics of the consumption increase in the household sector was higher in the studied years from the dynamics of the waste amount increase (The factors of the green economy in Poland 2017). From the presented situation a conclusion is coming, that the taken actions conductive to implementation of the sustainable development in the Wielkopolska voivodship are concentrated on decreasing waste production through propagation of appropriate consumption patterns and the ecological awareness development of the society, must be continued with no less intensity (The environment protection program of the Wielkopolska voivodship 2012).

The irrational energy use in the production processes and in the households also leads to issues with environment pollution (through the greenhouse gases emission). Combined with the increasing request for energy, it becomes a cause of the energetic resources depletion (The factors of green economy in Poland 2017). Simultaneously, it should be emphasized that in the last few years in Poland the primary energy share, whose carrier primarily is the coal and lignite, and the increase of energy consumption itself was lower than the development rate of GDP, which indicates relative break of dependence between the economic growth and the energy consumption (The factors of green economy in Poland 2017). The values of the diagnostic variable may constitute a confirmation that in the rural areas in particular counties the actions aiming limitation of the electric consumption are concentrated in an inefficient way. In 2005 in the rural areas it amounted to 727,9 kWh per capita and having been characterized by average annual changes rate amounting 100,57 it stood at 770,5 kWh in 2015 (Tab.1). The majority of the voivodships is characterized by undesirable direction of changes, and only in the following counties: Grodzisk county, Koło county, Krotoszyn county and Rawicz county a negative trend in the range of the level of the researched component was noticed (the average annual changes rate shaped at a level below 100). The observed tendencies are the succession of the growing durable goods consumption, thus, the actions aiming the progress of the energetic efficiency and increase of participation of energy coming from the renewable sources in the energy carries structure is very significant. Wielkopolska is a region characterized by favorable conditions for development of the power engineering coming from the renewable sources, the majority of the Wielkopolska counties has potential possibilities for the practical energy engineering use from at least two sources: the wind energy or the sun energy or the energy from

[10] Despite the changes on the rural areas the target value of the factor determined for the year 2020 in „The Strategy Energetic Safety and Environment" has not been reached yet (The factors of Poland's sustainable development 2015).

biomass, biogas or biofuels (The Wielkopolska voivodship environment protection 2012). It is more and more visible direction of the voivodship's actions, which is a chance and a challenge in the process of striving for modern and sustainable development of the region (Dolata, Jaworska 2018).

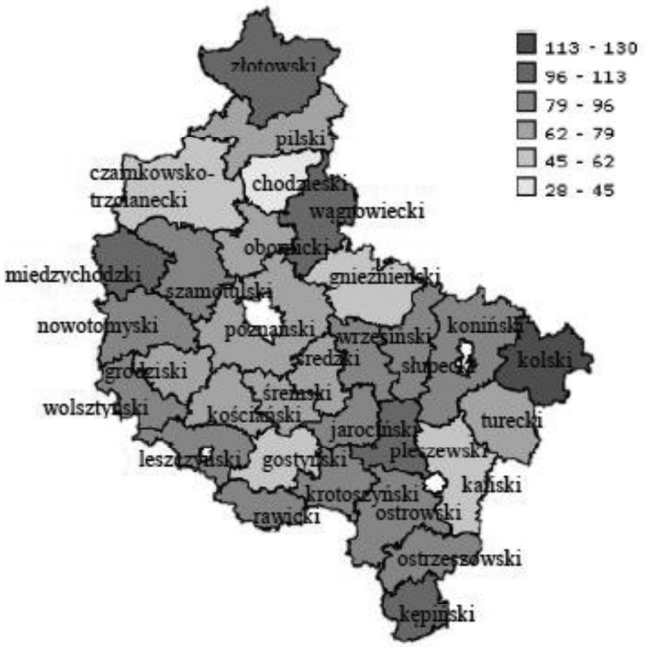

Fig. 1. Delimitation of the rural areas of Wielkopolska voivodship in terms of the progress in implementing the sustainable development in the range of selected components of the environmental orders' sustainable development in years 2005-2015 in the cross-section of the counties (the amount of points).

Source: calculations and the author's study based on Local Data Bank CSO, 2017.

The empirical analysis of the counties' ranking indicated that in the Koło country there was the largest progress in implementing of the sustainable development in the range of selected five components of the environmental orders' sustainable development in years 2005-2015 (Fig. 1). The demanded direction of changes took place in case of all studied parameters, and in reference to two of them the highest changes rate was noticed. Jointly, the Koło country gained 125 points. In the first five there were also: Kępno county (109 points), Złotowo county (105 points), Pleszew county (99 points) and Międzychód county (98 points), however, none of them was the pioneer in reference to the studied factors. The analysis of the gained points in particular components clearly indicated the areas in case of which the actions connected with realization of the idea of sustainable development should be intensified. In the Pleszew county they should be concentrated on rationalization of the energy management, in the Koło and Złotowo counties – on the waste management, in Międzychód county – on optimization of the water resources management. In the following counties: Gniezno county, Gostyń county, Czarnków-Trzcianka county, Kalisz county and Chodzież county, which are placed in the last places of the created ranking, the changes in shaping particular factors in years 2005-2015 which are not conductive to implementation of the sustainable development in the range of the environmental order were noticed. The exception was

the wastewater management, where they adopted the demanded direction, and also the forest management in the Czarnkow-Trzcianka and Kalisz counties. The observed undesirable tendencies in the dynamics of the indicators describing the environmental order pay special attention to the urgent issues, which should be solved as soon as possible in order to minimize their negative influence on the environment in the future.

SUMMARY

The conception of sustainable development in the rural areas is a difficult idea to realize in the current economic and social conditions. Passing from the declared ecological values to specific practical actions constitutes a huge challenge, which demands long time perspective. The analysis of the progress in the process of implementation of the sustainable development, through presenting the dynamics and direction of changes in the level of selected parameters of the environmental order in the rural areas of Wielkopolska in the cross-section of years 2005-2015, allowed to formulate the following conclusions and generalizations:

1. The analysis of the woodiness factor in particular years of the researched period indicated demanded direction of changes, however, the rate of those changes was relatively low. The highest values of the average annual rate of changes were noticed in the Koło country. In case of six counties the relative increase of the factor was characterized by the falling trend.
2. The exploitation of the water resources has been developing in the undesirable direction, and although it should be explained by the increasing industry demand and watering the agriculture and forest grounds, it demands special observation. The highest relative increases took place in the following counties: Czarnków-Trzcianka county and Chodzież county, and the lowest in the Wągrowiec county and Nowy Tomyśl county.
3. The evaluation of progress in the range of the wastewater management, where the factor showing the percentage of population using the sewage treatment plants was useful, is positive. The trends showing transformations of the wastewater treatment system was increasing in all researched counties, and the most preferable condition is in the following counties: Leszno county and Oborniki county.
4. The values of the factor showing the amount of collected mixed waste gradually increased in each of the studied counties. Taking into consideration such unfavorable tendency, the actions minimizing their creation, maximizing their management and limiting their storage to the necessary minimum should be paid more attention.
5. The majority of the voivodships is characterized by undesirable direction of changes in the level of electric Energy consumption. Only in the following counties: Grodzisk country, Koło county, Krotoszyn county and Rawicz county the falling trend was noticed in the range of the researched component. The observed tendencies confirm the significance of actions aiming improvement of the energetic efficiency and increase the share of energy gained from the renewable sources in the energy carriers structure.

The empirical analysis of created ranking of counties indicated that the largest progress in implementing the sustainable development in the range of selected five components of the environmental order's sustainable development in years 2005-2015 was done in the Koło county area. In the first five there were also: Kępno county, Złotów county, Pleszew county and Międzychód county, however, none of them was not a pioneer in reference to the researched factors. The analysis of the amount of gained points in particular components clearly identified the areas in case of which the action connected with realization of sustainable development idea should be intensified. In the following counties: Gniezno county, Gostyń county, Czarnków-Trzcianka country, Kalisz country and Chodzież county, placed in the last places, the changes which are not favorable to implementation of sustainable development conception in the range of environmental order were noticed.

In the end, it should be emphasized that only the range and character of the changes in view of selected components of the environmental dimension are presented in the elaboration, and the gained results are only one of the elements of the comprehensive research embracing the sustainable development in the rural areas of the voivodship.

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