

## THE MANAGEMENT OF URBAN COMMUNES IN THE ASPECT OF SUSTAINABLE DEVELOPMENT

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**Abstract:** The awareness of sustainable development principles is becoming increasingly widespread, but the implementation of this idea into economic, social, and political life is associated with numerous difficulties and still constitutes a complex problem. This paper aims to assess the stimulants and destimulants of implementing sustainable development principles. A survey questionnaire was conducted between March and May 2021, and the data was analyzed using Canonical Correspondence Principal Components Analysis (CCPCA) and Classification and Regression Trees (CART) methodology to discern the relationships among variables. Fisher's test was employed to assess the strength of the relationships between the identified factors. The results revealed that the main opportunities associated with sustainable development include access to EU programs and funds, tourism development, city and region promotion, and job creation through attracting foreign and domestic investments. On the other hand, the most significant threats identified were unstable financial policies, increased tasks without ensuring financial resources, and lack of support for eco-friendly business activities. These factors contribute to potential social, economic, and environmental problems, such as air pollution, low environmental awareness among residents, and inadequate road infrastructure. The findings emphasize the need for to consider both internal and external factors when implementing sustainable development measures.

**Key words:** sustainable development, environment, management, municipalities, CCPCA, CART, Fisher's test

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### Introduction

Rapidly evolving public governance has prompted significant changes in recent years (Pollitt and Bouckaert, 2000; König, 2003). While the turn of the 20th century witnessed the development of Public Administration by H. Fayol and the theory of bureaucracy by M. Weber (Weber, 2002; Caiden, 2017), the emergence of the New

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Public Administration and New Public Management concepts in the 1980s marked a watershed moment in public governance (Hausner, 2008), particularly in the United States, Great Britain, Australia, and New Zealand. Notably, the late 1990s saw the inception of Public Governance, emphasizing the collaboration of citizens, non-governmental organizations, and entrepreneurs, alongside accountability, transparency, and social consultations in governance processes, as well as the application of sustainable development principles (Blau, 2005; de Gay, 2005; Ansell and Gash, 2008).

The recent prevalence of global challenges such as climate change, economic instability, and social inequality has underscored the importance of sustainable development principles in addressing such challenges. Furthermore, the COVID-19 pandemic has emphasized the need for sustainable development as a means of promoting resilience and adaptability to unforeseeable crises.

Against this backdrop, the present study seeks to assess the stimulants and destimulants of implementing sustainable development principles in public governance. This research is of particular significance as it can provide valuable insights into the challenges and opportunities of implementing sustainable development principles in public governance, which can ultimately inform policy decisions and improve the effectiveness of governance strategies. Therefore, this study represents a vital contribution to the field of public governance and sustainable development, advancing knowledge and providing crucial evidence-based guidance for public governance stakeholders.

### Literature Review

Sustainable development is currently defined as the totality of natural environment transformations and exploitation of economic, human and environmental resources with the goal of satisfying social needs and improving the quality of life. The aim of these activities is to protect the ecological, economic and social aspects and correlate them with the amount of natural resources in the short- and long term (Arrow et al., 2003; Basiago, 1998; Diefenbacher, 2001; Haugan, 2014; Jałowicki, 2015; Holden et al., 2018; Gunzenova, 2019; Govindan et al., 2021; Popescu and Siminică, 2019; Bran et al., 2020). Zaděcka (2018), Jaszczak et al. (2021) concludes that there is no one universal model of urban development. Sustainable development in the broad sense is treated as implementation of a new, realistic model in the economy that is also a political vision of the future (Freiman, 2006; Ștefan et al., 2019; Jucevičius and Jucevičienė, 2020).

Research question 1: What are the key factors influencing effective cooperation between different stakeholders in promoting sustainable development at local level?  
Hypothesis 1: Effective cooperation between stakeholders such as local authorities, businesses and the community can contribute to the achievement of SDGs at local level.

In accordance with the principles of subsidiarity, the most important decisions should be taken at the level closest to the citizens. Propagation of the idea of

sustainable development depends to a large extent on the engagement of state institutions, self-government bodies and other entities (Borys, 2003; Popa et al., 2017). Partnership-based cooperation, supported by territorial agreements between local authorities and the government enables the implementation, programming and control of the directions of sustainable development evaluation. As A. Kurzynowski stresses, proper relationships between the different levels of government in a country have an important impact on the creation of conditions for sustainable development (Kurzynowski, 2000; Popa et al., 2020).

Research question 2: How can technological development, data science and artificial intelligence contribute to achieving the Sustainable Development Goals in cities and regions?

Hypothesis 2: The deployment of advanced technologies, data science and artificial intelligence can contribute to better monitoring, analysis and management of resources and to achieving sustainable development goals in cities and regions.

Self-government at municipal level fulfils a constitutive function for the concept in question and for integration of its principles with the way of governing a municipality through the degree of achievement of both high level of satisfaction among residents and sustainable development goals (Sobczak, 2021; Kręcidło and Karaszewski, 2018). Hence, municipalities should concentrate on raising the level of quality through governance, as it determines the integrity of development measures that impact social protection and well-being (Androniceanu et al., 2022a). The most important benefits of applying the assumptions of the concept of sustainable development in municipalities include (Szałata, 2015; Popescu et al., 2020): coherence of the economic policy of self-government at municipal level, streamlining of the procedures connected with the implementation of investments, increased effectiveness of executed tasks, adjustment of the activities of a municipality to the needs of the local community, improvement of environmental parameters and quality of life of future generations. Thus, the implementation of the assumptions of sustainable development is building responsibility and awareness in society as well as the possession of specialist knowledge resources, creation of appropriate economic, social, and environmental conditions within a given territorial unit.

Research question 3: What are the most effective ways to integrate social, economic and environmental objectives into urban planning and management processes?

Hypothesis 3: Integrating social, economic and environmental objectives into urban planning and management processes can lead to improved quality of life for residents, increased efficiency of investments and improved environmental performance at local level.

Cities and regions were of interest at the recent COP26 summit in Glasgow, where major gaps were identified between countries' current actions and their long-term carbon-free strategies (Kaplan and Birnbaum, 2021; Mocanu and Mocanu, 2021). Studies show that the current rate of urban expansion can raise global temperatures by 1-2°C (Georgescu et al., 2014; Drigă and Ciocoiu, 2017; Swar, 2019),

dramatically exacerbating the risks of climate change such as drought, floods, extreme heat, loss of species, and poverty for hundreds of millions of people. This is particularly important in the context of urban development, where contemporary infrastructure and technology will contribute significantly to the sustainable use of resources and thus to the reduction of CO<sub>2</sub> emissions and climate protection over the next 40 years (Georgescu et al., 2014; Rosenzweig et al., 2010; Filipkowski and Kisilowski, 2021).

Others examined strategic governance processes based on collaboration in the context of balanced cross-sectoral partnerships between municipalities, businesses, and other stakeholders in the sector (Clarke and MacDonald, 2019; MacDonald et al., 2018a; MacDonald et al., 2018b; Pop et al., 2019; Mihai and Olimpia, 2019). The diversity of topics addressed in the field of sustainable development shows how complex this research field is. Recent research in Management and Marketing ([managementmarketing.ro](http://managementmarketing.ro)) and Engineering Management in Production and Services ([pb.edu.pl](http://pb.edu.pl)) emphasize the need for effective cooperation between stakeholders in the promotion of sustainable development and the importance of integrating social, economic, and environmental goals into urban planning and management (Ciulu et al., 2020; Kowalczyk et al., 2019).

The continuous advancement in the field of sustainable development highlights the necessity of interdisciplinary collaboration and the integration of different research perspectives. This includes not only the traditional domains of ecology, economics, and sociology, but also the emerging areas of technology, data science, and artificial intelligence (Łupina-Wegener and Bąk, 2019; Filipkowski and Kisilowski, 2021). Consequently, it is essential to adapt and refine research methods and approaches to address the challenges of sustainable development in the context of urban and regional planning, technological advancements, and societal transformations (Lis et al., 2018; Woźniak and Poczowski, 2020).

Research question 4: What are the best practices for implementing sustainable development principles in cities and regions, taking into account contemporary technological and societal challenges?

Hypothesis 4: Best practices for implementing sustainable development principles in cities and regions combine advanced technologies, participatory decision-making and a multi-faceted approach to resource and infrastructure management.

As sustainable development research progresses, attention should be paid to developing innovative management models that take into account the diverse needs of local communities, exploit technological potential and are based on sound science (Gorzeń-Mitka and Okręglicka, 2020; Poczowski and Woźniak, 2021). Ultimately, the pursuit of sustainability requires a holistic approach that integrates ecological, economic, social and technological perspectives, and supports collaboration between different stakeholders, sectors and scientific disciplines (Klimczak et al., 2018; Rădulescu et al., 2020).

Therefore, further research on sustainable development should focus on identifying, analysing and assessing different governance models that can effectively address

contemporary challenges including government effectiveness, both locally and globally (Androniceanu et al., 2022b). There is also a need to monitor and evaluate actions taken under global initiatives, such as climate agreements, and to analyse how these actions affect the achievement of the SDGs in different contexts (Ionescu and Ghiță, 2019; Filipkowski and Kisilowski, 2021). In addition, an important aspect is the study of the impact of changing social, political and economic conditions on processes related to sustainable development. In particular, it is important to understand how these conditions affect the actions of local authorities and other stakeholders, and how they can be taken into account for effective planning and management of sustainable development (Moșteanu et al. , 2020; Staniewski and Awruk, 2020).

Research question 5: How do changing social, political and economic conditions affect sustainable development processes as well as cooperation and communication between different stakeholders?

Hypothesis 5: Changing social, political and economic conditions affect sustainable development processes by modifying priorities, available resources and adaptive capacities of stakeholders, which in turn may lead to changes in approaches to planning and managing sustainable development.

To meet today's sustainability challenges, researchers should use an interdisciplinary approach that combines different research methods and perspectives, such as data analysis, systems modelling, case studies or participatory research (Ciulu et al. , 2020; Kowalczyk et al. , 2019). This type of approach may lead to a better understanding of the complex interrelationships between different aspects of sustainable development and may also help to identify new strategies and instruments that will be effective in practice (Lis et al. , 2018; Woźniak and Poczowski, 2020).

In this context, future research on sustainable development should focus on the following areas:

1. Develop and evaluate innovative governance models that take into account the diverse needs of local communities, exploit technological potential and are based on sound science.
2. Analysis of the impact of changing social, political and economic conditions on sustainable development processes and on cooperation and communication between different stakeholders.
3. The use of an interdisciplinary approach that allows the combination of different research methods and perspectives, such as data analysis, systems modelling, case studies or participatory research.

### **Research Methodology**

The conducted study focused on learning about the specificity of governing an urban municipality in the aspect of sustainable development. Verification of the research hypotheses and an attempt to find answers to the questions posed by the researchers were carried out using a questionnaire interview, which enabled the diagnosis of the

implementation of the principles of sustainable development by urban communes. Questionnaires were chosen because, firstly, the analysis of the source material, in particular the extensive development strategies of the municipalities surveyed, does not always provide meaningful data for a benchmarking analysis, and secondly, as suggested by the municipal authorities, completing a questionnaire was preferable to a direct interview. The electronic version of the survey was addressed to the municipal authorities - city presidents.

In total, 14 urban municipalities of Lesser Poland Voivodeship (n=14) were covered by the study. It should be stressed that all the entities participated in the study, namely: Krakow, Nowy Sącz, Tarnów, Bochnia, Gorlice, Limanowa, Mszana Dolna, Grybów, Nowy Targ, Bukowno, Oświęcim, Jordanów, Sucha Beskidzka, Zakopane. The study was conducted in urban municipality offices in the period March to May 2021. Its aim was to acquire information on the situation of urban municipalities of Lesser Poland Voivodeship regarding sustainable development and to verify its importance for municipality governance. Based on the survey results, an attempt was also made to analyze the frequency of percentage distributions of the responses to the individual questions. The analysis was conducted using statistical package R. In order to examine the relationships between nominal data, Fisher's exact test was used. Significance level  $\alpha = 0.05$  was selected.

Multidimensional analysis of CCPCA and CART was performed to illustrate cause and effect relationships. The CCPCA model is a variant of the main component analysis with the difference that the factor rotation takes place according to class centroid (Topolski and Beza, 2022; Topolski, 2020a; Topolski 2020b). For the original questionnaire, CCPCA was based on probabilities, where the explained variance refers to the strength with which the extracted components explain the variability of the multidimensional vector of features. The choice of the method is dictated by the fact that there are nonlinear relationships between variables, which is due to their categorical nature. The second reason for using CCPCA is the small sample of data. In the end, seven main components were identified. These components contain different questions and answers to them, which are related to each other in certain relationships (grouping answers with different questions). Such isolated constructs form the basis for building a hierarchical model, which for this paper is a CART tree. It is a model that indicates the transitions (sequence) of responses, where the successive appearing characteristics are dependent on those that are their predecessors. In this way, we can define IF THEN rules in a multidimensional aspect. The prerequisites (components) may belong to different rules, and the only difference is the power of discrimination of such a rule.

### Research Results

All the analyzed municipal authorities confirmed that they have a development strategy in place and include sustainable development principles in it, with 71.4% in the economic aspect, 71.4% - in the social aspect, and 64.3% - in the environmental aspect. It can be thus concluded that the analyzed entities give almost equal attention



to all the three dimensions of sustainable development. The inclusion of all the three aspects in the development strategies of the analyzed municipalities is a correct approach. All participants of the study declared knowledge of the concept of sustainable development indicating that the implementation of its principles is handled by: an interdepartmental team (35.7%) and a dedicated unit (28.6%), followed by a mayor (burmistrz), city president (7.1%) and department heads (7.1%), second deputy president, fields coordinators, and units responsible for implementing individual strategic programmes (7.1%). An overwhelming majority of the analysed urban municipalities (92.9%) confirmed that the governance of their entity is oriented towards the implementation of sustainable development measures. The analysed entities most often indicated that such measures had been employed in their city for 6–10 years (50%). According to 21.4% of the respondents, this period lasted 16 years or more; according to 7.1% of the respondents - 0-5 years and 11-15 years, whereas 14.3% did not have any knowledge on that subject. According to the analysed municipalities, the implementation of sustainable development principles was primarily driven by: the objectives adopted in the development strategy (78.6%), desire to improve the level of governance in the city (64.3%) and top-down legal regulations (42.9%). Positive experiences of other cities and self-awareness of those governing were indicated by 7.1% of the municipalities. The measures of a city most often concentrate on the environmental sphere (42.9%). The social sphere was indicated by 35.7% of the analysed municipalities, whereas the economic sphere - by 21.4%. The analysed entities most often indicated the implementation of the following sustainable development measures: raising environmental awareness of the local community (71.4%), provision of appropriate financial resources to fund environmental protection tasks (57.1%) and streamlining of the procedures connected with investment implementation (57.1%). Building nature protection networks was indicated least often (14.3%). The following were indicated as the major barriers to the implementation of sustainable development in a city: access to financial resources (100%), insufficient understanding of the sustainable development principle by society (50.0%), legal regulations (42.9%) and the policy of the central authorities (42.9%). Less often indicated were specific local conditions (14.3%), unsustainable practices in the transport sector (14.3%) and road infrastructure (7.1%). As the main reasons behind the decisions regarding the measures to increase the level of sustainable development in the city, 85.7% of the respondents indicated social needs, 78.6% - requirements placed by the European Union, 42.9% - the alarming state of the environment, while 42.9% - infrastructural needs. Half of the analyzed municipalities confirmed monitoring sustainable development indicators, with 28.6% not undertaking such activities. 21.4% of the analyzed entities indicated lack of knowledge in that area. According to 42.9%, monitoring sustainable development indicators rather impacts the management of task execution in the city. The overwhelming majority of the analyzed municipalities (85.7%) indicated that based on the monitoring of indicators, the level of sustainable development in the city can be evaluated as satisfactory, whereas seven analyzed

entities monitor the indicators in that area cyclically, once a year. In order to verify the hypotheses, the analyzed entities were asked in a survey questionnaire to indicate whether the different aspects of sustainable development represent a strength or weakness of the city.

When evaluating the strengths, most of the analyzed entities indicated social support programme (92.9%) or net migration (78.6%; only 21.4% of the cities struggle with a negative net migration, however it is a problem on a national scale and refers in particular to the outflow of working-age population). The strengths of the analyzed municipalities include: water quality, tourist values, and waste management. Analysis of the study results shows that municipalities perceive their area as a territory with rich tourist values. They also take care of water quality and waste management. Moreover, a significant part of the analyzed entities (n=11) indicated the quantity of green areas as a strength. Hence, it can be concluded that in urban municipalities of Lesser Poland Voivodeship, the strengths mainly refer to the environmental dimension of sustainable development. With respect to the weaknesses, air quality, housing and financial situation were indicated. Air quality is a significant problem in the territory of Lesser Poland Voivodeship. This is particularly visible in the city of Krakow, which struggles with smog that has a negative impact on the quality of life of its residents. The city Zakopane, which is a known tourist destination, also struggles with air pollution. In further part of the study, the municipalities were asked to evaluate the chances and threats in selected areas. The majority of the analyzed entities stated that economic recession poses a threat to their city (n=11; 78.6%). This is a negative economic phenomenon caused by internal and external factors as well as an inappropriate economic and financial policy, which also affects local governments. An unstable financial policy (n=13) and increase in the tasks of the city without provision of financial sources were indicated as a threat by the most analyzed municipalities (n=12). This means that the analyzed entities are most concerned about the measures of the central authorities. It should also be noted that a large portion of the entities is concerned about increasing environmental pollution and increasing amount of waste. Despite undertaking activities in the environmental dimension and indicating its different aspects as strengths, municipalities perceive a constant threat posed by increased pollution and waste, which may lead to deterioration in this sphere of sustainable development. In the economic aspect, municipalities mainly look to the EU funds as a chance to solve financial problems. Promotion of the city and tourism development were indicated as chances by all the analyzed municipalities. In the subsequent part of the study, municipalities were asked to evaluate the degree to which their territory is bothered by specific social, economic and environmental problems.

To a small extent, the examined municipalities struggle with the following problems: unemployment (57.1%), homelessness (64.3%); crime (78.6%), illegal landfill sites (57.1%), waste separation (64.3%), inappropriate state of infrastructure (50.0%). To a medium extent, their problems refer to: insufficient rest and recreation infrastructure (n=6, 42.9%; n=4, 28.6%), low share of investments in the city's



expenditure (n=7, 50.0%; n=4, 28.6%), low level of the city's expenditure on the environmental protection (n=7, 50%; n = 5, 35.7%). 78.6% of the respondents pointed to the low level of environmental awareness among the residents, while 57.1% - to environmental pollution. Subsequently, a statistical and econometric study was conducted. It enabled indication of the factors that contribute to both stimulating and destimulating sustainable development of the analyzed municipalities as well as determining the relationships between them. In order to examine the relationships between nominal data, Fisher's exact test (recommended for small samples), which is an equivalent of the chi-squared test, was used (table 1).

**Table 1. Stimulants and destimulants of sustainable development of urban communes of the Lesser Poland Voivodeship - Fisher's test results**

	<b>B - No own funds for infrastructure improvement</b>				
<b>A - Balance of migration</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>		
Strengths	0	3	3		
Weaknesses	9	2	11		
<i>Fisher's test result</i>					
	<i>P</i>		<i>V-Cramera</i>		
A/B	0.027		0.70		
	<b>B - Creation of new jobs by attracting internal and external capital</b>				
<b>A - Balance of migration</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>		
Strengths	1	2	3		
Weaknesses	11	0	11		
<i>Fisher's test result</i>					
	<i>P</i>		<i>V-Cramera</i>		
A/B	0.033		0.78		
	<b>B - Infrastructural lag</b>				
<b>A - Economic recession</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>		
Strengths	9	2	11		
Weaknesses	0	3	3		
<i>Fisher's test result</i>					
	<i>P</i>		<i>V-Cramera</i>		
A/B	0.027		0.70		
	<b>B - Public transport</b>				
<b>A - Housing economy</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>		
Strengths	6	0	6		
Weaknesses	3	5	8		
<i>Fisher's test result</i>					
	<i>P</i>		<i>V-Cramera</i>		
A/B	0.031		0.65		

		<b>B - Lack of financial resources to improve the condition of infrastructure</b>			
<b>A- The financial situation</b>		<b>Yes</b>	<b>No</b>	<b>Total</b>	
Strengths		1	4	5	
Weaknesses		8	1	9	
<b>Fisher's test result</b>					
		<i>P</i>	V-Cramera		
A/B		0.023	0.69		
		<b>B - Infrastructural lag in the region</b>			
<b>A - Increase in environmental pollution</b>		<b>Yes</b>	<b>No</b>	<b>Total</b>	
Strengths		9	2	11	
Weaknesses		0	3	3	
<b>Fisher's test result</b>					
		<i>P</i>	V-Cramera		
A/B		0.027	0.70		

Cramér's V constitutes the so-called strength of the effect and enables measurement of the relationships between two variables (Magiera, 2018). It takes values from 0 to 1 (the closer to 1, the bigger the strength of the relationship between the variables). Analysis was conducted in statistical package R.  $\alpha = 0.05$  was adopted as the level of significance.

Of the eleven municipalities, as many as nine stated that they lack own funds to improve infrastructure (81.8%). The result of Fisher's exact test indicates an important relationship between net migration and lack of own funds for improvement of infrastructure in the city. A proper infrastructure determines the quality of life in the city and affects the day-to-day functioning of the local community. Limiting investments in infrastructure improvement and modernisation translates into a negative image of the city from the perspective of its residents. The activities of municipalities should be focused on securing funds to improve the infrastructure and stop the outflow of residents from their areas. All the municipalities (n=11) indicating net migration as their weakness also indicated that creation of new jobs by attracting internal and external capital is a chance for the development of the city (100.0%). The result of Fisher's exact test points to a significant relationship between net migration and the chance to create new jobs by attracting internal and external capital ( $p=0.033$ , V-Cramera=0.78). Based on this relationship it can be argued that municipalities should take measures to create new jobs by attracting internal and external capital. Increased access to jobs has a positive impact on the inflow of working-age people into the area of a given municipality. Of the eleven municipalities indicating that economic regression poses a threat to the city, nine also note a threat in the form of infrastructural backwardness (81.8%). The result of Fisher's exact test indicates a significant relationship between economic recession

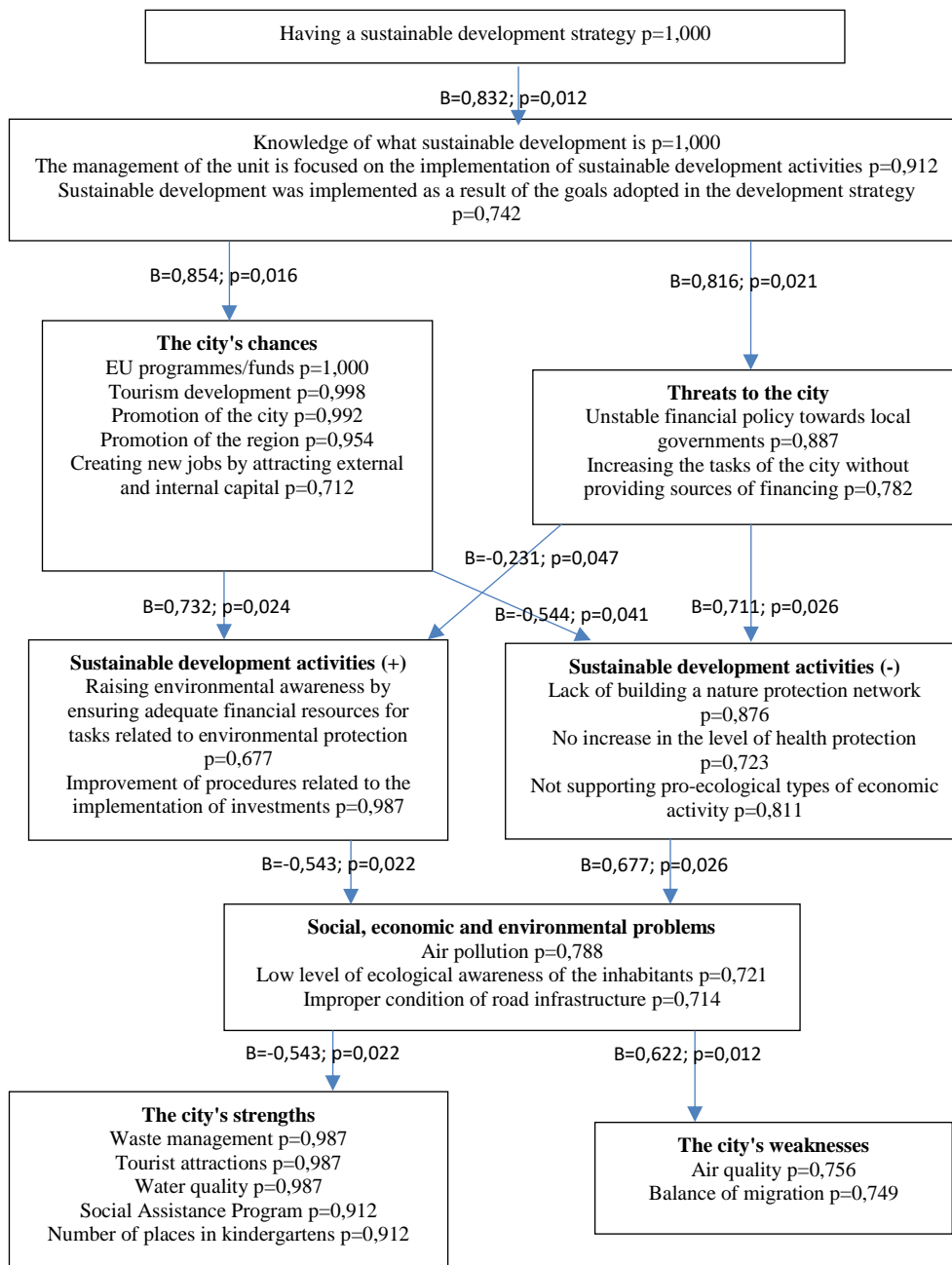
and infrastructural backwardness ( $p=0.027$ ; V-Cramera=0.78). Municipalities for which infrastructural backwardness in the region is a threat are also afraid of potential economic recession, which contributes to the slowdown of the rate of development. They should prevent external threats by modernising the infrastructure. Of the eight municipalities indicating that housing is a weakness of the city, five (62.5%) pointed to public transportation as a weak point. The result of Fisher's exact test indicates a significant relationship between housing and public transportation ( $p=0.031$ ; V-Cramera=0.65). Given that housing in a municipality is connected with public transportation, it should be stressed that municipalities should also focus on the development of public transportation when executing housing tasks. A properly functioning public transport in urbanised areas is a significant factor of sustainable development. It positively impacts not only the social aspect, but also the environmental one. Of the nine municipalities that indicated financial situation as a weakness of the city, eight confirmed that a lack of financial resources to improve the state of infrastructure should be treated as a threat (88.9%). The result of Fisher's exact test indicates a significant relationship between the financial situation of self-government and a lack of financial resources to improve the state of infrastructure ( $p=0.023$ ; V-Cramera=0.69). A municipality should manage financial resources in a rational way allowing it to achieve the most important goals adopted in the development strategy. Of the eleven municipalities indicating a threat of increased environmental pollution, nine (81.8%) confirmed the threat of infrastructural backwardness in the region. The result of Fisher's exact test indicates a significant relationship between the threat of increased environmental pollution and the threat of infrastructural backwardness in the region ( $p=0.027$ ; V-Cramera=0.70). Municipalities should observe the external environment both in the socio-economic aspect, i.e. the changing level of infrastructure in the region, and the environmental one, i.e. the level of environmental pollution. Activities of a municipality should be oriented towards preventing the potential consequences of external threats.

In the next stage of the study, the CCPCA model with isolated 7 components was developed. The developed method explains a total of 86.87% of the total variance of the measured phenomenon (based on the questionnaire). The results are shown in Table 2. The isolated components are shown in Figure 1 as features in rectangles.

Table 2. CCPCA model with 7 components distinguished

Component	Component	Initial eigenvalues	Sums of squared charges after extraction	Total	% of variance	% cumulative
	Total	% of variance	% cumulative			
1	15,433	27,544	27,544	15,433	27,544	<b>27,544</b>
2	13,233	21,223	48,767	13,233	21,223	<b>48,767</b>
3	7,564	12,433	61,200	7,564	12,433	<b>61,200</b>
4	4,342	8,564	69,764	4,342	8,564	<b>69,764</b>
5	3,233	6,342	76,106	3,233	6,342	<b>76,106</b>
6	2,122	5,877	81,983	2,122	5,877	<b>81,983</b>
7	1,494	4,888	86,871	1,494	4,888	<b>86,871</b>

The developed model is a good fit as evidenced by the coefficient (RMSEA=0.034<0.05, GFI=0.966; Chi2=34.232; p<0.001). The p-coefficients indicate to what extent [0-1] a feature in a particular component has discriminatory power compared to other features. In other words, it determines the power of influence. The coefficient B [-1;1] determines the direction and return with which one component with variables influences the formation of responses in another component. At the value of B is p which is the level of significance. Only relevant features were included in the model as a result of feature removal according to the CCPCA method.



**Figure 1: Hierarchical model of the CART tree predictive relationship of factors (components) of sustainable development of urban communes**

Note that the respondents 100% believe that their city has a sustainable development strategy. This 83. 2% is related to the knowledge of what sustainability is. Respondents with knowledge of sustainable development 91. 2% believe that the management of the unit is oriented towards the implementation of sustainable development activities and to a lesser extent 74. 2% declare that the implementation of sustainable development arose as a result of the objectives adopted in the development strategy. The test subjects therefore demonstrate knowledge and thus the model can be regarded as an expert. The most important opportunities that respondents (85. 4%) see in terms of sustainable development are: EU programmes and funds, tourism development, promotion of the city, promotion of the region, creation of new jobs by attracting foreign and domestic capital. The same opportunities in 73. 2% are related to actions of sustainable development, i. e. raising environmental awareness, providing adequate financial resources for tasks related to environmental protection and improving procedures related to the implementation of investments. Respondents, who more often point to the dangers of the city, pay particular attention to unstable financial policy towards local governments, increasing the tasks of cities without providing financial resources. This, in turn, affects negatively in 71. 1%, i. e. respondents indicate more often that there is no building of a network of nature protection, no increase in the level of health protection and, according to respondents, there is a high risk 81. 1% of not supporting pro-ecological types of economic activity. It is the above-mentioned sustainable development measures (67. 7%) that contribute most to the social, economic and environmental problems that may arise, i. e. air pollution (78. 8%), low environmental awareness of the inhabitants (72. 1%) and poor road infrastructure (71. 4%).

### Discussion

In conclusion, quantitative research on the assessment of sustainable development was conducted by many authors. The assessment of the level of sustainable development of municipalities consists of monitoring a set of constructed individual and group indicators describing the economic, environmental and social aspects (Dunphy et al., 2000). In the literature on the subject, one can find various proposals for measuring the level of sustainable development at individual levels of territorial division (Brzozowska et al., 2022). Paris and Kates (2003) noted, that despite the persistent definitional ambiguities associated with sustainable development, much work (over 500 research efforts) has been devoted to developing quantitative indicators of sustainable development (Brzozowska et al., 2022). Research on the social determinants of sustainable development was carried out, among others, by Basar and Eren (2021). Research on the determinants of the human development index was also conducted by Khan et al. (2019). The study of the economic and social determinants of sustainable development was carried out by Cicea et al. (2019), Herwartz and Walle (2014), Nourry (2008), Paris and Kates (2003), Sachs et al. (2021). Also Evans et al. (2015) concluded that there is still no single method



of assessing the sustainability of development that is widely accepted as suitable and all methods developed have inadequacies that prevent a true measure of sustainable development from being determined.

In addition to quantitative research, the authors of this article have also undertaken qualitative research. The conducted studies show that sustainable development has foundations both in theory and practice, but local governments at municipal level are constantly searching for solutions that will allow this concept to be implemented in the process of their governance.

The survey questionnaire provided a lot of information on sustainable development principles, chances, threats, strengths and weakness of their implementation in governance of urban municipalities of Lesser Poland Voivodeship. Fisher's test confirmed the existence of strong correlations between the examined variables. Of key importance from the perspective of the undertaken study was the fact that all the analysed entities indicated that their development strategy considers the principles of sustainable development and each of the analysed urban municipalities monitors relevant indicators.

The municipal authorities interviewed confirmed that they are acting on the basis of a Sustainable Development Strategy, which is an important administrative tool as it provides opportunities for organisations to adapt to changing conditions. The implementation of municipal policies based on this strategy should be assessed as an appropriate direction of management, but the results of the questionnaire should be merged with the source documents of the municipal strategy in a next step and their interrelationships should be demonstrated.

On the basis of the survey results, 13 out of 14 municipal authorities indicated that they apply the principles of sustainable development in the management of the unit, which is very positive as it anchors the concept of sustainability in the awareness of the representatives of the municipalities and translates its principles into the administrative process. In addition, the nine units audited consider all three aspects of sustainable development (economic, environmental and social). It should be noted, however, that when managing a municipality, decision-makers must consider the specific factors, stimulants and destimulants that are crucial for proper development.

Municipal authorities where the problem of low environmental awareness among the population is moderate to widespread, consider it necessary to make changes and to take important measures to promote sustainability. Since a community is a community of inhabitants, it is up to them how successfully the principles of sustainable development are implemented. The authors therefore see another direction of research – the assessment of the level of environmental awareness of the inhabitants and their commitment to the implementation of the principles of sustainable development. In the studies mentioned in this article, nine municipalities have indicated that they are implementing sustainable development measures to raise awareness among the local population. Such measures are necessary because low environmental awareness leads to environmental damage which also affects other

sectors of society. The main obstacle to the implementation of the principles of sustainable development of towns in the Lesser Poland Voivodeship is the lack of adequate funding. The article examines the strong correlation between the lack of own resources for infrastructure and balance of migration. The opportunity for urban development is to create jobs and raise capital to improve infrastructure. The results of the Fisher's test also showed a significant correlation between the risk of increased pollution and the risk arising from the backwardness of infrastructure in the region. The decision to take appropriate measures depends primarily on the requirements imposed by central authorities and the European Union. The legal framework to combat the adverse climate change caused by environmental degradation requires very substantial financial resources. The results of the Fisher's test confirm a strong link between the financial situation of municipalities and the lack of financial resources to improve infrastructure. Unfortunately, local authorities are faced with a lack of their own budget revenue, are forced to receive subsidies from the state budget or support from EU funds, and often resort to borrowing. Soaring inflation, rising costs of bank loans (the result of interest rate hikes), the effects of the COVID-19 pandemic and, finally, the Ukraine war – these are just some of the key factors in slowing down investment activity, including environmental investment. Research has shown a strong link between economic recession and infrastructure backwardness. A sound macroeconomic framework and adequate sources of finance are needed to make up for the long-standing environmental failures. Unfortunately, the forecasted recession may help to slow down development and may have many negative effects at local, regional and global level.

### **Conclusion**

Sustainable development is a concept that is based on the integration of the different spheres of social, economic, and environmental life. The increased significance of this concept translates into seeking ways to implement appropriate principles that will allow the local authorities to reduce the negative effects of human activity on the environment, especially in the ecological context.

In conclusion, the evaluation of the weaknesses, strengths, opportunities, and risks allows us to prove that the stimulants and destimulants of sustainable development that affect the communities determine how sustainable development is managed in their area. Addition studies carried out on the basis of Fisher's test show that the management of the municipality is influenced by internal and external factors. Therefore, the measures taken by municipalities in the field of sustainability management should take them into account.

The conducted empirical studies allowed for verification of the formulated research hypotheses. Effective cooperation between stakeholders such as local authorities, businesses and the community can contribute to achieving the SDGs at local level. However, a high level of awareness of the principles of sustainable development is needed both on the part of local authorities and local communities. Integrating social, economic and environmental objectives into urban planning and management

processes can lead to a better quality of life for residents, increased efficiency of investments and improved environmental performance at local level. Unfortunately, this is largely dependent on changing social, political and economic conditions that affect sustainable development processes by changing priorities, available resources and adaptive capacities of stakeholders, which in turn may lead to changes in approaches to sustainable development planning and management.

Respondents pointed to monitoring, analysing and managing resources as a key process for achieving the SDGs in cities and regions, although the literature highlights that this facilitates the deployment of advanced technologies, data science and artificial intelligence. Best practices for implementing sustainable development principles in cities and regions combine advanced technologies, participatory decision-making and a multi-faceted approach to resource and infrastructure management. The CCPCA model and the CART hierarchical model of the predictive dependency of sustainable urban development factors (components) presented in the article allow us to see the links between urban development strategy, sustainable development knowledge and opportunities and threats, and city strengths and weaknesses. These are key elements in the construction of a model of municipal management. Unfortunately, they are very rarely an area of research in the field of management science, so the studies presented in this paper fill, albeit partially, the research gap in this field. The authors of the article are aware that the questions presented do not exhaust the subject matter under consideration, and they have endeavoured to describe further directions and stages of further research.

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## ZARZĄDZANIE GMINAMI MIEJSKIMI W ASPEKCIE ZRÓWNOWAŻONEGO ROZWOJU

**Streszczenie:** Świadomość zasad zrównoważonego rozwoju staje się coraz bardziej powszechna, jednak wdrożenie tej idei do życia gospodarczego, społecznego i politycznego wiąże się z licznymi trudnościami i wciąż stanowi złożony problem. Celem artykułu jest ocena czynników stymulujących i destymulujących wdrażanie zasad zrównoważonego rozwoju. Kwestionariusz ankiety został przeprowadzony w okresie od marca do maja 2021 r., a dane zostały przeanalizowane przy użyciu kanonicznej analizy głównych składowych (Canonical Correspondence Principal Components Analysis - CCPCA) oraz metodologii drzew klasyfikacyjnych i regresyjnych (Classification and Regression Trees - CART) w celu wykrycia zależności między zmiennymi. Do oceny siły związków między zidentyfikowanymi czynnikami zastosowano test Fishera. Wyniki ujawniły, że główne możliwości związane ze zrównoważonym rozwojem obejmują dostęp do programów i funduszy UE, rozwój turystyki, promocję miasta i regionu oraz tworzenie miejsc pracy poprzez przyciąganie inwestycji zagranicznych i krajowych. Z drugiej strony, najważniejszymi zidentyfikowanymi zagrożeniami były niestabilna polityka finansowa, zwiększone zadania bez zapewnienia środków finansowych oraz brak wsparcia dla proekologicznych działań biznesowych. Czynniki te przyczyniają się do powstawania potencjalnych problemów społecznych, gospodarczych i środowiskowych, takich jak zanieczyszczenie powietrza, niska świadomość ekologiczna mieszkańców i nieodpowiednia



infrastruktura drogowa. Wyniki podkreślają potrzebę uwzględnienia zarówno czynników wewnętrznych, jak i zewnętrznych przy wdrażaniu działań na rzecz zrównoważonego rozwoju.

**Słowa kluczowe:** zrównoważony rozwój, środowisko, zarządzanie, gminy, CCPCA, CART, test Fishera

## 城市公社的管理 在可持续发展方面

**摘要：**可持续发展理念的意识日益广泛，但将这一理念落实到经济、社会和政治生活中却困难重重，仍然是一个复杂的问题。本文旨在评估实施可持续发展原则的兴奋剂和抑制剂。在2021年3月至2021年5月期间进行了调查问卷，并使用典型对应主成分分析(CCPCA)和分类与回归树(CART)方法对数据进行了分析，以辨别变量之间的关系。Fisher检验用于评估已识别因素之间关系的强度。结果表明，与可持续发展相关的主要机会包括获得欧盟计划和资金、旅游业发展、城市和地区促进以及通过吸引国内外投资创造就业机会。另一方面，金融政策不稳、财力不保的任务增多、绿色经营活动支持力度不足等是最突出的威胁。这些因素导致潜在的社会、经济和环境问题，例如空气污染、居民环保意识低下以及道路基础设施不足。研究结果强调在实施可持续发展措施时需要同时考虑内部和外部因素。

**关键词:** 可持续发展, 环境, 管理, 市政当局, CCPCA, CART, 费雪检验