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INTERACTION BETWEEN PRO-ENVIRONMENTAL SPENDING AND ENVIRONMENTAL CONDITIONS AND DEVELOPMENT

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Abstract: The relationship between pro-environmental spending, the state of the environment and development refers to its impact on economic, social and environmental development, improved quality of life, and economic stability. The study aims to understand and assess the level of variation in pro-environmental spending by municipalities in relation to their environmental conditions and development. Quantitative data on pro-environmental spending, enironmental conditions, and development were obtained for municipalities in the Świętokrzyskie Voivodeship (province) from Statistics Poland for the years 2014, 2020, 2021, and 2022. The study is based on a literature review of the subject and statistical analysis, while the CRITIC-TOPSIS method was applied to generate synthetic measures. The results show changes in ecological spending, the state of the environment and development. The relationship between environmental status and development and pro-environmental spending has weakened during researched period. This may be due to a decline in public spending in response to financial crises, the COVID-19 pandemic or insufficient implementation of environmental projects. Maintenance (cleaning, greening, and waste management) has the greatest impact on the social and economic development of the municipality. Some improvements in the state of the environment in recent years are observed, with fluctuations in ecological spending and overall development. These changes may be the result of various environmental policies, local economic challenges, as well as sustainable development efforts at the municipal level.

Keywords: pro-environmental spending; sustainability; synthetic measure; CRITIC-TOPSIS method; Poland

1. Introduction

Green and sustainable development is becoming essential in the face of increasing environmental degradation and the depletion of natural resources (Kim et al., 2014). Implementation of these concepts allows municipalities to achieve long-term goals, and benefit from energy savings, better resource management, public health, and local economic development. Municipalities that opt for a green transformation become more resilient, innovative, and competitive regions, contributing to the achievement of sustainable development goals (European Commission, 2021). The environment is a source of energy, means

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and objects of labor, and means of consumption. It also serves as a receiver of production and consumption waste, and conditions for agricultural, forestry, and fishing production. The environment is a necessary, permanent, and natural condition for the actual life of society and its development. The general use of the environment is enjoyed by everyone for personal and household needs, as well as for economic activities (Act of Environmental Protection Law, 2001).

Environmental degradation prompts the integration of society's organizational efforts, the creation of systemic solutions (Tybulski, 2004). Deterioration of the environment has increased the need for changes in the area of economic policies in terms of environmental management, including making pro-environmental spending. The concept of a green economy is an important element of economic policy at the European Union (EU), national, and local levels. It consists of having such an economy that focuses on sustainable development, that is, with limited environmental pressure.

The aim of the study is to understand and assess the level of variation in municipalities' pro-environmental spending in relation to their environmental status and development. The municipality is the basic unit of local government in Poland. It is responsible for a wide range of activities within its community, including the provision of public services, management of space, and support for local development. This research cover municipalities within the Świętokrzyskie Voivodeship (province), as the cases. An agricultural south and an industrial north characterize the Voivodeship. Regarding economy, geography, and infrastructure, it is an outlying region of the EU, representing a less developed area. The region's declining population, the inefficiency of the economic structures, the labor market development and fragility, and the lack of innovation all contribute to the negative conditions for the Voivodeship's growth (Dziekański & Prus, 2020).

The purpose of the study is to identify how environmental financial spending improve the environment and the extent to which these changes contribute to economic development. In addition, the study aims to assess whether there is a sustainable mechanism in which pro-environmental spending supports both environmental protection and long-term socio-economic development. Empirical data on pro-environmental and development spending and environmental conditions were obtained at the level of municipalities in the Świętokrzyskie Voivodeship from Statistics Poland (SP) for the years 2014, 2020, 2021 and 2022. The applied research methods include literature analysis, statistical analysis, and synthetic measure. The synthetic measure (built according to the CRITIC-TOPSIS method) made it possible to rank and group the studied municipalities.

The difficulties that arise in describing the relationship between development, the state of the environment, and pro-environmental spending are due to the multidimensionality of the processes and the number of variables used in assessing the processes taking place in the local economy. The specific value of this article is in exploring the relationship between pro-environmental spending, the environmental quality, and the development of municipalities.

2. Literature review

The economy and the environment interact. The economic activity relies on the continued availability of material and energy resources and a sufficiently clean and attractive environment. Through the discharge of pollutants and other features associated with human activity, society interferes with environmental systems (D'Amato, 2021; Maitah et al., 2020; Malina, 2020). The green economy addresses issues of economic development on a sectoral and regional basis. The essence of this approach is the creation of solutions that make the economy more

compatible with the specifics of the environment (Drobniak, 2016). The regional view of the theory of the economic base refers to the existence of so-called spatial differentiation between regions, such as the possession of specific resources (e.g., energy resources) and the economic activities located in them. The possession (within territorial capital) of specific resources is therefore the driving force of a region determining its dominant economic structure.

The theory of growth poles or the concept of polarized development captures development in spatial terms (Gawlikowska-Hueckel, 2005; Li et al., 2023). The concept of independent regional development points to the environmental determinants. It responds to the development problems of peripheral regions, the inclusion of environmental issues in the development process, and the integration of the environmental aspect with the economic and social aspects (Borys, 2013; Gałązka, 2011). Proper use of environmental potential will generate additional economic effects, improve the environment, foster social goals, and improve the quality of life (Kasztelan, 2010). Their unsustainable use determines the process of environmental degradation and resource depletion, threatening the well-being of humanity and the environment. The concept of green economy is an instrument aimed at sustainable resource management (Merino-Saum et al., 2018).

The local economy, as indicated by Batty et al. (2004), is in constant evolution, diverse in nature, in terms of the scale and direction of change in response to internal interactions and due to the impact of environmental factors. Jewtuchowicz (2005) indicated that the sustainable development of the local economy needs the creation of conditions for the proper use of endogenous resources and the attraction of exogenous resources. This is a holistic approach, integrating the tangible and intangible elements of human life and management. Sustainable development occurs in the economic area, as well as in the social area, and affects the maintenance of balance in the environment. Its primary goal is to meet elementary social needs (Herbuś & Krawczyk-Sokołowska, 2012).

Green growth is based on the principle that environmental sustainability and economic development are not conflicting goals but rather mutually reinforcing ones (Zhang et al., 2024). The growing demand for natural resources has been driven by infrastructure requirements and improved standards of living (Gu et al., 2023). Municipalities' environmental investments are spent on the purchase or manufacture of tangible assets related to implementing statutory environmental tasks, including public utility activities.

The notion of the green economy is taking on multiple dimensions, encompassing social, economic, and environmental aspects. Additionally, it is a means of acquiring and applying resources (Loiseau et al., 2016). According to Murray et al. (2017), green economy refers to resource recovery, conservation of natural capital, and reduction of resource use. It boosts the local economy, offers more efficient ways to use limited resources, reduces and eliminates environmental pollution and ecological growth in the area, and enhances the standard of living for the locals. It appears to also be pointing toward the sharing or access economy. On a process level, the access economy affects a whole range of aspects related to production and consumption, perceptions of the economic sphere, society and the environment (Elimam, 2017).

As indicated by B. Wang et al. (2023) and Wu et al. (2023) the ecological concerns are primarily related to the economical use of resources. Natural resources are crucial in many areas of social and economic life. Responsible management of these resources is essential to ensure sustainable development and minimize the negative effects of their overexploitation. Their use ranges from industrial sectors to everyday activities such as agriculture, tourism, and health.

The green infrastructure (GI) is emerging as an additional crucial element for various sectors and activities. It is turning to attaining sustainable development. In order to achieve sustainable development, GI is multifaceted and aims to close gaps between the social, technological, and economic spheres. Achieving green development targets is becoming dependent on how successfully natural resources and GI are used. In addition to promoting social equality and bettering the built environment and possibilities for people to interact with nature, GI can also increase human wellbeing and health (influencing migratory patterns, Huy et al., 2024). By enhancing the environment, delivering significant economic advantages to the surrounding areas, and encouraging the sustainable growth of the local economy, it can draw in visitors, tourists, shoppers (consumers), and investment (Wolf et al., 2020).

According to Miyauchi and Setoguchi (2023), depopulated regions frequently have vacant houses and lots, resulting in low-density urban areas that may cause inefficiencies in public services and financial degradation. A decrease in tax revenues and the hollowing out of existing metropolitan areas result in inefficiencies in public services. Variation in the level of development of municipalities is an element of dynamic reality. So far, the criteria documented in research that order the spatial distribution of social and economic phenomena relate specifically to the description of the level of development. Dynamics are ordered by a separate criterion. They are usually related to the specifics of local conditions, which mean that there is no single development path that all municipalities must follow (Stanny et al., 2016).

3. Research methods

The 102 municipalities of Poland's Świętokrzyskie Voivodeship—different by type of settlement, urban (1), rural (2), and urban–rural (3) municipalities, are the focus of the investigation. The empirical variables used in the analysis were taken from SP (2024), for years 2014, 2020, 2021, and 2022. The years indicated were chosen to capture important moments in the funding cycle for pro-environmental measures in order to track their effectiveness and assess how they affect the environment and development. In addition, there have been significant changes in politics, the economy, and the community over the past few years. This is important for examining the relationship between environmental spending and long-term economic and social development. The year 2014 was the year of the introduction of new national and international policies, such as the European Green Deal and the environmental policy update (European Commission, 2014). The year 2020 marked the end of an important EU budget period (2014–2020) (Council regulation, 2013; European Parlament, 2023). This can serve as a starting point for assessing the impact of previous environmental investments and their development and environmental impact.

In 2020, 2021, and 2022, the COVID-19 pandemic affected countries' economies, including public spending, policy priorities, and changes in the state of the environment. During these years, it is possible to examine the impact of the pandemic on pro-environmental spending and environmental conditions and development. Intermediate years were excluded due to inconsistency and unavailability of data. These specific years were chosen to provide a comparable and clear picture of significant changes in the economy and environment while taking into account limitations in data comparability and changing regulations.

The selected simple diagnostic variables (Table 1) allow describing the aspect of pro-environmental spending, environmental conditions and the development process of municipalities. The evaluation of the selected variables (in order to eliminate quasi-stable variables) was made based on the coefficient of variation (threshold value = .10) and the downturn correlation matrix

(Malina & Zieliaś, 1996). Analyses were performed using Statistica 13.3 software. The diagnostic variables were presented as a matrix where X_{ij} represent the values diagnostic variables under study of the j-th variable (j = 1, 2, ..., m) for the i-th object (i = 1, 2, ..., n; Strahl, 2000).

$$X_{ij} = \begin{bmatrix} X_{11} & \cdots & X_{1n} \\ \vdots & \ddots & \vdots \\ X_{m1} & \cdots & X_{mn} \end{bmatrix}, \quad (1)$$

Table 1. The variables describing the pro-environmental spending, condition of the environment, and development of the municipalities

Variables	Unit	S/D	2014	2020	2021	2022
			The weights of the variables			
Pro-environmental spending						
On municipal management facilities	PLN per inhabitant	S	.075	.097	.088	.123
On cleaning of cities and villages	PLN per inhabitant	S	.068	.100	.060	.200
On maintenance of greenery in cities and municipalities	PLN per inhabitant	S	.128	.105	.091	.111
On protection of atmospheric air and climate	PLN per inhabitant	S	.114	.113	.081	.133
On sewage management and water protection	PLN per inhabitant	S	.140	.095	.101	.164
On municipal waste management	PLN per inhabitant	S	.475	.490	.578	.269
Environmental conditions						
Share of legally protected areas	%	S	.247	.260	.260	.245
Natural monuments	number per 100 km^2	S	.103	.091	.101	.094
Mixed waste collected	kg per capita	D	.095	.081	.086	.100
Water consumption	m^3/inhabitant	D	.052	.052	.052	.053
Share of industry in total water consumption	%	D	.078	.070	.069	.080
Industrial and municipal wastewater requiring treatment	m^3/inhabitant	D	.065	.076	.077	.072
Forest cover	%	S	.147	.145	.144	.140
Total spending for municipal management and environmental protection	PLN per inhabitant	S	.095	.092	.080	.083
Population using wastewater treatment plants	%	S	.120	.133	.131	.133
Development						
Water network	km/100 km^2	S	.053	.049	.050	.048
Sewage network	km/100 km^2	S	.054	.052	.054	.051
Gas network	km/100 km^2	S	.064	.056	.054	.058
Housing stock	housing units per 1000 inhabitants	S	.091	.095	.095	.082
Population per public pharmacy	inhabitant/units	S	.112	.115	.115	.096
Public libraries	number per 10000 inhabitants	S	.132	.131	.129	.097
Health care clinics	number per 10000 inhabitants	S	.075	.080	.082	.079
Own income	PLN per inhabitant	S	.061	.060	.060	.054
Investment spending	PLN per inhabitant	S	.093	.112	.099	.109
Entities entered in the register	number per 1000 inhabitants	S	.066	.057	.061	.057
Natural persons engaged in business activity	person/1000 inhabitants	S	.079	.077	.083	.079
Employed	person/1000 inhabitants	S	.079	.077	.077	.097
Unemployed	person/1000 inhabitants	D	.043	.040	.041	.0937

Note. S–Stimulant, D–Destimulant, PLN–Polish Zloty. Own study based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

Then, in order to standardize the diagnostic variables, zeroed unitization was performed according to their type (stimulant, destimulant), according to the Equations 2 and 3:

$$X_j \in S;\ Z_{ij} = \frac{x_{ij} - min_i x_{ij}}{max_i x_{ij} - min_i x_{ij}}, \tag{2}$$

$$X_j \in D;\ Z_{ij} = \frac{max_i x_{ij} - x_{ij}}{max_i x_{ij} - min_i x_{ij}}, \tag{3}$$

where *S*—stymulanta, *D*—destymulanta, x_{ij}—the value of the *j*-th variable (*j* = 1, 2...m) for *i*-th object (*i* = 1, 2...n), $Z_{ij} \in [0; 1]$, normalized value of *j*-th variable for *i*-th object (Kukuła, 2000; Kukuła & Bogocz, 2014). As a result, a matrix of unitarized values (Z_{ij}) is represented in Equation 4:

$$Z_{ij} = \begin{bmatrix} Z_{11} & \cdots & Z_{1n} \\ \vdots & \ddots & \vdots \\ Z_{m1} & \cdots & Z_{mn} \end{bmatrix}, \tag{4}$$

The weights of the variables are shown in Table 1. They were determined based on standard deviations and correlations using the criteria importance through intercriteria correlation (CRITIC) method (Hassan et al., 2023; Polcyn, 2022), using the following equations (5 and 6):

$$w_j = \frac{C_j}{\sum_{k=1}^{K} C_k},\ j = 1, 2, \ldots, K, \tag{5}$$

$$C_j = S_{j(Z)} \sum_{k=1} (1 - r_{jk}),\ j = 1, 2, \ldots K, \tag{6}$$

where C_j denotes a measure of the information capacity of the *j*-th variable, $S_{j(Z)}$ is the standard deviation oblicated from the normalized values of *j*-th variable, r_{jk} correlation coefficient between the trait *j* and *K*. The normalized values of the diagnostic variables are multiplied by the weighting factor w_j ($Z^*_{ij} = Z_{ij} * w_j$) (C. Wang et al., 2023).

The synthetic measure for municipalities (aspects of the pro-environmental spending, environmental conditions, and the development process of municipalities) was determined by the technique for order of preference by similarity to ideal solution method (TOPSIS), as shown in Equation 7 (Kozera et. al., 2021; Wang et al., 2021):

$$q_i = \frac{d_i^-}{d_i^- + d_i^+}, \tag{7}$$

where $q_i \in [0; 1]$, *i* = 1, 2,...,n; d_i^- is the euclidean distances of the object from the anti-pattern (= 0), and d_i^+ is the euclidean distance of the object from the pattern (= 1). A higher value of the synthetic measure means a better situation of the municipality in the studied area (Bąk, 2018; Lenormand & Deffuant, 2013; Łuczak & Kalinowski, 2020; Polcyn, 2021).

The municipalities were grouped by synthetic measure: environmental spending, environmental status and development, using the average ($\bar{x}$), and standard deviation (S_d).

The first group included municipalities with the highest values of the synthetic measure, followed by groups with lower values. The grouping was done according to the Equation 8:

$$\begin{aligned} &\text{Group I} && \bar{x} + S_d \le q_i \\ &\text{Group II} && \bar{x} \le q_i < \bar{x} + S_d \\ &\text{Group III} && \bar{x} - S_d \le q_i < \bar{x} \\ &\text{Group IV} && q_i < \bar{x} - S_d \end{aligned} \tag{8}$$

Also, the maps of spatial variation of the synthetic measure, measures of descriptive statistics, Pearson's linear correlation coefficient, bag charts and development, and concentration measures, which were performed in Statistica software, are presented (Dziekański et al., 2023; Kisielińska & Stańko, 2009).

4. Results

Despite its central location in Poland, Świętokrzyskie Voivodeship is a peripheral region in terms of economic, infrastructural, and social development. From the EU perspective, the Świętokrzyskie Voivodeship can be considered a peripheral due to differences in the level of development, access to resources and investment level compared to more developed areas of the EU. Table 2 shows the groups of municipalities by the average value of the synthetic measure: pro-environmental spending, environmental conditions, and development.

Table 2. The number of municipalities in each group according to the synthetic measure and the synthetic measure's average value

Group	$\bar{x}$ q measures	Number of units	$\bar{x}$ q measures	Number of units	$\bar{x}$ q measures	Number of units	$\bar{x}$ q measures	Number of units
		2014		2020		2021		2022
q pro-environmental spending								
I	.40	12	.46	13	.55	10	.39	17
II	.27	36	0.33	45	.44	56	.41	41
III	.20	42	0.25	31	.34	22	.22	30
IV	.04	12	0.05	13	.05	14	.06	14
q environmental conditions								
I	.64	12	.68	15	.68	14	.68	17
II	.56	47	.59	44	.59	44	.59	41
III	.49	19	.50	20	.51	21	.51	20
IV	.40	24	.41	23	.41	23	.42	24
q development								
I	.44	13	.45	17	.46	11	.54	14
II	.36	28	.37	29	.37	33	.44	35
III	.30	44	.32	42	.31	43	.38	38
IV	.25	17	.26	14	.26	15	.32	15

Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

There was a decrease in the synthetic measure of environmental spending in 2022 relative to 2021 after earlier years of growth (from .59 to .47, respectively). The relationship between pro-environmental spending and environmental status and development has weakened. This

could be due to decreased public spending in response to financial crises, the COVID-19 pandemic, and the inadequate implementation of environmental projects. It will be important to monitor this trend in future years to assess whether it is long-term or short-term. The synthetic measures ranged from .01 to .47 in 2022, .01 to .59 in 2021, and .01 to .52 in 2014. In subsequent years, the best group included following municipalities: Sandomierz (1), Działoszyce (3), Suchedniów (3), Połaniec (3), Nowiny (2), and Busko-Zdrój (3). The group with the weakest measure included: Baćkowice (2), Klimontów (3), and Łoniów (2) (Figure 1).

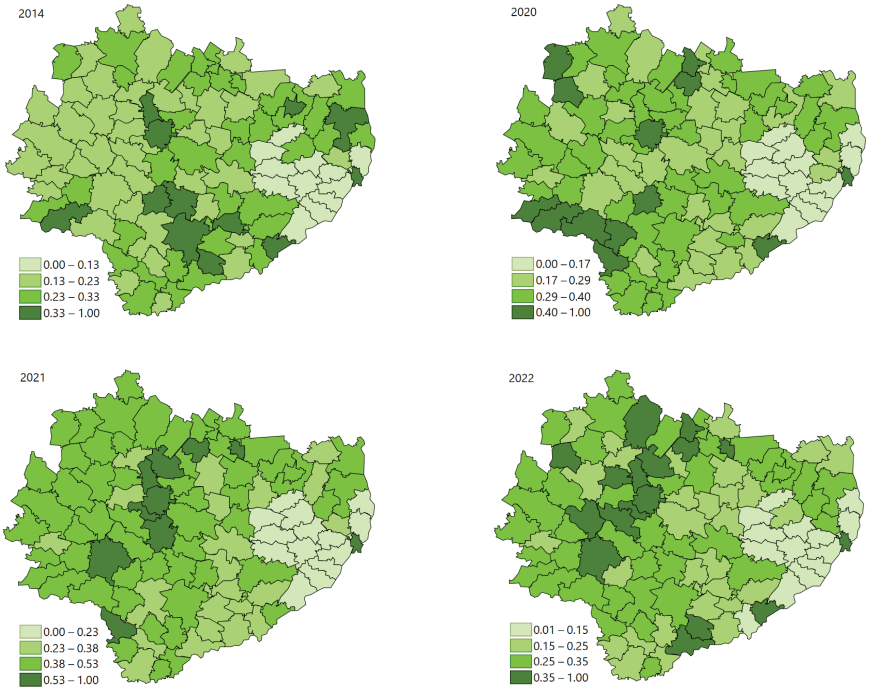


Figure 1. Variation of the synthetic measure of pro-environmental spending in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022.

Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The way that communities are geographically differentiated by their quality of life, population, and entrepreneurial activities may provide insight into how the environment affects social and economic situations, as well as the process of development, including the shift to a green economy. Despite regional variations in the assessed municipalities, the synthetic measure of environmental conditions in 2022 and 2021 ranged from .37 to .74, while in 2014 it ranged from .34 to .67. A synthetic measure of environmental condition shows some improvement, but with variation between municipalities still present. The environmental condition of the municipalities has improved, which may be due to investments in environmental protection. The reason for existing variation may be: the structure of the local economy and infrastructure, the environmental policy pursued, and the natural resources held.

The group of municipalities with the highest level of the measure of environmental conditions included: Zagnańsk (2), Wąchock (3), Suchedniów (3), Bliżyn (2), Brody (2), Miedziana Góra (2), and Bodzentyn (3), while with the weakest ones were Dwikozy (2), Wśniów (2), Tarłów (2), and Ćmielów (3). These are mostly municipalities with a developed agricultural function (Figure 2).

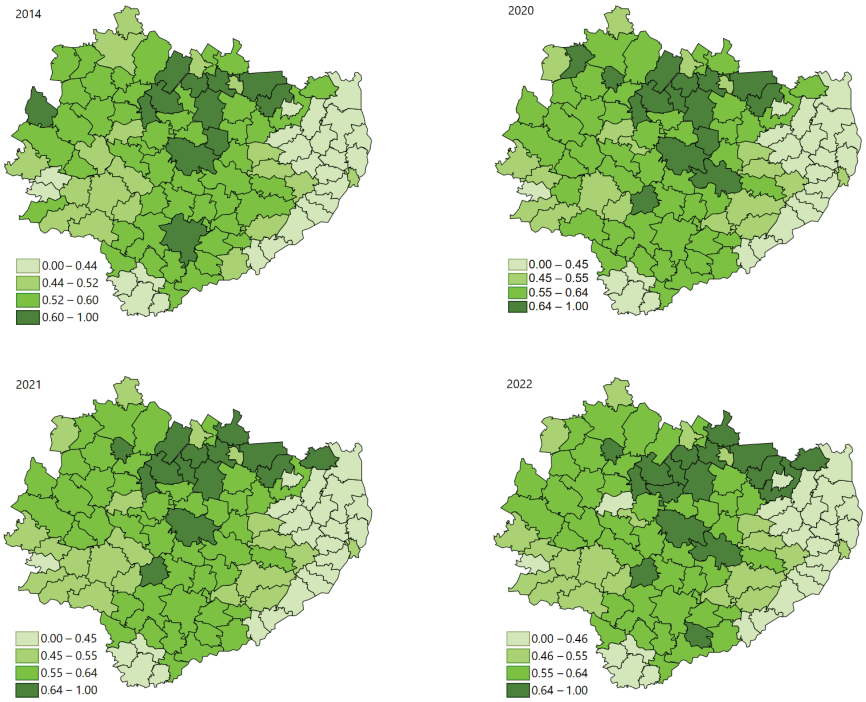


Figure 2. Distinction between the synthetic measure of the environmental conditions in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022.
Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The synthetic measure of development for 2022 compared to 2021 is up (from .57 to .64). Among the municipalities in the best group I, that had the highest measure level were: Kielce (1), Sandomierz (1), Morawica (3), Nowiny (2), Starachowice (1), Ostrowiec, and Świętokrzyski (1). These are industrial municipalities with a developing labor market and a sector of small and medium-sized enterprises. In the weakest group IV, are municipalities: Skalbmierz (3), Kazimierz Wielka (3), Wilczyce (3), Łoniów (2), and Bliżyn (2). The measure ranged from .27 to .64 in 2022, from .25 to .57 in 2021, and from .24 to .54 in 2014 (Figure 3).

The findings show that spatial differentiation in the studied areas has increased and decreased during the observed years. Measures of central tendency (mean, median) take values from 2014 to 2022 (higher) and from 2021 to 2022 (lower) for pro-environmental spending, higher and unchanged for environmental conditions, and higher for development. Regarding the measurements of variability (spread, standard deviation, coefficient of

variation), the link between 2014 and 2022 and 2021 by 2022 exhibits growth and drop, as well as an equilibrium. An increase in the values of kurtosis (environmental quality) indicates a greater concentration of the municipalities around the average value; their decrease (pro-environmental spending, development) indicates a greater spread of values. The measure of pro-environmental spending and the state of the environment shows leftward skewness, while the measure of development shows rightward skewness.

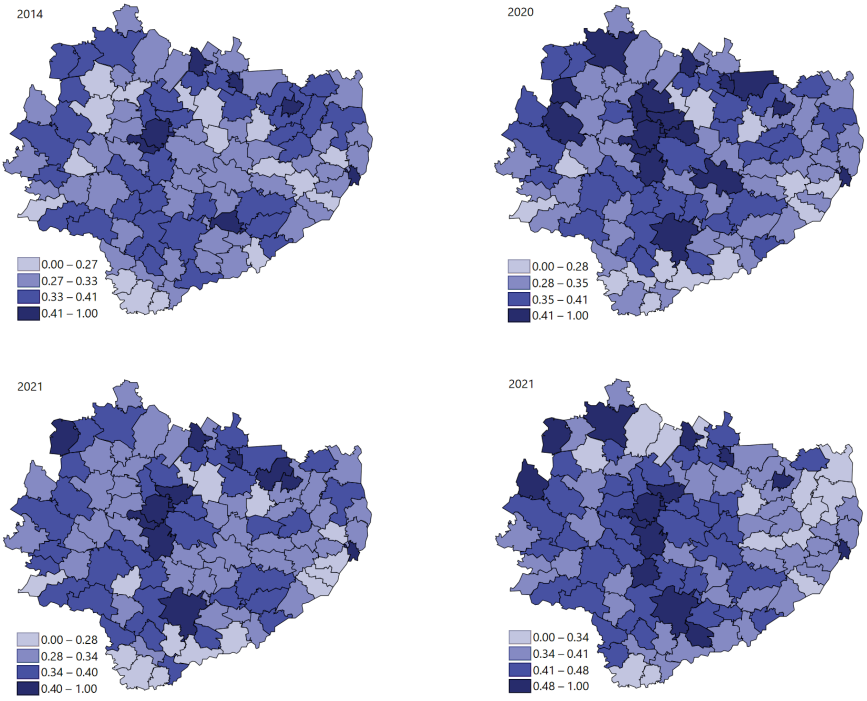


Figure 3. Differentiation of the synthetic measure of development in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022.
*Note.*Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The association between pro-environmental spending and the synthetic measure of the environmental quality is shown in Figure 4. The Pearson correlation coefficient between the value of the synthetic measure was .228 (2014), .290 (2020), .461 (2021), and .357 (2022). The group of outliers units (with domestic values) included, among others, the municipalities of: 1) Starachowice, Sandomierz, and Kielce; 2) Baćkowice, Bogoria, Miedziana Góra, Dwikozy, and Zagnańska, and 3) Klimontów, Iwaniska, and Wąchock.

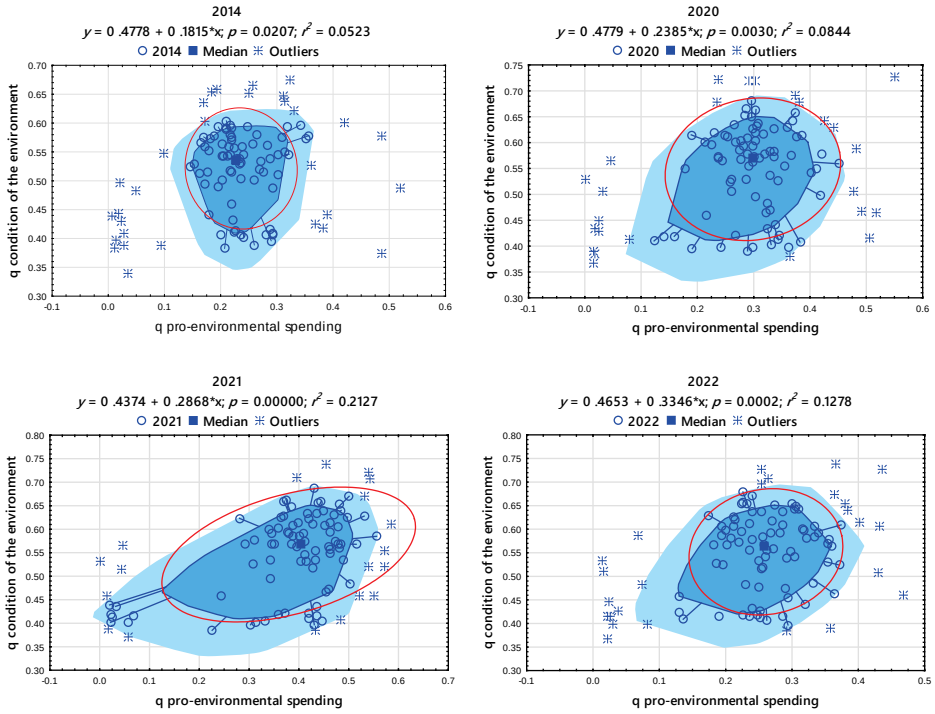
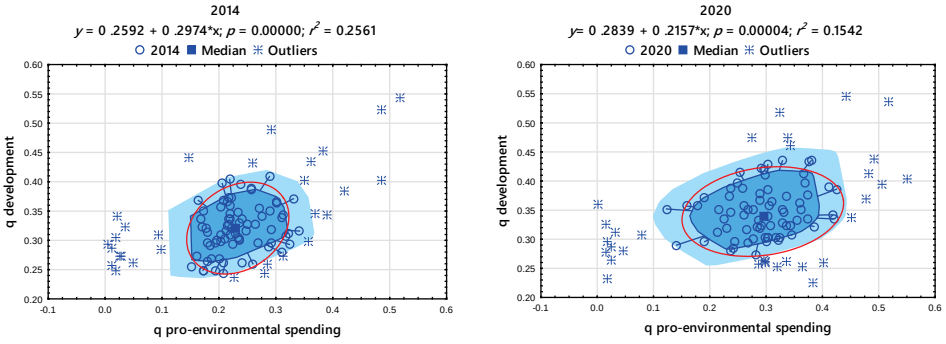


Figure 4. The relationship of the synthetic measure of pro-environmental spending and environmental conditions in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022.
Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The synthetic measure of green spending and development was, .392 in 2020 and .476 in 2022. The outliers include the municipalities of: 1) Kielce, Sandomeirz, Starachowice, and Ostrowiec Świętokrzyski, 2) Bejsce, Skarzysko-Kościelne, Samborzec, and Dwikozy, and 3) Stąporówk, Suchedniów, and Nowy Korczyn (Figure 5).



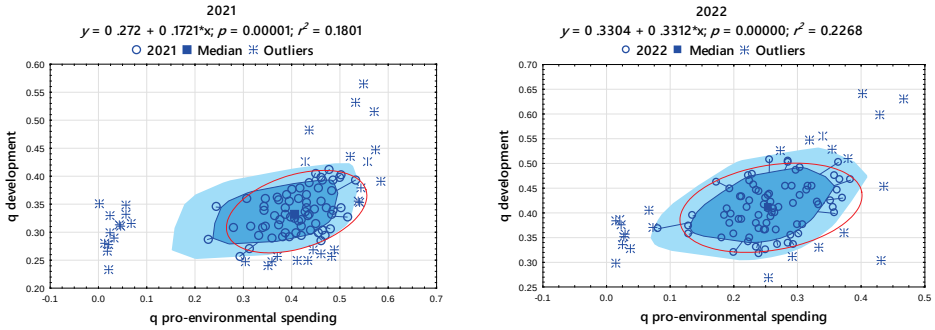


Figure 5. The relationship of the synthetic measure of pro-environmental spending and development in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022.
Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The biological obstacles, raw material shortages, and geographic constraints are among the ecological (environmental) risks to economic growth. Table 4 presents the correlation values (positive and negative) between the pro-environmental spending aspects and the synthetic measure of pro-environmental spending, development, and environmental state.

Table 4. Pearson's linear correlation measure between the measure of pro-environmental spending, environment conditions, and development in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022

	q pro-environmental spending	q environmental conditions	q development
Municipal management facilities	.03	–.05	–.01
Cleaning of cities and villages	.25	.04	.41
Maintenance of greenery in cities and municipalities	.27	.03	.47
Protection of atmospheric air and climate	.16	.09	.27
Sewage management and water protection	.25	.30	.25
Municipal waste management	.33	.10	.49

Note. Linear correlation coefficients for sample observations (N = 408). Own study based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by SP, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

The values of the correlation coefficients between environmental spending and various aspects of its implementation by municipalities indicate positive but rather weak correlations. Pro-environmental spending in municipalities can be distributed over many different areas and is not necessarily strongly correlated with individual environmental activities. Environmental management in municipalities is a complex process and not always all these activities are directly related to environmental spending. The environmental conditions can also be influenced by economic changes and regulations. Maintenance activities (cleaning, greening, and waste management) have the greatest impact on the development of the municipalities, both socially and economically.

Changes in the socio-economic space of municipalities are determined by a number of infrastructural, environmental, demographic, business and financial variables (including environmental spending). They can be a derivative of a region's economic attractiveness.

They are also a factor in the spatial polarization (differentiation) of phenomena (Table 5). The values of the Gini coefficient show inequalities in environmental spending between municipalities. Its decrease suggests that pro-environmental spending is becoming more evenly distributed between municipalities. Such a trend may be due to the fact that more and more municipalities are starting to invest in environmental protection and policies that support sustainable development. The decrease in inequality by 2021 may reflect growing environmental awareness and increased investment in this area. An increase in inequality in 2022 may be the result of fewer resources available to municipalities or a reduction in state support for environmental measures. The Gini coefficient for the state of the environment shows relatively little change. The noticeable increase in the Gini coefficient in 2020 may suggest that there has been some variation in the state of the environment during the COVID-19 pandemic or as a result of other social and economic changes. The Gini coefficient for development initially increased slightly in 2020. This increase may be the result of investment in development in municipalities, which may have led to a concentration of development. In the following years, we observe stabilization and a reduction in development inequalities.

Table 5. Gini concentration measure of the synthetic measure of pro-environmental spending, environment conditions, and development in the Świętokrzyskie Voivodeship's municipalities in 2014, 2020, 2021, and 2022

Year	q pro-environmental spending	q environmental conditions	q development
2014	.254	.106	.116
2020	.233	.118	.121
2021	.221	.116	.116
2022	.234	.116	.111

Note. Based on SP data for 2014, 2020, 2021, 2022. Data are from "Data by domains" [Unpublished Data Base], by Statistics of Poland, 2024 (https://bdl.stat.gov.pl/bdl/dane/podgrup/temat). In the public domain.

5. Discussion and conclusion

Generally, efforts to lessen the load on the environment by establishing favorable conditions for habitation and commercial activity are the fundamental source of pro-environmental spending, development, and the condition of the naturalized environment. Improvements in resource efficiency result in fewer pollutants and less use of non-renewable resources, which benefits ecology, waste management, quality of life, and the environment (A. Łuniewski & S. Łuniewski, 2020). Some social and economic phenomena cause environmental degradation. In order to achieve economic and social goals, people sometimes destroy the environment, which leads to reduced well-being, such as loss of health (Kryk, 2004). As Burzyńska (2011) points out, environmental protection needs exceed the possible financial resources of municipalities, and their nature of environmental spending benefits development.

The results of the research show that a high level of economic development, as well as environmental sustainability, is characteristic for municipalities in the vicinity of the local economic centers, such as Jędrzejów, Busko Zdrój and Staszów, or in their immediate vicinity (Kielce). Municipalities that are less developed economically but have an above-average level of environmental quality are located on the periphery of the Świętokrzyskie Voivodship. They are characterized by the existance of protected areas, agricultural character, high unemployment and a small number of economic entities (Popławski & Wojewodzic, 2009).

Investments for ecological purposes can be a source of income for the municipality, and they can also build up the revenue stream of the municipality indirectly due to the fact that they affect local development where they are implemented (Burzyńska, 2011). However, significant financial resources are needed for Poland to meet sustainable development goals, including environmental targets (Bąk et al., 2023).

The researched municipalities of Świętokrzyskie Voivodeship are differentiated in terms of pro-environmental spending, environmental conditions, as well as development. Relationships between the studied aspects of the presented research results in Świętokrzyskie Voivodeship are not synergistic. The recorded trend in the growth of these relationships is increasing, decreasing and weak, depending on the years studied.

Municipalities in Świętokrzyskie Voivodeship are differentiated in terms of pro-environmental spending, the state of the environment, and development. The relationship between the indicated researched areas has weakened. The reason for this may be the reduction of public spending in response to financial crises, the COVID-19 pandemic, or inadequate implementation of environmental protection projects. Maintenance, greenery, and waste management have the greatest impact on the social and economic development of the municipalities. While the impact of water management, air protection, and climate protection on the development of municipalities may not be visible in the short term, in the long term they might attract investment and improve quality of life and development.

A synthetic measure enables the assessment of complex phenomena or processes by transforming many different indicators or parameters into one condensed value. It also allows for a linear ordering of the surveyed units. The obtained measures depend on the number and type of variables adopted in the study. This knowledge can be used by authorities to assess the effectiveness of the development instruments currently employed and the efficiency of the tools used in policy implementation, allowing for the identification of strengths and areas needing improvement in decision-making processes in the studied areas.

Further lines of research into the relationship between environmental spending, environmental conditions and development could be pursued using structural models to diagnose the latent relationships of sub-metrics. It also seems interesting to examine these relationships at the level of counties and provinces with different levels of economic development and environmental condition. The main difficulty identified in carrying out this study was the limited availability of up-to-date information (limited statistical sources, inconsistency of statistical sources) on pro-environmental spending, environmental status, and development variables at the municipal level.

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