Consumption and Sustainable Development of Polish Metropolitan Cities

Agnieszka Dembicka-Niemiec[1] | *University of Opole, Opole, Poland*
Michał Buczyński[2] | *Statistical Office in Opole, Opole, Poland*
Maria Mołodowicz[3] | *Statistical Office in Opole, Opole, Poland*

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Abstract

The purpose of the study is to determine the level of sustainable development of metropolitan cities in Poland within the basic dimensions of sustainable development. At the same time, the levels of development of cities in terms of consumption were determined, and an attempt was made to identify the relationship of the levels of development of cities and the levels of development of consumption. Three main dimensions of sustainable development were considered: social, economic and environmental-spatial. It was important to find an answer to the question whether consumption can influence the levels of sustainable development achieved by cities, and in what aspects? A taxonomic method was used, which allows organizing the studied territorial units in a hierarchical manner. The levels of their development in each dimension were determined. Identifying the structure of features allows determining at what distance from the ideal structure of features the studied cities are. The research was carried out in dynamic terms by analyzing 2007 and 2020.

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Sustainable development, metropolitan cities, consumption, consumption	*https://doi.org/10.54694/stat.2022.39*	*R15, D16, Q01, P25*

INTRODUCTION

Implementing the concept of sustainable development is one of the key challenges facing the European Union. Attempting to transition to a low-carbon economy, increasing energy efficiency, fighting poverty, but also new trends and patterns in consumption, are among the areas in which member states are implementing initiatives and activities aimed at achieving the 17 global sustainable development goals. In the case of consumption, it is important to focus on large urbanized areas such as metropolitan areas. This is because it is in them that the largest percentage of the country's population lives, which significantly influences

[1] Faculty of Economics, University of Opole, Ozimska 46, 45 058 Opole, Poland. Corresponding author: e-mail: adembicka@uni.opole.pl. ORCID: <https://orcid.org/0000-0003-3992-6989>.
[2] Statistical Office in Opole, Hugona Kołłątaja 5B, 45 064 Opole, Poland. E-mail: m.buczynski@stat.gov.pl.
[3] Statistical Office in Opole, Hugona Kołłątaja 5B, 45 064 Opole, Poland.

the development of the area and, through its consumption decisions, influences to a greater or lesser extent the realization of the principles of sustainable development.

The concept of sustainable development is becoming increasingly important in the development of urban areas, especially large cities. The most frequently cited definition is that contained in the Brundland Report (1987), according to which sustainable development is considered to be development that consists in satisfying the needs of present generations without compromising the ability of future generations to satisfy their needs. In this case, the goal is to make the most efficient use of limited resources that have alternative uses in the present as well as in the future. The literature draws attention to three basic aspects of sustainable development: economic, environmental and social. The essence of the concept is to not significantly and irreversibly violate the human environment and to reconcile the laws of nature with the laws of economics (Kozlowski, 1997) The concept has evolved over many years and is now considered a paradigm of 21st century development. An important event that strengthened and popularized its importance was the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, when important documents were adopted, i.e. Agenda 21 and the Rio Declaration.

The importance of consumption for achieving sustainable development is increasingly highlighted in the literature. Researchers from various countries are addressing topics related to sustainable consumption of, for example, foodstuffs and its impact on achieving sustainable development goals (Böhm et. al., 2016; Hirsch and Terlau, 2015, Hwang et al., 2010). It is important to remember that consumption is not only limited to the consumption of goods and services, but also affects the consumption of resources during their production or the provision of these services. The entire life cycle of products is important. Here it is worth noting the consumption of energy both directly and indirectly. Its importance is pointed out by Matthew Cole and Andrea Lucchesi, among others. The authors emphasize the roles of energy consumption and energy policy-making in the possibility of reducing environmental pollution (Jackson, 2014). As Akenji and Bengtsson (2014) emphasize. Conference in Rio de Janeiro (1992), unsustainable consumption patterns were also identified as a major cause of environmental degradation. Akenji and Bengtsson prove the relationship between a country's level of development and ecological footprint in their study. The results of their study show a correlation that the higher the level of economic development a country achieves, the larger the ecological footprint it leaves. Often the incentive to decouple economic growth from resource consumption and environmental degradation is one of the key ways to achieve sustainable development goals (Jackson, 2009). However, few countries succeed in doing so (Akenji and Bengtsson, 2014).

The concept of sustainability is particularly important in cities which, in a way, constitute a kind of ecological-social-economic system and in which the disruption of one of its components causes a burden on others (Rzeńca, 2018). In this context, it is important to maintain self-regulation. It is essential that any economic activity be adapted to natural conditions, and that the social activities undertaken take place within the limits of the adaptive capacity of the environment. A significant role in this context is played by the local community of a given city. Its environmental awareness, behavior and consumption. Referring to the basic definition of sustainable development, which draws attention to development involving, among other things, meeting the needs of present and future generations without diminishing access to non-renewable resources, clean environment, sustainable consumption is important. If the satisfaction of human needs is considered as a direct act involving the use of a particular material good or service we define it as consumption (Bywalec, 2010). Sustainable consumption, on the other hand, is considered to be such a shape of its processes that enables the realization of sustainable development goals (Kielczewski, 2008). Due to the scant availability of statistical data in this regard for cities, it is difficult to study this issue comprehensively. Nevertheless, such an attempt has been made using basic indicators, complete, reliable and available, which determine the level of consumption.

1 LITERATURE REVIEW

The literature review conducted by Quoquab, Jihad, Sukari shows that most of the research on sustainable consumption is at a conceptual level and does not emerge a synthetic measure that would measure sustainable consumption. Existing measurement scales are mainly concerned with ethical consumption presented by the consumer and his desire to care for the environment . One of the most widely used methods of consumption research is the survey. Surveys in this area have been conducted by, among others Fiore (Fiore et al., 2022), Széchy (Széchy et al., 2011).

When determining the consumer's impact on the environment, various indicators of measurement are pointed out. However, many studies most often consider five critical areas of household consumption: housing, mobility, food, household goods and appliances (Castellani and Sala, 2019; Comin et al., 2007). In selecting indicators of sustainable consumption, an effort was made to include these five areas, with the principle of accessibility and completeness of indicators. An analysis of the literature and policy documents made it apparent that the vast majority of studies are conducted on a macro or regional scale, and sometimes they involve entire countries, e.g. Indicators and assessment of the environmental impact of EU consumption (Publication Office…,2019) or the publication by Bentley and Leeuw (2003). The availability of a suite of indicators at the local level is very limited.

There are also studies in the literature on the impact of consumption that are based on life cycle assessment (LCA) conducted for specific representative products. However, these studies only deal with the macro scale (e.g. Goralczyk and Manfredi, 2013; Althaus et al., 2013; Heijungs et al., 2022; Hertwich, 2005) and it is difficult to relate them to the local scale which concerns cities. In the case of sustainable consumption, the importance of consumer footprint is emphasized, which is often based on the use phase study in the LCA (Castellani et al., 2017).

Other studies of sustainable consumption are based on an analysis of consumer lifestyles in terms of consumption patterns (Birkved et al., 2016; Kočí and Matuštík, 2019).

When it comes to researching sustainable consumption in urban areas, there are attempts to study and identify the indicators needed to measure it. However, these are often limited to only a selected aspect of sustainability. An example is the study by Hoff et al. concerning the water footprint of cities (Döll et al., 2014). The authors focused their considerations on the consumption of goods such as food and its relation to the amount of water required for their production and the impact of this water consumption in regions. Another example of the authors' focus on only a selected aspect of sustainability is Goviandan's (2018) publication in which the authors provide a brief review of the literature on sustainable supply chain management and sustainable supply chains in the food industry.

In view of the above, the use of a taxonomic method that allows determining both the level of development and the structure of the characteristics of individual urban units in terms of sustainable consumption seems to make sense. In this context, consumption is treated as holistically as the available indicators within the previously mentioned five areas allow.

There are studies in the literature based on a suite of sustainable consumption indicators. However, they are often limited only to households or the consumer himself, assessing his behavior. An example is a study conducted in rural and urban areas in China as well as elsewhere. A system of indicators was developed to assess the sustainability of HFC (Cheng et al., 2023). This system consists of dimensions such as nutrition, environment, economy and socio-cultural culture, as well as a comprehensive index for evaluating the analysis.

2 METHODOLOGICAL ASSUMPTIONS

In the case of research on the level of development of a given territorial unit in the adopted aspect (sustainability or consumption) and the need to present rankings, Michalski's method is a frequent method. It is useful insofar as, in addition to identifying the level of development of units, it also

identifies units in terms of their similarity of feature structure to the model object, which seems to be valuable.

In order to achieve the set research goal, a taxonomic method called Michalski's method was used (Michalski, 2001). This method made it possible to study the similarities of the level and structure of the characteristics that describe the studied cities to the designated benchmark object, taking into account the dimensions of sustainable development. Taxonomic measures were determined for selected time moments, i.e. 2007, 2020, and then used in the comparative analysis of multi-feature objects for each year. The objects of the study are metropolitan cities in Poland. It is worth noting that indicators of sustainable development are considered as a feature.

Cities with a given level of sustainability may be characterized by a different structure of the analyzed phenomenon. Identifying the degree of similarity of the structure of the phenomenon for a given city with the ideal structure, provides information about the degree of sustainability of a given city. This provided a primer on the results of sustainable consumption for selected cities in the years analyzed.

A measure μ $(i; j)$ was used to identify the degree of similarity between metropolitan cities due to **the structure** of diagnostic features. This measure presents the similarity of the *i-th* city's feature structures with the benchmark object. The construction of the benchmark object consisted of determining the highest value for each feature in the studied set of cities.

At the same time, it should be emphasized that the highest value of the indicator in the studied group of cities, does not mean that this value is optimal, because the benchmark object applies only to the studied set of metropolitan cities.

In the process of constructing a measure to assess the similarity of the structures of diagnostic features in the *i-th* city and the benchmark object, vectors z_i and z_p were used . The measure of similarity of structures is given by the formula:

$$\mu(i; p) = \frac{z_i \times z_p}{|z_i|\,|z_p|},$$

where: z_i – *i-th* row of Z matrix (i-th object), z_p – *p-th* row of Z matrix (reference object), $z_i \circ z_p$ – dot product of vectors z_i, z_p, $|z_i|$ – length of z_i vector, $|z_p|$ – length of z_p vector.

For practical purposes, the measure $\mu(i; p)$ was normalised to eliminate taking values in the <–1,1> range. The normalised measure $\mu \times (i; p)$ s given by the formula:

$$\mu \times (i; p) = \frac{1 + \mu(i; p)}{2}.$$

The normalizes measure $\mu \times (i; p)$ takes values in the range <0,1> and means that the larger value of the similarity index takes, the more similar the objects are.

The higher the value of $\mu \times (i; p)$ indicator the more similar the metropolitan city was to the benchmark object i.e. it had a structure of diagnostic characteristics similar to the desire one.

As a second measure, a measure was introduced that represents the **level of values** of diagnostic characteristics describing the studied metropolitan cities. With this measure, it was possible to measure the distance between objects, taking into account the similarity of objects due to the variation in the level of values of diagnostic characteristics. The measure $d \times (i; p)$ is given by the formula:

$$d \times (i; p) = 1 - \frac{1}{2\sqrt{kn}}\, d(i; p),$$

where: k – number of features, n – number of cities.

$$d \times (i; p) = \sqrt{\sum_{j=1}^{k} (Z_{ji} - Z_{jp})^2} .$$

The construction of a measure of similarity of feature levels is based on the concept of distance between *i-th* and *p-th* objects. This distance is determined using the Euclidean metric. The parameter j determines the point from which the distance is measured. The measure $d \times (i; p)$ takes values in the range <0;1> and means that the closer the indicator value is to 1, the more similar the objects are to the reference object.

The difference between the level of values of diagnostic characteristics and their structure allows to identify units with the same level of development, but a different structure of diagnostic characteristics (city "Z" may have the same structure of characteristics as city "Y", for example, A: 5555, B: 2222, but a different level of characteristics).

The baseline set of potential sustainable development indicators consisted of 221 features and was based on the sustainable development indicators of the System of Local Government Analysis,[4] taking into account the three aspects of sustainable development: social, economic and environmental-spatial. In the case of sustainable consumption, on the other hand, the base set of potential indicators included 17 characteristics. During the process of selecting variables for the study, variables that were incomplete at selected time points, highly correlated with each other (>0.8) and those whose coefficient of variation was low (<10%) were eliminated. The final set of variables included: 19 characteristics describing the social dimension, 10 characteristics describing the economic dimension, 15 characteristics describing the environmental-spatial dimension, and 6 characteristics describing sustainable consumption (Appendix).

3 ANALYSIS AND RESULTS

3.1 Identification of feature structures of sustainable development aspects of metropolitan cities

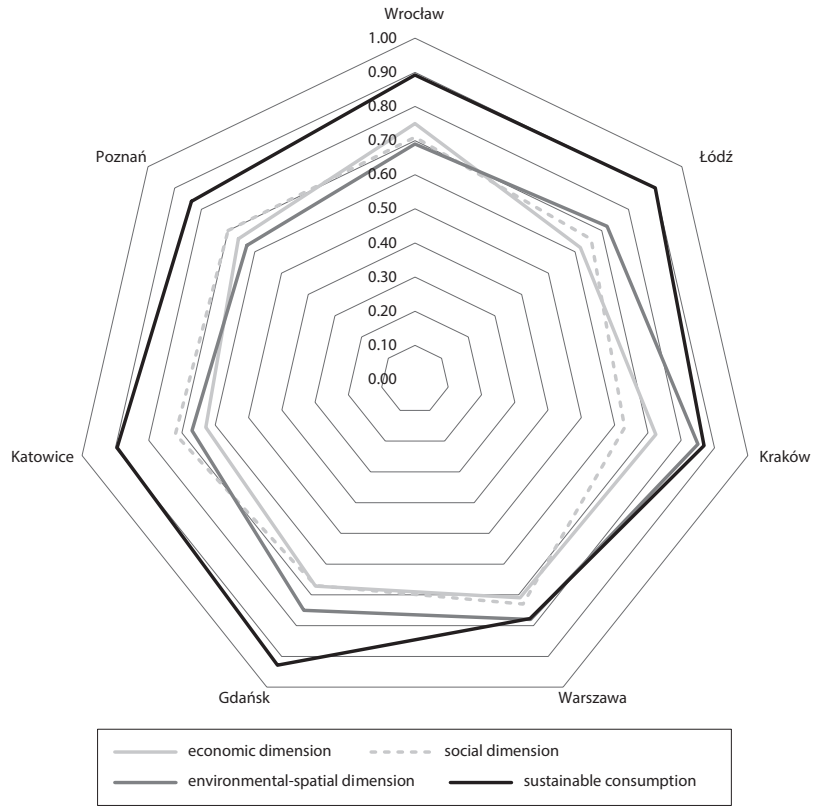
To determine the variation in the level of sustainable development of metropolitan cities, the resulting measures of development were analyzed. The studied cities were compared within the three dimensions of sustainable development as well as the level of sustainable consumption for two years: 2007 and 2020 (Figures 1 and 2). The analysis of the results shows that the levels of sustainable development obtained by the cities in each dimension, compared to the levels of sustainable consumption, differ from each other.

It should be noted that the similarity achieved by cities in the levels of sustainable consumption characteristics decreased in all cities. The exception is Gdansk, for which the similarity measure was unchanged. Wroclaw and Katowice were characterized by the largest changes because they decreased by 0.10 and 0.07, respectively (Table 1).

The biggest changes occurred in the economic dimension of sustainability, within which Krakow, Gdansk and Katowice achieved higher values of the similarity index, meaning that they came closer to the benchmark object. In the social dimension of sustainability, on the other hand, all cities except Poznań and Katowice moved closer to the benchmark in 2020 compared to 2007. In the case of the environmental dimension, an increase in the similarity of feature levels to the benchmark object (Wroclaw, Poznan, Gdansk, Katowice) was noted for most cities (Table 2).

[4] *<https://systemanaliz.pl>*.

Figure 1 Similarity of feature levels with the benchmark within the three dimensions of sustainability and sustainable consumption in 2007



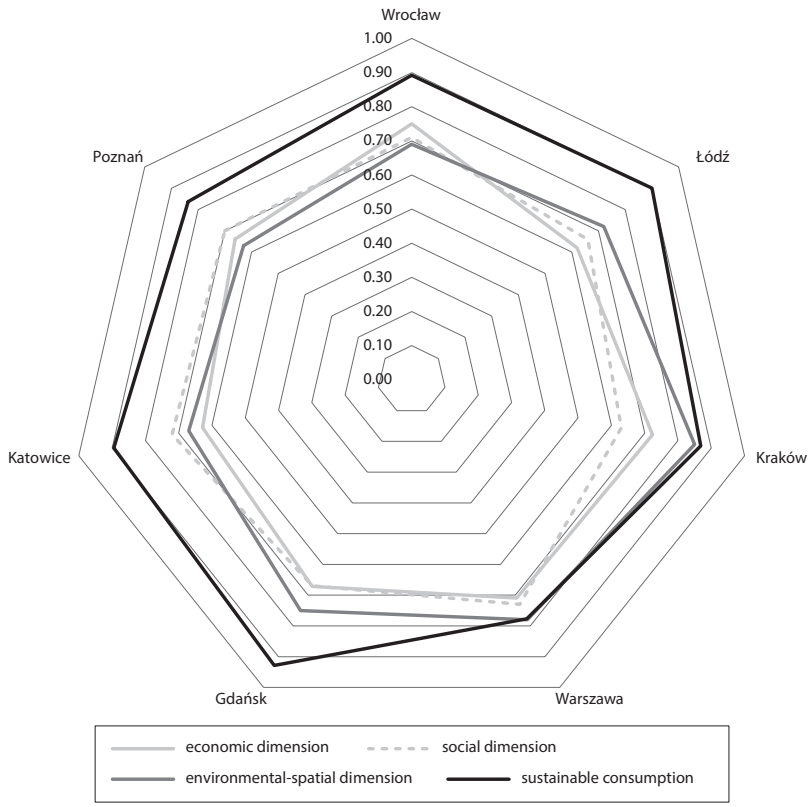
Source: Own study

Table 1 Level of similarity of feature levels to benchmark object in terms of consumption in 2007 and 2020

	2007	2020	Difference
Wrocław	0.89	0.79	0.10
Łódź	0.90	0.84	0.06
Kraków	0.87	0.83	0.05
Warszawa	0.78	0.75	0.03
Gdańsk	0.93	0.93	0
Katowice	0.89	0.82	0.07
Poznań	0.84	0.81	0.03

Source: Own study

Figure 2 Similarity of feature levels with the benchmark under the three dimensions of sustainability and sustainable consumption in 2020



Source: Own study

Table 2 Level of similarity of feature levels to the benchmark object in each dimension of sustainable development in 2007 and 2020

Economic dimension			Social dimension			Environmental dimension		
	2007	2020		2007	2020		2007	2020
Wrocław	0.75	0.72	Wrocław	0.71	0.73	Wrocław	0.69	0.70
Łódź	0.62	0.62	Łódź	0.66	0.68	Łódź	0.72	0.69
Kraków	0.72	0.74	Kraków	0.63	0.65	Kraków	0.85	0.79
Warszawa	0.71	0.67	Warszawa	0.73	0.74	Warszawa	0.78	0.77
Gdańsk	0.67	0.72	Gdańsk	0.67	0.68	Gdańsk	0.75	0.77
Katowice	0.63	0.62	Katowice	0.72	0.71	Katowice	0.67	0.69
Poznań	0.66	0.63	Poznań	0.70	0.63	Poznań	0.63	0.66

Source: Own study

3.2 Identification of feature structures of sustainable development of metropolitan cities in economic, social and environmental-spatial aspects

In the case of changes occurring within the structures of sustainable development features, there is a much higher rate of change than in the case of feature levels, so this issue is presented in more detail. The similarity of the feature structures of metropolitan cities to those of the benchmark object was also analyzed within the three dimensions of sustainable development with consumption. In the case of the value structure of sustainable consumption characteristics, the changes in the years under study are unfavorable. All cities moved away from the model object in this regard and achieved a worse structure of feature values. The largest changes were recorded for Wroclaw (0.56) and the smallest for Gdansk (0.03) (Table 3).

Table 3 Level of similarity of feature structure to model object in terms of consumption in 2007 and 2020

	2007	2020	Difference
Wrocław	0.84	0.28	0.56
Łódź	0.86	0.58	0.28
Kraków	0.85	0.49	0.35
Warszawa	0.65	0.36	0.29
Gdańsk	0.98	0.94	0.03
Katowice	0.80	0.44	0.36
Poznań	0.78	0.41	0.37

Source: Own study

In the case of the economic dimension, cities were characterized by varying directions of change. An unequivocal improvement in terms of similarity to the benchmark structure of features in the economic dimension took place in Łódź, Cracow, Katowice and Gdańsk (Figure 3). On the other hand, distancing from the benchmark during the examined time moments, characterized such metropolises as Wrocław, Warsaw and Poznań. The lowest values were characteristic for Poznań, and the highest for Cracow (Figure 3).

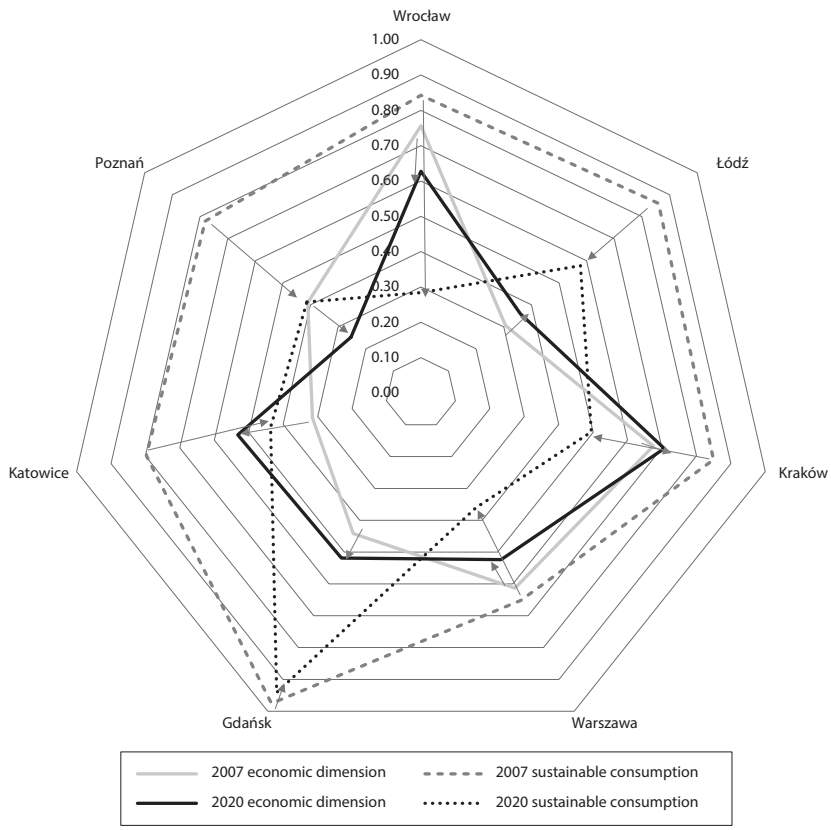
The achieved by cities structures of values of features in the economic dimension were compared with the structure of sustainable consumption. Among the studied metropolises there were those which approached the model object in the discussed scope, but at the same time moved away from the model in the case of sustainable consumption (Łódź, Kraków, Gdańsk, Katowice), as well as those which worsened the structure of feature values in both aspects (Poznań, Warsaw, Wrocław) (Figure 3).

Analyzing the dynamics of change occurring in the two issues under discussion, no clear direction of change emerges. The cities for which negative significant changes in consumption were noted were characterized by a slight deviation from the pattern in the economic dimension (Poznań, Warsaw, Wrocław). The second direction of change concerned Krakow, Lodz and Gdansk, for which improvements in the economic dimension were visible, while at the same time moving away from the pattern in the case of consumption. The only city for which a departure from the benchmark structure of feature values in consumption and a simultaneous significant improvement of this aspect in the economic dimension was noted was Katowice (Figure 3).

Changes in the structure of trait values in the economic dimension are not associated with deterioration or improvement in the structure of traits in sustainable consumption. The survey did not indicate the existence of a relationship in terms of the economic dimension and sustainable consumption.

Within the social dimension of sustainable development, the values achieved by the cities indicate that the most similar structure of features to the benchmark structure was recorded by Wrocław, reaching a value of (0.78) in 2020, while in 2007 this place was occupied by Warsaw (0.68) (Figure 4). In turn, Poznań in the last year under review recorded the lowest value among all metropolitan cities in the dimension in question (0.14). The analysis of changes in the structure of the characteristics indicates a dominant trend of improvement in the structures of the characteristics of individual cities. Only the aforementioned Poznań and Katowice show a trend of decreasing similarity of feature structures to that of the benchmark object.

Figure 3 Similarity of feature structures with the pattern within the economic dimension of sustainable development and sustainable consumption in 2007 and 2020



Source: Own study

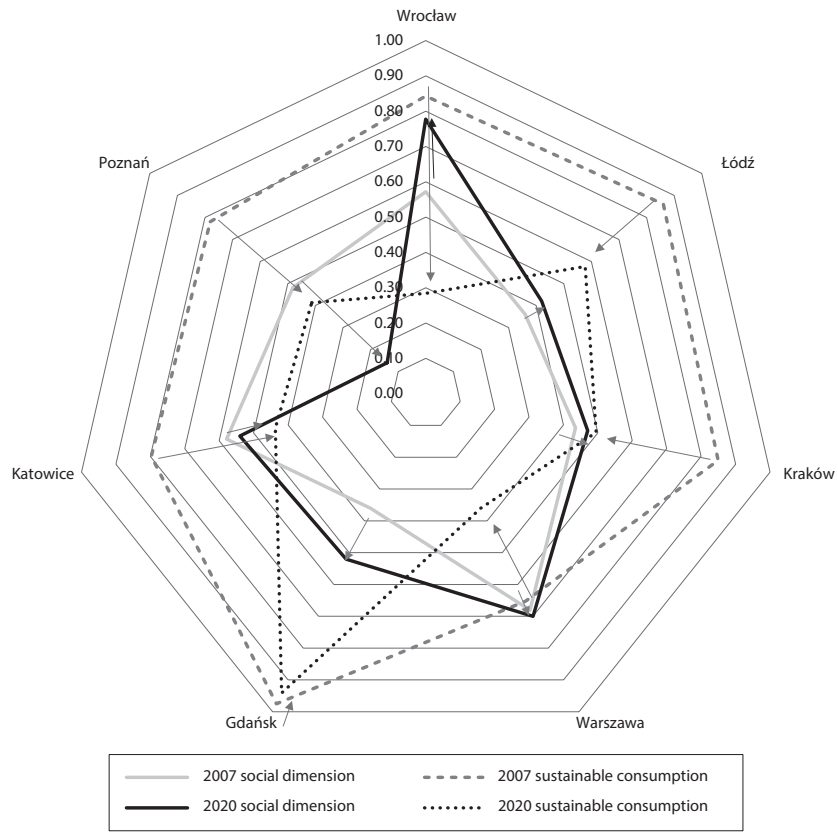
Comparing the obtained results for the social dimension of sustainability with the similarity values of the feature structure for sustainable consumption, two trends of change are evident. The first is characterized by the distance of the city from the benchmark object for both the social dimension and sustainable consumption (Poznań, Katowice), and the second by an improvement in sustainable consumption and a simultaneous deterioration in the social dimension (other cities) (Figure 4).

The reduction in consumption by the society and the realization of sustainable consumption is mostly reflected in the social development of this city and the feature structure in the social dimension represented by the city. An improvement in the structure of features in the social dimension is associated

with a deterioration in the structure of features in sustainable consumption. The exceptions are Poznań and Katowice for which this relationship was not observed (Figure 4).

Analyzing the dynamics of change, one can notice a significant deterioration in the structure of the value of the characteristics in the field of sustainable consumption (the exception is Gdansk, for which this change was small) and a much smaller dynamics of change in the social dimension in this regard (exception: Poznan, Wroclaw) (Figure 4).

Figure 4 Similarity of feature structures with the pattern within the social dimension of sustainable development and sustainable consumption in 2007 and 2020



Source: Own study

In terms of the environmental-spatial dimension, the city that had the most similar structure of features to that of the model object was Gdansk, and the least similar was Warsaw (Figure 5). Within the analyzed dimension, three directions of change are evident:

- cities that have moved away from the model structure of features (Katowice, Warszawa);
- cities that came close to the benchmark facility in the scope analyzed (Kraków, Łódź);
- cities that did not show major changes in terms of changing the similarity of feature value structures to the benchmark object (Poznań, Wrocław, Gdańsk).

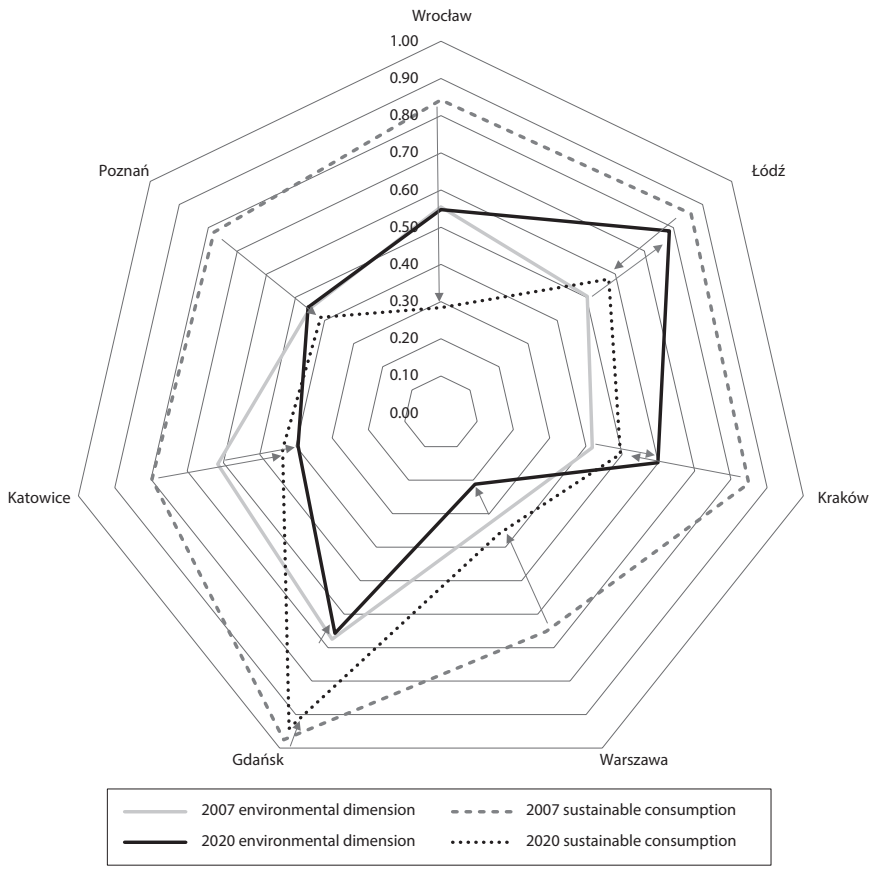
An analysis of the obtained results against sustainable consumption shows that almost all cities (with the exception of Lodz and Krakow) worsened the structure of features in the environmental and spatial

dimensions as well as sustainable consumption. Only Łódź and Kraków recorded an improvement in the dimension in question (Figure 5).

In order to better present the relationships occurring between the directions of change in a given dimension of sustainability and sustainable consumption, it was necessary to present these issues in separate figures (Figures 6a,b, 7a,b, 8a,b).

An analysis of the similarity of feature structures within a dimension to the feature structure of sustainable consumption reveals a significant similarity in the environmental-spatial dimension. In this case, the directions and dynamics of change in sustainable consumption as well as development within the mentioned dimension are very close to each other. Within the other dimensions of sustainable development, the similarity is no longer apparent. Changes in the value structure of consumption characteristics are correlated with changes in only the environmental-spatial dimension (Figure 8a,b).

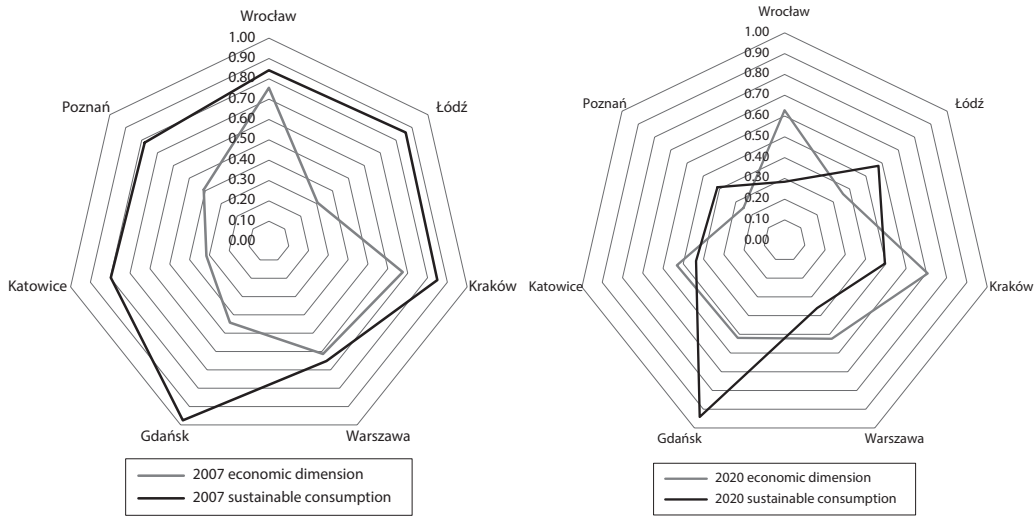
Figure 5 Similarity of feature structures with the pattern within the environmental-spatial dimension of sustainable development and sustainable consumption in 2007 and 2020



Source: Own study

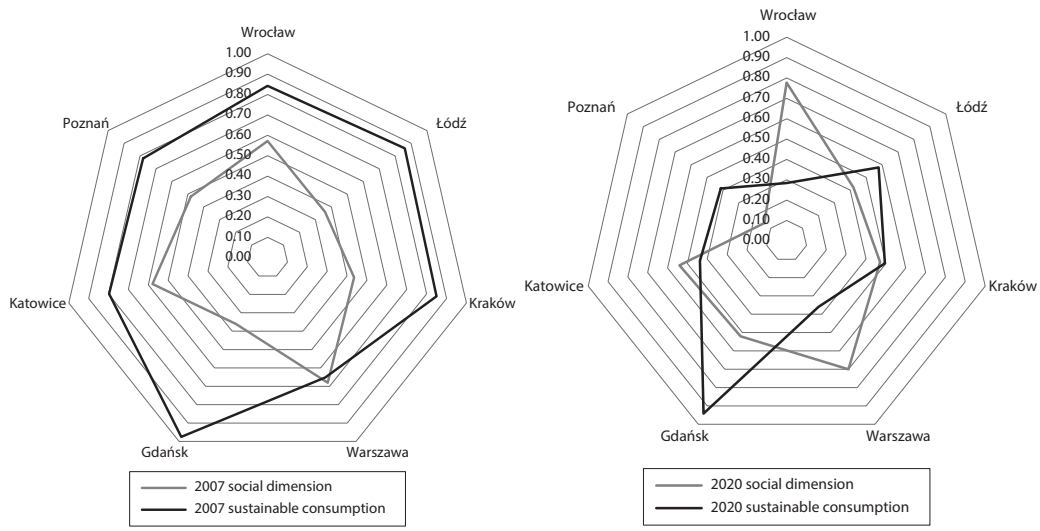
Comparing the years under study, it is evident that the structure of features is moving away from the benchmark object in consumption for all cities except Gdansk. This means that the community of metropolitan cities realizes the assumptions of sustainable consumption but to a lesser extent.

Figure 6(a,b) Similarity of the features structure of features with the pattern within the economic dimension of sustainable development and sustainable consumption in 2007 (6a) and 2020 (6b)



Source: Own study

Figure 7(a,b) Similarity of the features structure of features with the pattern within the social dimension of sustainable development and sustainable consumption in 2007 (7a) and 2020 (7b)



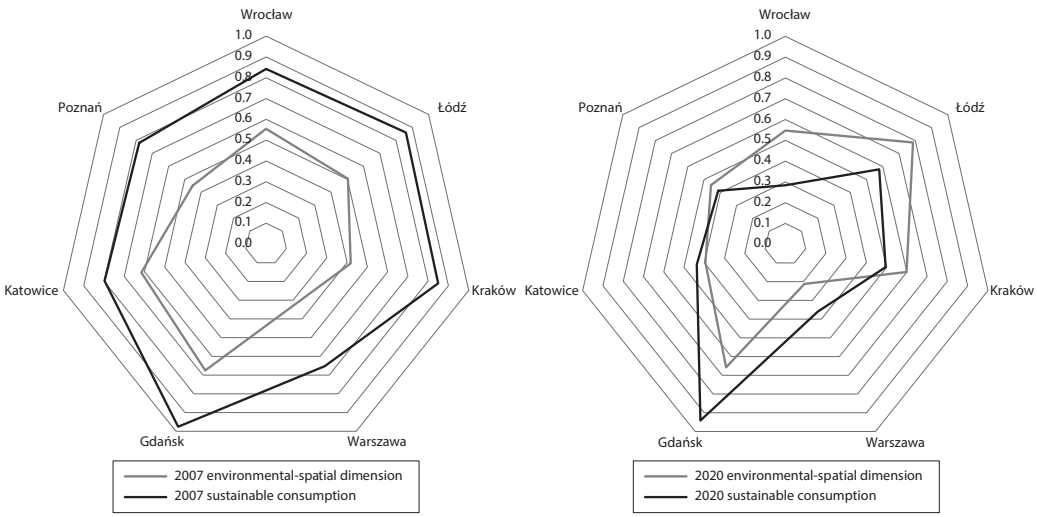
Source: Own study

At the same time, most cities record a departure from the benchmark feature structure in the environmental and spatial dimension (with the exception of Łódź, Kraków and Poznań).

The analysis of changes in the structure of feature values indicates differentiated ranges of values in each dimension of sustainable development. The highest values which testify to the greatest similarity of the trait value structure, metropolitan cities achieved in the environmental dimension.

It is important to note the development of cities within all three dimensions of sustainability and consumption. In this case, the city that in 2007 achieved the most similar feature structures in all dimensions was Poznań. In 2020, that city was already Gdansk. Looking through the prism of sustainable consumption, it is important to emphasize that Gdańsk deteriorated the structure of feature values to the least extent among the surveyed cities, as it only deteriorated by (–0.03). Poznań, on the other hand, in 2020 recorded significant differences between the similarity of feature value structures to the benchmark object between dimensions and a significant departure from the benchmark in terms of consumption (–0.37).

Figure 8(a,b) Similarity of the features structure of features with the pattern within the environmental-spatial dimension of sustainable development and sustainable consumption in 2007 (8a) and 2020 (8b)



Source: Own study

DISCUSSION AND CONCLUSIONS

The analysis of the obtained results within the framework of similarity of the value levels of the characteristics of each dimension of sustainable development and sustainable consumption indicates small changes in the dynamics and directions of change. These changes are not correlated with each other, and it is not possible to clearly indicate the existence of a relationship between the levels of consumption and the levels of sustainability represented by the cities in the sustainability dimensions analyzed.

The level of similarity of feature levels to the benchmark object in terms of consumption worsened for all metropolitan cities except for Gdansk, for which the level was the same. On the other hand, in the case of dimensions of sustainable development, the most favorable changes occurred in the social dimension within which all cities except Katowice came closer to the model object in the analyzed scope. The departure from the model object within the level of feature values occurred to the greatest extent in the environmental-spatial dimension within which as many as three cities recorded lower values of the index (Łódź, Kraków, Warsaw).

Changes in the structure of feature values in the economic dimension are not related to deterioration or improvement of the structure of features in sustainable consumption. The survey did not indicate the existence of a relationship in terms of the economic dimension and sustainable consumption.

The deterioration of public consumption and the realization of sustainable consumption are mostly reflected in the social development of this city and the feature structure in the social dimension represented

by the city. An improvement in the structure of features in the social dimension is associated with a deterioration in the structure of features in sustainable consumption. The exceptions are Poznań and Katowice for which this relationship was not observed.

The dynamics and directions of changes in the value structure of consumption traits are correlated with changes in the environmental and spatial dimensions. This observation is also confirmed by other studies in the literature, which conclude that the volume of consumption is closely related to environmental impact (Alfredsson et al., 2018). Thus, there is a need to change the style of consumption in a way that ensures sustainability.

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APPENDIX

Table A1 Indicators of sustainalbe development of the city

	Social dimension
1	Total net migration per 1 000 population [in per mille]
2	Infant deaths per 1 000 live births
3	Natural increase per 1 000 population [in per milles]
4	Population density – number of population per km^2
5	Pharmacies per 1 000 population
6	Expenditure on health care per capita (PLN/person)
7	Expenditure on the lighting of streets, squares and roads per capita [PLN]
8	Total expenditure on dwelling economy per capita (PLN/person)
9	Property expenditure on dwelling economy per capita (PLN/person)
10	Expenditure on green areas in cities and gminas per capita [PLN]
11	Accommodation per 1 000 inhabitants
12	Nights spent (overnight stays) per 1 000 inhabitants
13	Collection of public libraries per 1 000 inhabitants
14	Public library users per 1 000 inhabitants
15	Councillors up to 29 years of age in relation to the total number of councillors [%]
16	Share of women in the council [%]
17	Number of economic entities per 1 000 population
18	Unemployed persons per 100 persons of working age
19	Unemployed women per 100 women of working age

Table A1 (continuation)

	Economic dimension
1	Gmina budget expenditure per capita (PLN/person)
2	Investment property expenditure compared to total budget expenditure [%]
3	Investment property expenditure per capita [PLN]
4	Employment rate – number of employed persons per 1 000 inhabitants
5	Accommodation per 1 000 inhabitants
6	Nights spent (overnight stays) per 1 000 inhabitants
7	Nights spent (overnight stays) by foreign tourists in tourist accommodation establishments per 10 thousand inhabitants
8	Expenditure on waste management per 1 gmina inhabitant
9	Expenditure on protection of air and climate per 1 gmina inhabitant
10	Expenditure on treatment of urban and rural areas per 1 gmina inhabitant
	Environmental-spatial dimension
1	Area of land under legal protection as % of gmina's area
2	Expenditure on green areas per capita [PLN]
3	Area of land under legal protection in ha per 1 000 inhabitants
4	Area of land under legal protection as a share of gmina's area
5	Area of landscape parks in the total gmina's area
6	Area of forests and forest land as % of gmina's area
7	Expenditure on treatment of gmina compared to total budget expenditure [%]
8	Waste generated during the year in thousand tonnes per capita (excluding municipal)
9	Municipal and industrial untreated wastewater (combined) in the total amount of produced wastewater
10	Untreated industrial wastewaster discharged directly into surface water or into the ground compared to total amount of wastewaster discharged by the industry
11	Water consumption per capita (m^3/year)
12	Total sulphur dioxide emission in t/year from plants of significant nuisance per km^2
13	Total carbon dioxide emission in t/year from plants of significant nuisance per km^2
14	Total nitrogen oxides emission in t/year from plants of significant nuisance per km^2
15	Total carbon oxide emission in t/year from plants of significant nuisance per km^2
16	Total emission of gaseous pollutants in t/year from plants of significant nuisance per km^2
	Sustainable consumption indicators
1	Consumption of electricity in households per capita
2	Average useful floor area of dwellings per capita
3	Number of passenger cars per 1 000 population
4	Sales of heat energy during the year to residential buildings (GJ)
5	Water sold from water supply system to households per capita
6	Total mass of municipal waste generated per capita (kg)

Source: System Analiz Samorządowych (Self-Government Analysis System) <*http://www.systemanaliz.pl*>