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INVESTMENTS IN WATER MANAGEMENT IN RURAL AREAS

Key words: environment, rural area, investments, water management, voivodships

ABSTRACT. The aim of this study is to evaluate the implementation of environmental investments in rural areas and prepare a ranking of voivodships. Detailed studies covered Polish rural areas according to voivodship division and were focused on environmental investments related to water management: the sewage network, water supply systems, collective and individual sewage treatment plants, water treatment plants and flood embankments. The research period covered the years 2010-2019. The research uses indicators characterizing investments in water management. The method of zero unitarization was used, which allowed to compare the values of the adopted indicators and establish a synthetic indicator determining a ranking of voivodships according to the implementation of environmental investments. Research shows that more than half of all expenditure are investments related to the sewage and water supply network. The exceptions are the Łódzkie and Podkarpackie voivodships, where greater expenditure is incurred on collective treatment plants than on the water supply network. The values of the synthetic index make it possible to determine the regions where the most and least environmental investments were implemented. The highest values of the synthetic index are found in the Mazowieckie, Wielkopolskie and Małopolskie voivodships. The lowest values of the indicator are recorded for the Opolskie, Podlaskie, Świętokrzyskie and Śląskie voivodships, where the least environmental investments were implemented.

INTRODUCTION

From the beginning of mankind, the environment has played a key role in human life. It guarantees the satisfaction of all existential, spiritual and social needs, offering security and development [Krajewski 2018]. The availability of natural resources and values, their existence, protection and multiplication form the basis of human existence and development. Mankind functioning in the environment generates pollutants that lead to changes in ecosystems, and each of them has a certain capacity, i.e. the ability to bear anthropogenic burdens. Exceeding this capacity causes irreversible consequences to the environment [Poskrobko, Kostecka 2016]. Pollution affects all elements of the environment: water, air and soil. They can be natural and anthropogenic. They generate huge losses in the entire economy (including industry, agriculture and water management) and result in a deterioration of the health of society [Augusewicz et al. 2012]. All of this leads to a reduction in the quality of life.

According to Archie Carroll and Ann Buchholtz [according to Ratajczak 2013], actions are necessary to maintain a balance of factors of nature necessary for its development and existence. This calls for the necessity of environmental protection, which today should be considered crucial [Dobrzańska et al. 2010]. Environmental protection is related to the collection, disposal, reduction, prevention or complete elimination of pollution and losses resulting from human activity [Broniewicz, Poskrobko 2003]. Caring for its condition is the fulfillment of obligations under national and international law. These activities are reflected in many adopted solutions and documents at a national level. On February 14, 2017, the Polish Council of Ministers adopted the Responsible Development Strategy, which forms the basis for the creation of many strategies, including the environmental strategy [Resolution No. 8 of the Council of Ministers of February 14, 2017, Resolution No. 67 of the Council of Ministers of July 16, 2019].

Achieving environmental protection objectives requires a number of environmental investments. Particular attention is paid to the construction, expansion and modernization of the environmental protection infrastructure. This applies to the creation of new facilities and devices for environmental protection and monitoring, which include devices for the water supply, sewage disposal and treatment, drainage services, air protection, the gas network and waste landfills [Kłos 2018]. All these activities, regardless of where they are carried out, are accompanied by high investment expenditure [Adamska 2012, A. Pawlewicz, K. Pawlewicz 2012, Kropsz-Wydra 2017]. According to Ewa Mazur-Wierzbicka [2015], based on the Central Statistical Office of Poland, investment expenditure is financial or material expenditure aimed at creating new fixed assets or improving (reconstructing, extending, adapting or modernizing) existing fixed assets, as well as expenditure on so-called first investment equipment.

Barbara Bujanowicz-Haraś [2009] attributes the poor condition of the environment to, among other things, low investment outlays. This opinion cannot be completely accepted. In recent years, social awareness of the state of the environment has increased, which has resulted in an increase in expenditure on environmental objectives [Adamska 2012, Górka 2013, Kropsz-Wydra 2017], and the expenditure indicators in Poland are similar to those in Western Europe, amounting to approximately 1.5% of GDP [Górka 2018]. The greatest amount of funds is spent on water protection [Górka 2013, Gołębiewska, Ślusarz 2014, Kozłowski 2016, Chojnacki 2017]. Investment activities, as part of water management, are supplying water of appropriate quantity and quality in order to meet living and production needs, which improve the quality of life of society in accordance with the paradigm of sustainable development.

Rural areas are of particular importance for environmental protection, which results from the richness of the landscape, biodiversity as premises for the attractiveness of life, broadly understood tourism and the activities of enterprises [Kokoszka 2014]. Natural valuable areas and the agricultural landscape are of special value [Gwiazdowicz 2010]. We should strive to protect these natural resources, as they are instrumental in the production of high-quality food.

The implementation of environmental investments in rural areas as part of water protection requires special expenditure, which results from the imperfections of the environmental infrastructure and the large dispersion of buildings. This problem is

highlighted in the financial support under the Rural Development Programme 2014-2020 [MRiRW 2019].

The implementation of environmental investment measures in rural areas requires analysis and monitoring. This is of grave importance in environmental management - especially when making the right decisions. Due to the key importance of the rural environment in this paper, the main objective is to evaluate the implementation of environmental investments in rural areas as protective activities.

RESEARCH MATERIAL AND METHODS

The conducted research is empirical in nature and aims to achieve the goal of the work, which is to evaluate the implementation of environmental investments in rural areas and determine a ranking of voivodships in this field. The following are used to achieve the objectives of the study: an analysis of expenditure on environmental protection in Poland, an analysis of expenditure on environmental investments in rural areas in individual voivodships, an analysis of selected material effects and the calculation of a synthetic indicator determining a ranking of voivodships according to the value of environmental investments in rural areas. In this study, the analysis of environmental investments is limited to water management: the sewerage network, waterworks, collective and individual sewage treatment plants, water treatment plants and flood embankments. The choice of such a thematic area mainly results from its importance for environmental protection and the possibility of obtaining data (including the amount of investment expenditure). The basic source material comes from public statistics and is of secondary nature (desk research). Detailed research covers the rural areas of Poland divided into voivodships. The analysis period is 2010-2019. The study uses the methods of analysis, synthesis, logical inference and statistical methods (including zero normalization).

The use of the zero unitarization method allows to reduce the values of selected indicators characterizing environmental investments in water management to an objective comparison. These indicators include the number of commissioned collective and municipal sewage treatment plants, water treatment stations, the commissioned water supply, the sewage system and flood embankments in kilometers. For research purposes, it is assumed that all indicators are stimulants, i.e. the higher the value, the higher the assessment of the phenomenon under study. The following formula is used for the stimulant, by means of which the values 0 to 1 are obtained, thus facilitating a comparison of analyzed investments in years and between voivodships [Wysocki 2010].

$$Q_i = (W_i - W_{min}) / (W_{max} - W_{min})$$

where: Q_i – the unitized value of the indicator for the i -th feature, W_i – the index value for the i -th feature, W_{max} – the maximum value of the indicator for the i -th feature, W_{min} – the minimum value of the indicator for the i -th feature,

RESULTS

According to many researchers, the effectiveness of the implementation of environmental protection tasks depends on expenditure value. In the analyzed period, these outlays were gradually increasing and in 2018 amounted to almost PLN 65 billion (Figure 1). The total sum of environmental outlays includes: investment outlays on fixed assets, running costs and household expenses (investments and services). Among total environmental expenditure, the largest percentage being expenditures by households, the share of which has significantly increased from approximately 54% in 2010 to 74% in 2018, currently accounting for almost $\frac{3}{4}$ of all expenditure, i.e. almost PLN 48 billion. A significant part of these funds is allocated to services, such as sewage collection and treatment as well as waste disposal. In 2020, an even greater increase in outlays by households can be expected. The result is a significant increase in fees for the disposal of waste, even by over 100%. This phenomenon affects all inhabitants regardless of their place of residence (town or countryside). Second place in the structure of environmental protection expenditure is occupied by fixed assets, the share of which decreased from 24.5% in 2010 to 16% in 2018. However, if we focus on quantitative amounts, there are no such large differences. Therefore, it can be concluded that outlays on fixed assets remains at a similar level. On the other hand, running costs have decreased in quantity and percentage (Figures 1 and 2).

The analysis of expenditure on environmental investments in rural areas in 2010-2019 can be divided into regions more or less involved in the implementation of the described activities (Table 1). Taking into account the average expenditure on collective wastewater treatment plants, most funds were spent in the Podkarpackie, Małopolskie, and Wielkopolskie voivodships, and the least in the Opolskie, Lubuskie and Kujawsko-Pomorskie voivodships. In the case of individual wastewater treatment plants, first place is taken by the Warmińsko-Mazurskie and Wielkopolskie voivodships, and in last place

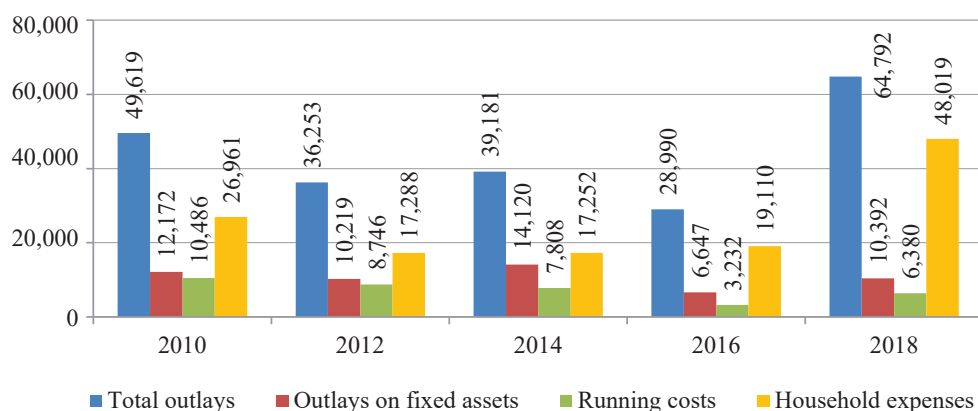


Figure 1. Expenditure on environmental protection in Poland in 2010-2018 [PLN billion]

Source: own calculation based on GUS (CSO) data

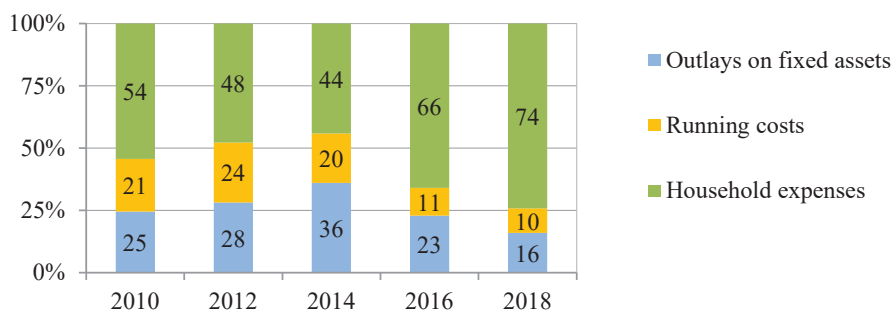


Figure 2. Structure of expenditure on environmental protection in Poland in 2010-2018

Source: own calculation based on GUS (CSO) data

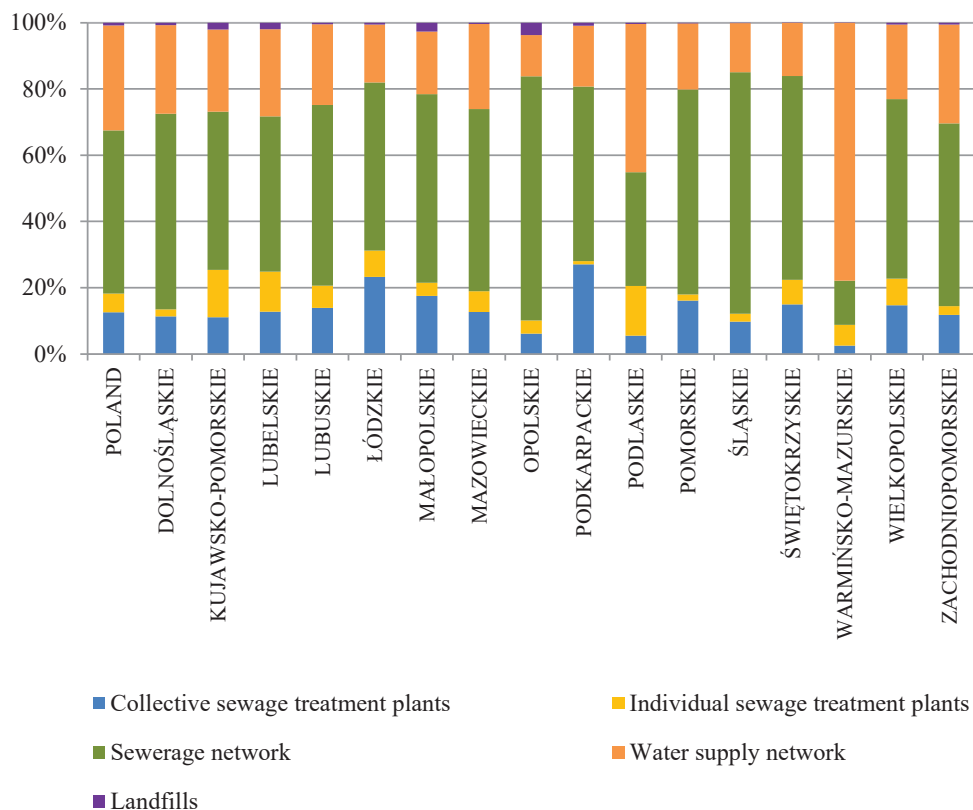


Figure 3. Structure of the average level of expenditure on environmental investments in rural areas by type in Poland in 2010-2019

Source: own calculation based on GUS (CSO) data

Table 1. Average level of expenditure on environmental investments in rural areas in 2010–2019

Name of territory	Collective sewage treatment plants		Individual sewage treatment plants		Sewerage network		Water supply network		Landfills	
	PLN billion	%	PLN billion	%	PLN billion	%	PLN billion	%	PLN billion	%
Poland	500,979.2	100	227,229.4	100	1,969,302.80	100	1,265,613.1	100	31,562.9	100
Dolnośląskie	32,267.7	6.4	5,792.0	2.5	167,456.6	8.5	75,812.8	6.0	2,151.0	6.8
Kujawsko-pomorskie	14,521.5	2.9	18,683.7	8.2	62,480.7	3.2	32,407.6	2.6	2,728.3	8.6
Lubelskie	21,018.6	4.2	19,844.6	8.7	77,068.7	3.9	43,184.7	3.4	3,207.0	10.2
Lubuskie	12,834.8	2.6	6,138.6	2.7	50,352.1	2.6	22,474.3	1.8	412.9	1.3
Łódzkie	45,731.0	9.1	15,622.9	6.9	99,657.8	5.1	34,272.8	2.7	1,144.3	3.6
Małopolskie	62,780.0	12.5	14,010.9	6.2	203,633.5	10.3	67,746.2	5.4	9,426.9	29.9
Mazowieckie	50,660.2	10.1	24,913.2	11.0	219,965.9	11.2	102,850.2	8.1	1,519.0	4.8
Opolskie	6,947.6	1.4	4,412.5	1.9	82,967.5	4.2	14,054.1	1.1	4,188.8	13.3
Podkarpackie	68,268.4	13.6	2,384.3	1.0	133,103.6	6.8	46,310.8	3.7	2,307.7	7.3
Podlaskie	4,610.1	0.9	12,423.7	5.5	28,502.0	1.4	37,102.5	2.9	286.9	0.9
Pomorskie	29,182.3	5.8	3,393.8	1.5	112,322.3	5.7	36,084.8	2.9	382.8	1.2
Śląskie	29,708.6	5.9	7,342.5	3.2	223,125.3	11.3	45,285.1	3.6	291.5	0.9
Świętokrzyskie	25,865.6	5.2	12,698.4	5.6	106,148.1	5.4	27,825.8	2.2	6.9	0.0
Warmińsko-mazurskie	17,739.7	3.5	43,123.5	19.0	92,030.8	4.7	539,322.4	42.6	220.4	0.7
Wielkopolskie	58,687.0	11.7	31,898.5	14.0	216,305.2	11.0	89,883.9	7.1	2,337.8	7.4
Zachodniopomorskie	20,156.1	4.0	4,546.5	2.0	94,183.0	4.8	50,995.3	4.0	950.5	3.0

Source: own calculation based on GUS (CSO) data

the Podkarpackie and Pomorskie voivodships. In the case of the Warmińsko-Mazurskie Voivodship, almost half of all investment expenditure was allocated to water supply networks, while in the Małopolskie Voivodship – almost 30% to landfills.

As can be seen from the data in Table 1, the average expenditure on environmental investments in rural areas significantly differs in individual voivodships. It is difficult to clearly define the causes of this phenomenon. They may result from a lack of or an outdated, inefficient environmental infrastructure in individual regions.

Considering the structure of the average level of outlays for environmental investments in rural areas by type, investments related to sewage and water supply systems are in the foreground. They consume the most financial resources, often exceeding 50% of all expenditure. This phenomenon is observed in almost all voivodships. The exceptions are the Łódzkie and Podkarpackie voivodships, where more was spent on collective treatment plants than on the water supply system (Figure 3).

The synthetic indicator that defines the implementation of environmental investments takes six features into account: collective and municipal sewage treatment plants, water treatment plants, the water supply and sewage systems as well as flood embankments. The calculation of its value made it possible to select regions where the most and least environmental investments were carried out. In 2010, the largest number of environmental investments was carried out in the Mazowieckie, Pomorskie and Lubelskie voivodships. In these voivodships, the value of the indicator is the highest and amounts to

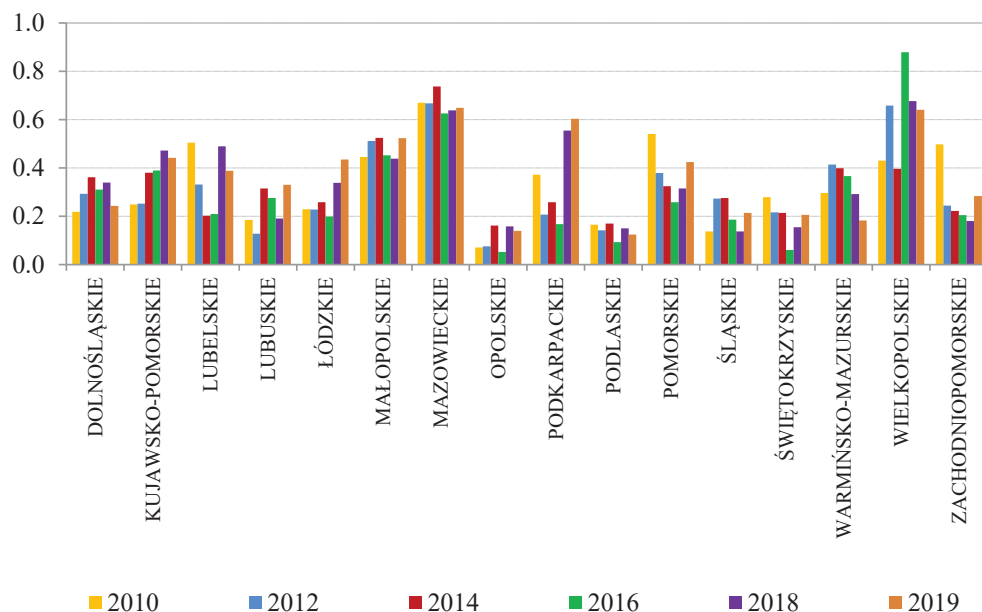


Figure 4. The Synthetic indicator (SI) determining a ranking of voivodships according to the implementation of environmental investments in rural areas in 2010-2019

Source: own calculation based on GUS (CSO) data

0.670, 0.540, 0.504 points, respectively. On the other hand, the lowest values of the index were recorded in the following voivodships: Opolskie (0.070 points), Śląskie (0.137 points) and Podlaskie (0.165 points), which means that the least environmental investments were realized in in these regions. In the following years, the voivodships are characterized by similar investment activities. In the entire analyzed period of 2010-2019, the Mazowieckie, Wielkopolskie and Małopolskie voivodships are leaders, with the highest values of the synthetic indicator each year. The lowest values of the synthetic index are found in the Opolskie, Podlaskie, Świętokrzyskie and Śląskie voivodships. In the last year of the analysis, i.e. in 2019, the most investments were made in the Mazowieckie (0.649 points), Wielkopolskie (0.641 points) and Podkarpackie (0.604 points) voivodships. The lowest values of the indicator are in the following voivodships: Opolskie (0.139 points), Podlaskie (0.124 points) and Warmińsko-Mazurskie (0.183 points). In the whole analyzed period, the highest increase in the value of the synthetic indicator is recorded in the Podkarpackie Voivodship from 0.372 in 2010 to 0.604 points in 2019 (Figure 4).

It should be noted that the average value of the synthetic indicator has an increasing tendency and amounts to: 0.330 points (2010), 0.314 points (2012), 0.325 points (2014), 0.295 points (2016), 0.345 points (2018), 0.364 points (2019). This is not a big change, but it shows that the level of environmental investments in rural areas of our country is growing.

CONCLUSIONS

The natural environment has a great influence on human activity and requires protection, which is increasingly becoming a priority in all economic and social activities. Among different aspects of environmental protection are environmental investments. The implementation of environmental investments is to prevent and counteract negative effects on the environment, including those related to rural areas, where it is not only the production of food raw materials that takes place. The conducted research helps to assess the degree of implementation of environmental investments in rural areas in Poland in a voivodship system. The results show the structure of the average level of expenditure on environmental investments, broken down by type in rural areas. The largest share in the structure of environmental protection directions is represented by funds allocated to wastewater management and water protection, air and climate protection as well as waste management. On average, in Poland and in most voivodships, more than half of all expenditure is related to the sewage and water supply network. The exceptions are the Łódzkie and Podkarpackie voivodships, where more was allocated to collective treatment plants than the water supply network. In the paper, the values of the synthetic index describing the level of implementation of environmental investments in rural areas were calculated. This facilitated the identification of regions carrying out more or fewer environmental investments. The ranking is headed by the Mazowieckie, Wielkopolskie and Małopolskie voivodships, where the highest values of the synthetic index were obtained due to the fact that they had the highest number of environmental investments. The ranking is closed by the Opolskie, Podlaskie, Świętokrzyskie and Śląskie voivodships, where index values are the lowest due to relatively small environmental investments compared to the rest of the country.

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INWESTYCJE W GOSPODARKE WODNĄ NA OBSZARACH WIEJSKICH

Słowa kluczowe: środowisko, obszar wiejski, inwestycje, gospodarka wodna, województwa

ABSTRAKT

Celem artykułu jest ocena realizacji inwestycji środowiskowych na obszarach wiejskich oraz określenie rankingu województw. Badaniami objęto obszary wiejskie zlokalizowane w poszczególnych województwach Polski. Skupiono się na inwestycjach środowiskowych, dotyczących gospodarki wodnej, tj. na: sieci kanalizacyjnej i wodociągowej, na zbiorczych i indywidualnych oczyszczalniach ścieków, stacjach uzdatniania wody oraz obwałowaniach przeciwpowodziowych. Okres badawczy obejmował lata 2010-2019. W badaniach wykorzystano wskaźniki charakteryzujące inwestycje w ramach gospodarki wodnej. Zastosowano metodę unitaryzacji zerowanej, która pozwoliła sprowadzić wartości przyjętych wskaźników do porównywalności i ustalić syntetyczny wskaźnik, określający ranking województw w realizacji inwestycji środowiskowych. Badania wykazały, że ponad połowa wszystkich nakładów, to inwestycje związane z siecią kanalizacyjną i wodociagową. Wyjątek stanowiły województwa łódzkie i podkarpackie, w których więcej wydano na oczyszczalnie zbiorcze niż na sieć wodociagową. Wartości syntetycznego wskaźnika wyłoniły rejon, w których realizowano najwięcej i najmniej inwestycji środowiskowych. Najwyższe wartości syntetycznego wskaźnika uzyskały województwa mazowieckie, wielkopolskie i małopolskie, które realizowały najwięcej inwestycji środowiskowych. Najniższe wartości wskaźnika zanotowano w województwach opolskim, podlaskim, świętokrzyskim i śląskim, w których realizowano najmniej inwestycji środowiskowych.

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