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Fees for Municipal Waste Management as an Element of Sustainable Regional Development on the Example of Selected Cities in Poland

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Abstract:

Purpose: *The aim of the article is to present the impact of calculating fees for municipal waste management in terms of the protection of natural resources that are part of the sustainable development of selected cities.*
Design/Methodology/Approach: *The article defines the concept of sustainable development, presents analyses of municipal waste management in Poland, and presents the relationship between the protection of natural resources and the method of calculating fees for municipal waste.*
Findings: *The result of the article is the presentation of the impact of changes in the calculation of fees for municipal waste management on the protection of the natural environment, which is an element of sustainable development.*
Practical Implications: *Research can contribute to better knowledge of the impact of waste management on the protection of basic natural resources.*
Originality/Value: *The article is an introduction to further research in the field of municipal waste management in Poland, which is important from the point of view of statutory changes in this area related to the country's desire to achieve the intended recycling levels and the need to protect basic natural resources.*

Keywords: *Sustainable development, waste, waste management.*

JEL codes: *P58, R11, R52*

Paper type: *Research study.*

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1. Introduction

The issue of waste commonly known as garbage is gaining more and more importance in the modern world. This is mainly due to the fact that the destructive impact of waste on the natural environment is becoming more and more noticeable. Another reason is the depletion of natural resources. These two aspects clearly affect the economic development of the modern world.

This became the basis of the idea of sustainable development, i.e. the one without unnecessary damage, rational use of available resources that are to serve the present and future generations. It should be remembered that the use of non-renewable resources must take place at a reasonable pace, ensuring that the natural wealth they represent is transformed into a good that will be used in the long term (Taiwo, 2009). This can be achieved in two ways, the first by reducing the negative impact of waste on the natural environment and by treating waste as a potential source of raw material and energy resources.

Finding an appropriate set of indicators of sustainable development for a community, a city, a region, a country or even the world is not an easy task. It requires knowledge of what is important for the viability of the systems involved, and how that contributes to sustainable development (Bossel, 1999).

Governance and sustainable development are children of similar history and parentage. They emerged in the late 1980's, with shared characteristics and overlapping potential. By the mid 1990's they were common terms in popular and professional discourse, along with renewed interest in the role of institutions in societal change (Kemp, Parto, and Gibson, 2005).

There are many factors that contribute to environmental degradation. One of them that contributes significantly to its deterioration is household waste (which can emit nitrogen oxide and methane), which contributes to 20% of the greenhouse effect. Therefore, this waste should be managed in a way that minimizes the emission of the dangerous gas, which is methane, which is the cause of global warming 21 times stronger than carbon dioxide (Jalil, 2010). The definition of waste taken from the Act on waste (Act of December 14, 2012 on waste, art. 3) is consistent with Directive 2008/98/EC (Directive 2008/98/EC of the European Parliament and of the Council of November 19, 2008 on waste and repealing certain Directives, art. 3 sec. 1).

According to these regulations, waste is defined as any useless substance or object that the holder disposes of while incurring the related costs. The fees charged for collecting waste give the municipalities funds to manage it. Differentiating the rates of charges for segregated and mixed waste can also provide a financial incentive for citizens to segregate it at source. As a consequence, it may contribute to an increase in the level of recycling, and thus reduce the negative impact on the environment. As

part of waste management, one should strive to follow the hierarchy of methods of handling waste. The best solutions is to prevent waste generation, and if it does occur, try to reuse or recycle it and use other forms of recovery. The final step should be landfilling, regarded as the worst form of disposal. Such actions carried out globally and will consistently contribute to the conservation of natural resources and the creation of a green order.

2. The Essence of Sustainable Development

Nowadays, the idea of sustainable development translates into the practice of activities aimed at development that promotes and strengthens the social, political and economic well-being of people in terms of ecological balance at all levels of social organization. This prioritizes local, national, regional and international actions that ensure that the basic social and material needs of people around the world are met, promote social and economic justice, increase universal participation, and promote peace (Estes, 1993).

In recent years, debates on how to measure of human well-being have influenced by two dichotomies: the constituents versus the determinants of human well-being, and current versus sustainable well-being (Dasgupta, 2007). The effects of the degradation of the natural environment caused by human activity, as well as the risks associated with the depletion of basic natural resources, have become commonly felt. Humanity is constantly striving to satisfy its needs in terms of improving living conditions and the related development of civilization. The consequences of such action translate into degradation of the natural environment.

Seeking a compromise for further civilization development going hand in hand with nature protection, the idea of a new concept was born, defined as sustainable development or eco-development (Placzek, 2012). Pursuant to the Environmental Protection Law, it is a socio-economic development in which the process of integrating political, economic and social activities takes place. The necessary condition is to maintain the natural balance and durability of basic natural processes, to ensure the possibility of meeting the basic needs of both the modern and future generations (Act of April 27, 2001, Environmental Protection Law, Journal of Laws 2020, item 1219, art. 3 sec. 50). The main goal of this idea is to introduce mechanisms and methods of action enabling the further development of civilization with respect for nature and social and economic aspirations of humanity. In order for this idea to be realized, the following is necessary:

- global protection of the natural environment;
- solidarity in relations between countries, with particular emphasis on the extreme level of socio-economic development;
- solidarity with future generations;

- treatment of economic, political and social factors and ecological as mutually dependent (https://encyklopedia.pwn.pl/haslo/rozwoj-zrownowazony;3969442.html).

The principles concerning the following are of crucial importance for sustainable development:

- the rights of states to use their natural resources;
- the responsibility of states for the activities carried out in the field of environmental damage;
- integration of development processes and environmental protection;
- eliminate sustainable production and consumption and promote an appropriate demographic policy;
- establishing laws in the field of environmental protection, including responsibility for its degradation;
- the prevention of transboundary pollution;
- wide application of preventive actions;
- implementing the "polluter pays" principle;
- using environmental impact assessments as an instrument in making administrative decisions;
- citizens' rights to environmental protection, including access to information on its condition (http://libr.sejm.gov.pl/tek01/txt/inne/1992.html).

The goals of such development indicate the level of three basic directions of activities in the following areas:

- ecological – stopping environmental degradation and eliminating threats;
- economic – meeting the basic material needs of humanity without destroying the natural environment;
- social and humanitarian – securing safety and a minimum social level by eliminating hunger, scarcity and poverty, health protection, spiritual and cultural development and education (Płaczek, 2012).

In order to achieve the goals of building a green economy, it is necessary to solve both existing and emerging problems in solidarity. There is also a need to promote the idea of sustainable development in society and to strengthen the contacts of the involved public organizations with corporations and other stakeholders (Czech, 2013). The condition for the successful implementation of the assumptions of the idea is universal awareness and knowledge, as well as acceptance and commitment of every citizen to take actions in the field of eco-development. It is an ongoing process and requires global and strict adherence to provisions and assumptions to be effective. The involvement of society, state structures and business entities is also essential and social organizations. Effectiveness also requires constant adaptation to changing social, environmental and economic conditions.

3. Characteristics of Municipal Waste Management in Poland

The production of waste is an inseparable element of human existence related to economic activity and living. With the increase in the number of people, technological development, and the rising standard of living, the amount of generated waste increases rapidly (Hordyńska, 2017). In terms of the source of waste, i.e. the zones of its generation, it can be divided into two main groups, which include municipal and industrial waste. Municipal waste is generated in households. This group also includes waste from other producers, which in nature or composition is similar to that generated in households, but may not contain hazardous waste (Act of December 14, 2012 on waste, Journal of Laws of 2020 item 797, art. 3).

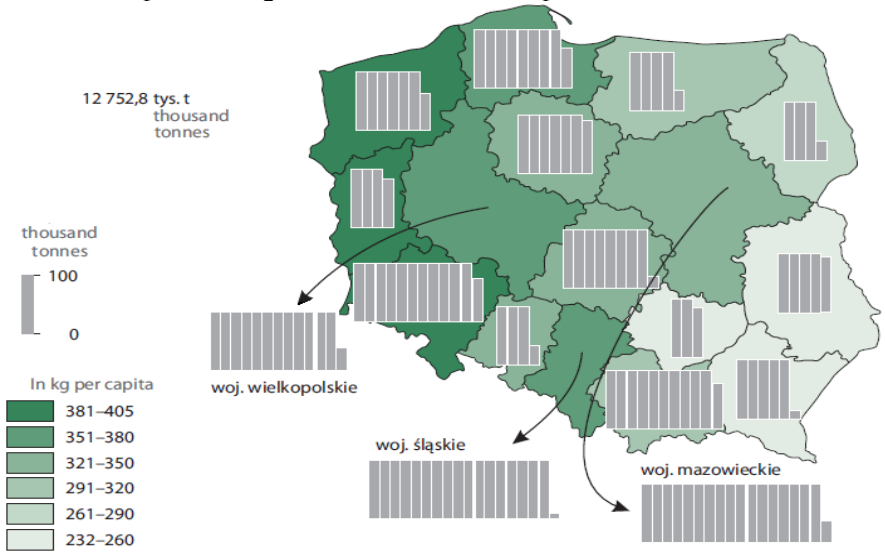
In 2019, a total of 12,753 tons of municipal waste. This amount increased by 2.1% compared to the previous year. This means an increase in the amount of waste generated per one inhabitant of Poland from 325 to 332 kg, resulting in an increase by 2.15%. The greatest amount of waste per 1 inhabitant was recorded in the Lower Silesian Voivodeship with the amount of 404 kg, while the lowest was in the Holy Cross Voivodeship, where there was 232 kg of waste per inhabitant. Variable values of these quantities depend on consumption patterns, which in Poland is particularly visible between voivodeships in the western part of the country and eastern voivodeships, where there is much less waste. Even greater differentiation can be observed between individual communes. 34% of these territorial self-government units recorded a ratio of less than 200 kg of municipal waste per capita, which mainly concerned rural areas, including one with a value below 50 kg.

On the other hand, in 56% of communes the amount of generated waste was in the range of 200-400 kg per capita. The greatest amount of waste was generated in tourist communes, where 8 of them recorded over 1000 kg of municipal waste per capita. For comparison, the average amount of municipal waste per capita in the European Union in 2018 was 489 kg. The most waste was generated by countries with the highest prosperity, i.e., Denmark – 814 kg, Germany – 615 kg and Luxemburg – 610 kg, and countries with a high share of tourists, such as Malta – 640 kg and Cyprus – 637 kg. Poland has one of the lowest rates among European countries, but unfortunately, in the segregation process in 2019, only 104 kg of waste per capita was used, which is 32.3% of the total municipal waste. Of this amount, 25% was recycled for incineration with energy recovery, 22% was transferred to biological treatment, and 9% was recycled for biological treatment.

Unfortunately, as much as 43% of waste was sent to landfill, and 1% to neutralization by thermal conversion without energy recovery. For comparison, in 2018, of the total amount of municipal waste generated in the European Union, 30% was recycled, 28% was thermally disposed of, 23% was disposed of by landfilling, 17% was composted (https://stat.gov.pl/obszary-tematyczne/srodowisko-energia/srodowisko/ochrona-srodowiska-2020,1,21.html).

Figure 1 shows the average amount of waste per capita and the amount of waste generated in individual provinces.

Figure 1. *Municipal waste generated in voivodeships, in 2019*



Source: *https://stat.gov.pl/obszary-tematyczne/srodowisko-energia/srodowisko/ ochrona-srodowiska-2020,1,21.html.*

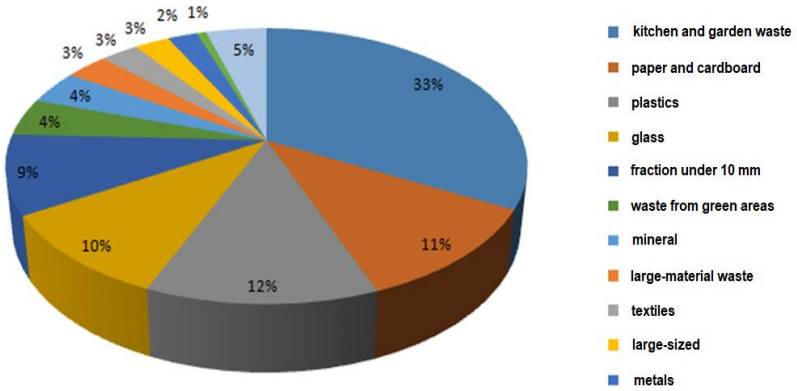
Municipal waste in Poland accounts for about 10% of the global amount of waste generated. Despite their small share, they constitute a serious problem resulting from their considerable spatial and seasonal differentiation as well as material and assortment heterogeneity and high mixing. The decisive factors are: the wealth of the society and the related level of consumption, the level of population, the type of buildings, the way buildings are heated, the season and the type of settlement unit (village, city). The amount of waste generated is also influenced by the number of tourists, the presence of public utilities, and the type and size of commercial, industrial and service outlets. In the morphological composition of municipal waste, which is the average for large and medium-sized cities and villages, the fraction share is distinguished, which was presented in Figure 2 (Resolution no. 88 of the Council of Ministers of August 11, 2016 on the National Waste Management Plan 2022, MP from 2016, item 784, p. 11-14.).

Such a large assortment of municipal waste means that in terms of logistic activities and processes, it has a number of disadvantages, such as:

- quantitative and qualitative variability depending on the seasons, as well as differentiated in the annual and multi-annual cycle (waste generation growth trend);

- high heterogeneity of the chemical and raw material composition, even in the scope of one type of waste collected selectively;
- the presence of a high risk related to the presence of pathogenic microorganisms in kitchen waste and liquid municipal waste;
- high susceptibility to rotting and odour generation, which occurs at the point of origin, collection and processing;
- the presence of hazardous waste, such as: batteries, electrical and electronic equipment, household chemicals, out-of-date drugs and others (Szołtysek, 2009).

Figure 2. *Morphological composition of municipal waste*



Source: *Own study based on Resolution no. 88 of the Council of Ministers of August 11, 2016 on the National Waste Management Plan 2022, MP of 2016, item 784, p. 11-14.*

The following groups can be distinguished among municipal waste:

- home, related to the life of people;
- large-size furniture and used household appliances;
- street from cleaning of streets, squares and rooms;
- from public utility facilities such as urban, educational, cultural and commercial infrastructure;
- from green areas (parks, squares, lawns);
- snow and ice from cleaning squares, streets and sidewalks that is contaminated with sand, dust and other debris;
- spoil from construction works in the form of soil, gravel, clay;
- rubble from renovation and demolition;
- household and living waste from industrial facilities, which may contain large amounts of hazardous substances, e.g. varnish and paint packaging;
- thermometers and waste containing heavy metals (Szołysek, 2009).

All this makes municipal waste a serious challenge for economic entities dealing with collecting and processing. At the same time, activity in this area generates

costs, which increase with the increase in the amount of generated waste and the level of its processing. The obligation to organize the waste management system rests with the municipal governments, which are obliged to define the framework for the functioning of this system and determine the method of calculating fees for waste disposal.

4. Principles of Calculating Fees for Municipal Waste Management

Pursuant to the Act on waste, the costs of waste management are borne by the first producer (Act of December 14, 2012 on waste, Journal of Laws of 2021, item 779, art. 22.), which in the case of municipal waste relates directly to residents. Fees for the management of municipal waste are calculated in accordance with the Act on maintaining order and cleanliness in municipalities (Act of September 13, 1996 on maintaining cleanliness and order in municipalities). In the case of inhabited real estate, the fee is the product of the agreed rate and the selected one of the following amounts:

- number of inhabitants living in a given property;
- the amount of water used from the property in question;
- area of a dwelling.

In the case of uninhabited real estate, the fee is the product of the declared number of containers or bags intended for collecting municipal waste generated on a given real estate. It is also allowed to differentiate the fee rate depending on the type of development and the division into rural or urban areas, which is decided by the commune council when deciding on the criteria used for the administered area (Act of September 13, 1996 on maintaining cleanliness and order in municipalities, art. 6j). When determining the rates of fees, the commune council takes into account:

- number of inhabitants living in a given commune;
- the amount of municipal waste generated in the commune;
- costs of functioning of the municipal waste management system;
- cases where property owners produce waste irregularly, which may be due to seasonal use.

The rates of fees for municipal waste collected in a selective manner may be up to a month:

- in the case of the method of calculating the number of inhabitants living in a given real estate – 2% of the average monthly disposable income per person in total[3] per capita;

[3] *It amounts to PLN 1,919, according to the Announcement of the President of the Central Statistical Office of March 29, 2021 on the average total monthly disposable income per person in 2020.*

- in the case of the method of calculating the amount of water used – 0.7% of the average monthly disposable income per 1 person in total for $1m^3$ of water consumed;
- in the case of the calculation method for the area of a dwelling – 0.08% of the average monthly disposable income per person in total for 1 person total per $1m^2$ of the dwelling area;
- in the case of the method, in relations to real estate – 5.6% of the average total monthly disposable income per person for a household;
- in the case of the method with regard to real estate where residents do not live – 3.2% of the average monthly disposable income per 1 person in total for a container with a capacity of 1100 litres or 1% of this income for a bag with a capacity of 120 litres, intended for collecting municipal waste on the property.

The commune council increases the fee rates if the real estate owner does not fulfil the obligation to collect municipal waste selectively. The fee is not less than twice the amount and not more than four times the amount of the agreed rate (Act of September 13, 1996 on maintaining cleanliness and order in communes, art. 6k).
Fees obtained for the management of municipal waste constitute the commune's income, however, the obtained revenues cover the costs of the municipal waste management system, which include the costs of:

- collection, transport, acquisition, recovery and disposal of municipal waste;
- creating and maintaining separate collection points for municipal waste;
- administrative support of this system;
- environmental education in the field of proper handling of municipal waste (Act of September 13, 1996 on maintaining cleanliness and order in communes, art. 6r).

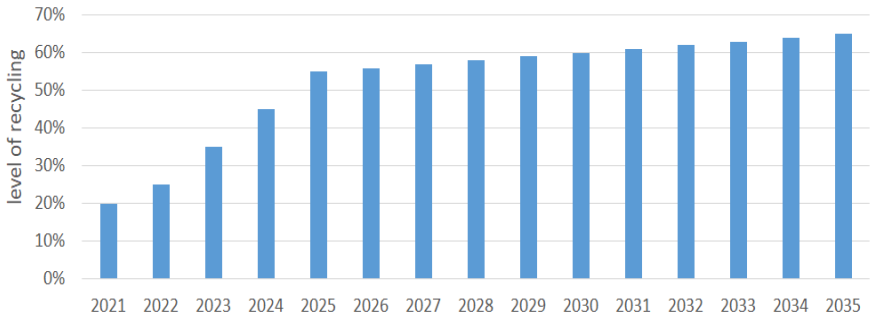
The binding legal regulations oblige municipalities to transfer all costs related to the functioning of the waste management system to waste producers. This is consistent with one of the basic principles of environmental law that the polluter pays.

5. Own Research

Poland's striving to comply with the provisions of the European Union Community legislation contained in Directive 2018/851/EC (Directive (EU) 2018/851 of the European Parliament and of the Council of May 30, 2018 amending Directive 2008/98/EC on waste) determining the levels of recycling of municipal waste, which by weight are to be at least 55% by 2025, 60% by 2030, and by 2035 they are to reach the level of 65%, which clearly resulted in changes in national regulations. In the Act on maintaining cleanliness and order in municipalities, local governments are obliged to achieve the level of preparation for re-use and recycling of municipal waste for subsequent years in the amounts presented in Figure 3. This value is

calculated as the ration of the mass of municipal waste prepared for reuse and recycled to the mass of municipal waste generated. The calculation does not take into account municipal waste other than hazardous construction and demolition waste (Act of September 13, 1996 on maintaining cleanliness and order in municipalities, art. 3b).

Figure 3. *Planned level of municipal waste recycling in Poland for 2021-2035*



Source: *Own study based on the Act of September 13, 1996 on maintaining cleanliness order in communes, Journal of Laws of 2021 item 888.*

Adapting to the required levels of waste recovery increases the costs incurred by municipalities, which must cover them from fees. On the other hand, all funds from the collected fees for municipal waste management are allocated to the costs of operating the system:

- waste collection and management – including bulky waste such as furniture;
- maintenance of the so-called PSZOK[4], i.e. points where residents can return waste that is not collected directly from their place of residence free of charge;
- purchasing, maintaining and emptying street litter bins;
- removal of illegal dumps;
- environmental education;
- other costs of waste management (http://www.um.warszawa.pl/aktualnosci/nowe-stawki-op-za-mieci-od-kwietnia?fbclid=IwAR0XnRF4wPQUE1PORpZop__bcfSCT2gUi6YozEhwEnMdQdWlAz02PNcjoxs, 20.05.2021.

The changing principles of municipal waste management, consisting in, among others, increasing the number of waste selectively collected for bio-waste and achieving recycling levels, made it necessary to adjust the fees to the real operating costs. These costs were transferred to the inhabitants, which contributed to the increase in fees related to municipal waste management in the country. Table 1 shows the level of fees for municipal waste in selected cities in Poland, together with the level of increase in fees after price changes.

[4] *PSZOK – selective municipal waste collection point.*

Table 1. *Level of fees for municipal waste in selected cities in Poland*

City	Fees after the increases			Sample monthly fees for a family of 3 living in an apartment of the area of 50 m^2		
	Sorted waste		Unsorted waste	Increased fee [PLN]	Fee before the increase [PLN]	Change [%]
	Multi-family housing	Single-family housing				
Warsaw	PLN 12.73 for 1 m^3 of used water	PLN 12.73 for 1 m^3 of used water	As for segregated waste	152.76	65.00	+135.0
Kraków	PLN 23 per person	PLN 23 per person	PLN 46 per person	69.00	78.00	-11.5
Wrocław	PLN 1.20 per 1 m^2 of apartment* or PLN 25.50 per person	PLN 1.30 per 1 m^2 of the house* or PLN 29.50 per person	As for segregated waste	60.00	42.50	+41.2
Poznań	PLN 25 per person	PLN 28 per person	As for segregated waste	75.00	42.00	+78.6
Gdańsk	PLN 0.88 per 1 m^2 of space and PLN 0.10 for each 1 m^2 over 110 m^2	PLN 0.88 per 1 m^2 of surface and PLN 0.10 for each 1 m^2 over 110 m^2	PLN 1.76 for square meter of the area	44.00	22.00	+100.0
Katowice	PLN 21.40 per person	PLN 21.40 per person	PLN 42.60 per person	64.20	42.00	+52.9
Łódź**	PLN 9.60 per 1 m^3 of used water	PLN 34 per person	19.20 per m^3 of used water	115.20	102.00	+12.9
*rate for a square meter of the area is valid if there is less than 27 m^2 per tenant ** the planned date of entry into force of the new rates is July 1, 2021						

Source: *Own study based on https://www.bankier.pl/wiadomosc/Wywoz-smieci-drenuje-portfele-Podwyzki-siegnely-nawet-100-proc-8098854.html.*

According to the presented data, different methods of calculating fees were selected in the sample cities, which translated into a large differentiation of fees for the family. There is a noticeable increase in fees by up to 135% in the case of the city of Warsaw. There is also a big difference between the fees in the cheapest city – Gdańsk and the most expensive capital with the difference reaching PLN 108. In line with the above, it can be noted that waste management in the capital city is more than three times more expensive.

6. Results

The observed increase in the amount of municipal waste in Poland results from the increased level of consumption which is a consequence of the socio-economic development of the country. The tendency for this increase is on average about 2% per year, however, there are significant discrepancies between the east and west of Poland, related mainly to the level of wealth of the inhabitants and regional development. This is confirmed by the fact that the voivodeships generating the most municipal waste are the Mazovia, Silesia and Greater Poland. Compared to European countries, Poland is in the group of countries with the lowest indicator of the amount of waste per capita, however, a very disturbing phenomenon is the fact

that as much as 43% of waste is landfilled. This result is two times worse than in the European Union countries.

The fees related to municipal waste management are borne by their producers, who are mainly residents. Municipalities are responsible for organizing the waste collection and processing system, and the related costs are covered from fees paid by waste producers. The choice of the method of their calculation is made by each commune, using one of the three described possibilities. The changes presented in the article in the scope of the amount of fees for waste management show the scale of discrepancy in fees between the described cities after the introduced increases. These prices result from the increase in costs incurred by municipalities, which are already obliged to achieve recycling at the level of 20% this year, with the perspective of dynamic increases for the coming years. Cities such as Warsaw and Łódź, where billing for waste was combined with the amount of water used, deserve attention. This is extremely important from the point of view of sustainable development, as this method of calculation can double the protection of natural resources.

On the one hand, water, the saving of which will also reduce the amount of municipal wastewater, and on the other hand, the assumed level of waste recycling is implemented, the purpose of which is to protect resources and the natural environment. This simple financial mechanism should contribute to the achievement of these two goals, nevertheless, the presented research results may constitute the basis for the formulation of the research hypothesis with a high degree of probability. Its verification, however, requires further research, which will be possible only after the end of the annual cycle of settlements in terms of changes in the amount of waste generated and water used.

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