
Management of Municipal Solid Waste in Poland: Issues of Balancing Financial Flows

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Janina Kotlińska¹, Helena Żukowska², Marian Żukowski³

Abstract:

Purpose: The study deals with the management of municipal waste, and in particular the financial flows associated with it. The study aimed to establish what were, for the given period in Poland: a) the official regulations regarding the maximum charges for the collection of municipal waste, as well as the entitlements and the level of payment relief for the charges; b) the kinds of costs of the system of municipal waste management; c) the amount: of joint potential and actual revenues from charges for municipal waste management, annual financial flows of the system of municipal waste management, cumulated balance of the system of municipal waste management in local government units, the level of financing the costs of the functioning of the system of municipal waste management from the revenue of this system.

Design/Methodology/Approach: The authors used a systemic analysis of the legal environment and financial system of municipal waste management, supplemented by a literature review and statistical analysis of numerical data obtained from the official statistics. The research covered the period 2013-2021.

Findings: The authors concluded that in Poland during the studied period: (1) the real revenues from charges for the management of municipal waste showed a growing tendency (in particular over the first and the last two years of that period), however were still far removed from those possible to obtain by the municipal authorities when charged per resident and at the maximum rate; (2) the balance accumulated by the system of municipal waste management in the form of a deficit, occurred only in 2013 and 2014, with the highest surplus achieved in 2019; (3) in the cumulative approach, the system finally reached equilibrium in 2018, and in 2021 the monthly balance per capita amounted to nearly PLN 1; (4) the highest level of financing system costs was reached in 2019, while its decline in the following years was linked with turbulence in the external environment of local government units.

Practical implications: In Poland, at a local level, greater attention and care should be given to the execution of charges for the management of municipal waste. However, the answer to the problem of growing current costs of the functioning of the system is not increasing the charges but rather implementing the principle where the level of incurred charges would depend on the amount of produced waste (i.e., PAYT). The gap between the

¹Associate Professor, Faculty of Social Sciences, Institute of Economics and Finance, The John Paul II Catholic University of Lublin, e-mail: jankakotlinska@kul.lublin.pl;

²Associate Professor, Faculty of Social Sciences, Institute of Economics and Finance, The John Paul II Catholic University of Lublin, e-mail: helena.zukowska@kul.pl;

³Professor, Faculty of Social Sciences, Institute of Economics and Finance, The John Paul II Catholic University of Lublin, e-mail: marian.zukowski@kul.pl;

potential and real monthly revenues from these charges should encourage to review the existing way of calculating the rates of such charges and to indicate those entities which in practice operate outside the system of municipal waste management, but generate waste.

Originality value: *Calculation and summary of the flows related to municipal waste management in Poland and indication that the revenues obtained by local government units from this management are sufficient on a global scale to finance its costs.*

Keywords: *Municipal waste, system of waste management, financial flows, financial balance of the system*

JEL Classification: *H23, H41, H72.*

Paper Type: *Research case study.*

1. Introduction

The tendency to transfer additional tasks to local government units has become a tradition in Poland, while the problems of the non-continued decentralisation of public finances have already been addressed by several studies. In 2013, one such additional task for communes and the purposefully created associations of communes, became the management of municipal waste. The new scope of tasks for the indicated units of local government was enforced with the amended regulations in the Act on the maintenance of cleanliness and public order in communes (Act, 1996), the appropriately adjusted regulations in the Act on waste (Act, 2012), and the existing regulations in the Act on local self-government (Act, 1990).

With the Act of 1 July 2011, on the amendments to the Act of 1996 on the maintenance of cleanliness and public order in communes, and to some other acts (Act, 2011), the legislator decided that by 1 January 2013 communes (or associations of communes) would organise a system of collecting municipal waste from the owners of residential properties, and if so decided in the appropriate resolution, also from the owners of non-residential properties.

Thus, by the beginning of 2013 at the latest, communes took full control over the waste generated by the households located under their administration. All residents paid charges for waste collection, but in return did not have to seek individually an entity responsible for collecting and processing their household waste, because such enterprises were found by the local authorities.

The indicated changes resulted from the fact that the existing regulations regarding the management of municipal waste proved to be unsatisfactory, and unable to satisfy the EU requirements in terms of limiting the storage of biodegradable waste, its selective collection, and including all residents in the system approved by the existing regulations. Too much freedom was left to the companies collecting municipal waste from local property owners in the scope of its final processing.

There was also a shortage of instruments to control the manner of processing municipal waste, in particular in terms of attaining the adequate levels of its reclaiming and recycling. Additionally, the existing regulations did not guarantee that all residents would participate in this system, including the correct way of collecting (selectively) municipal waste and transferring it to the responsible entities.

The regulations concerning the management of municipal waste in Poland, in force since 2013, were supposed to implement the following: 1) Directive 91/271/EEG dated 21 May 1991, regulating treatment of municipal wastewater (Dyrektywa EWG, 1991); 2) Directive 1999/31/WE dated 26 April 1999 regarding waste storage (Dyrektywa Rady, 1999); 3) Directive 2008/98/WE dated 19 Nov 2008 regarding waste, and repealing certain other directives (Dyrektywa, 2008).

Art. 3 of the Act on the maintenance of cleanliness and public order in communes corresponds with the content of art. 16a of the act regulating the management of municipal waste. The regulations contained in these articles (art. 16a and art. 16b of the Act) define the mandatory tasks of communes. They clearly state that in order to meet EU regulations regarding the reduction of storage of biodegradable waste, it is necessary to separate toxic waste from the stream of municipal waste, as well as reach the designated level of reclaiming and recycling packaged waste, the commune has to include all its residents in the system of municipal waste, and also organise the system of selective gathering and collection of the waste.

Moreover, each commune has to ensure the construction, maintenance and exploitation of its own, or of those in joint use with other communes and/or enterprises, installations and equipment for reclaiming and processing dangerous municipal waste, or to provide conditions for the reduction of the mass of biodegradable waste designated for storage.

According to art. 6 of the act on local self-government, each commune is responsible for public matters of the local scope not regulated on behalf of other entities, while art. 7 of the same act lists a catalogue of own tasks of a given commune, aimed at satisfying the joint needs of the local population.

One of these (point 3), concerns matters related to the maintenance of cleanliness and order, of sanitary facilities and landfills, as well as waste disposal. Art. 7 sec. 2 of the act declares that separate acts regulate which of the commune's own tasks are mandatory; one of these is the above-mentioned act on cleanliness and order in communes.

The legislator included among the own and thus mandatory tasks of the commune, the duty to maintain cleanliness and order in the local area, and create conditions required to satisfy this requirement (see art. 3 sec. 2 of the act on the maintenance of cleanliness and order in communes). Hence the commune has to carry out all the duties related to these tasks, and should it neglect this duty for any reason, anyone

who incurred damage on this account could file a claim in the administrative court, following the lack of response on the part of the commune to undertake certain remedial actions.

The inclusion of the new tasks resulted in the immediate query as to the sources of their financing. In the case of municipal waste management, the finance originates mainly from dedicated charges whose level within a certain legal framework – depending on the assumed method – is set by the commune’s regulatory authorities.

The means obtained from these charges, according to the original regulations, were to guarantee the financial balancing of the systems of municipal waste management in individual communes (or in dedicated associations of communes).

In the actual practice of the functioning of communes (and associations thereof), the dishonest information provided on the part of some residents in regard to completing their “declaration on waste” as to the number of persons residing at a given address, and not fulfilling the duty of paying charges based on the supplied declaration, enforced the need to co-finance the local system of municipal waste management from other sources of revenues of the given unit. This does not mean, however, that in Poland as a whole, the system of municipal waste management does not reach break-even point.

The authors of this study assumed the hypothesis that the level of charges for managing municipal waste, and thus the revenue obtained on such a basis by local units of self-government (communes and their associations) on a national scale are sufficient to finance the costs of this activity. Conducting it does not require financing this expenditure from other revenue of local government units.

Therefore, the study aimed to establish what were, for the given period in Poland: a) the official regulations regarding the maximum charges for the collection of municipal waste, as well as the entitlements and the level of payment relief for the charges; b) the kinds of costs of the system of municipal waste management; c) the amount: of joint potential and actual revenues from charges for municipal waste management, annual financial flows of the system of municipal waste management, cumulated balance of the system of municipal waste management in local government units, the level of financing the costs of the functioning of the system of municipal waste management from the revenue of this system.

The study employed the following methods: critical literature analysis, and statistical analysis of numerical data. The data came from the official statistical records (the Ministry of Finance, and the Main Office of Statistics GUS), and in particular from budget reports for local government units (namely: Rb-27S – reporting on the revenue performance, and Rb-28S – reporting on the execution of planned expenditure), compiled at the end of the fourth quarter of each of the examined years, i.e., from 2013 to 2021.

2. Management of Municipal Waste and the Target System of Its Financing

The functioning of both the economy and society at their current stage of development entails generating ‘rubbish’ (things used-up or out of order) and waste, which are understood by the Polish legislator (Act, 2012) as any substance and/or object whose owner desires to be rid of, is in the process of getting rid of or is obliged to do so.

In Poland, annually there are generated 135 mln tons of waste, classified into 20 groups. According to the main classification criterion (the place of origin), waste can be either industrial (generated in production), or municipal. Industrial waste constitutes on average 91.5% of all waste, out of which over half originates from mining and excavation, while municipal waste amounts for 8.5% to 10% of all the waste (Hryb and Ceglarczyk, 2021, p. 14).

The amount of municipal waste produced globally is constantly on the rise; in 2021 this amounted to 521 kg per each EU resident, while in Poland this was 362 kg. By comparison, in 2015 this was 480 kg per EU resident, and 283 kg per person in Poland (Eurostat, online).

Bearing in mind the above, it is not surprising that management of municipal waste has been increasingly discussed in the academic literature, in particular in recent years. Specialist publications address the related problems in regard of specific countries (e.g., India – Sharma, Jain, 2019; Vietnam – Thanh, Matsui, 2011; Giao, Anh, and Nhi, 2023; Malesia – Jereme *et al.*, 2018; Brasil – Alfaia *et al.*, 2017; Iqbal *et al.*, 2021; China – Zhang *et al.*, 2010; Wei *et al.*, 2017; Wang *et al.*, 2022; Nigeria – Oladiran, 2021; Osikabor *et al.*, 2022; South Africa – Musigi Ruhiga *et al.*, 2022; the USA – Ranjbari *et al.*, 2021; Turkey – Öztaş *et al.*, 2022; developing countries – Kumor, 2016; Khan *et al.*, 2022; European countries – Minelgaitè, 2019).

Their conclusions centre on the following issues: the negative impact of the low quality waste management on health and on the natural environment, the use of innovative technologies in waste management, the lack of coordination and cooperation between various public bodies, the need to increase social awareness in terms of environmental protection, the insufficient qualifications of personnel occupied with municipal waste management, the insufficient number of waste collection points, the hierarchy of waste from the viewpoint of its disposal, the promotion of the principles of circular economy.

Municipal waste is generated by households and infrastructure facilities (services, industry, commerce, and others) (Rosik-Dulewska, 2015), hence it does not include waste from: 1) production, agriculture, forestry, and fisheries, 2) holding tanks, 3) sewage network and wastewater-processing plants, including sewage sludge, 4) out-of-circulation vehicles, and 5) construction and demolition waste. Municipal waste

can be collected selectively (paper and cardboard, glass, metal, plastics, bio-waste, wood, textiles, packaging, discarded electric and electronic equipment, used up batteries and accumulators, also bulky waste, including mattresses and furniture), as well as unsorted waste (mixed waste).

Sorted waste is generated in residential property (not applicable to bulky waste, gardens, parks, cemeteries), while unsorted originates from: open-air markets, streets, manholes, etc., (Hryb and Ceglarczyk, 2021, p. 12).

According to EU directives, several processes are connected with collection of waste (Dyrektywa, 2008, art. 3 pt. 10), its transport (Dyrektywa, 2008, art. 3 pt. 14), processing, treatment of places of waste disposal, and trading. The actions realised within these processes should be carried out in a way to ensure the protection of human life and health, as well as that of the environment. In particular, they are not allowed to: pose a threat to water, air, soil, animals and plants, nor be oppressive in terms of noise and/or smell; cause results unfavourable to rural areas and places of special significance, especially in terms of culture and natural environment.

Hence, the policy related to the management of waste should aim at limiting the use of resources and facilitate the practical implementation of the hierarchy of dealing with them (Mathews and Tan, 2016, p. 441). An answer to these actions may be programmes encouraging local community to recycle, also applying financial incentives (Hong, Adams, and Love, 1993, pp. 136-146).

The literature concerning charges for the management of municipal waste is relatively scarce, especially regarding regulation employed in developing countries. When such studies are found, they focus mainly on particular communes, larger territorial units (e.g., in the biggest agglomerations in the world – Wilson *et al.*, 2012; in cities in India such as Pune – Mani and Singh, 2016, and Jaipur – Prajapati *et al.*, 2021), and also in certain countries (e.g., Nepal – Bharadway *et al.*, 2020; China and the USA – Aslam, 2020).

The problems they address concern especially the basis of shaping charges and their levels, and the rationalisation of waste management costs. In the early 1990s, Jenkins (Jenkins, 1993) deliberated on the issue of whether communes should charge households for services rendered in connection with solid waste.

Nowadays, in view of the growing amounts of waste, such a question seems to be mere rhetoric, yet it is also related to another – i.e., what should be the level of the applied charges. Nowadays, the considerations in this scope are being viewed in the context of financial incentives which could reduce the amount of waste and increase waste recycling (Matter *et al.*, 2015), increasing the role of society in financing and management of waste (Ramandei, Nawipa, 2022), the circular economy (Smol *et al.*, 2020), and sustainable development (Taleb and Farooque, 2020).

A fundamental challenge now facing the system of the management of municipal waste in any country is the relation between the level of charges for waste management and the cost of its collection and disposal.

Thus, it is indispensable for every local government unit to create strategies of managing municipal waste, involving the economic, social and environmental factors (Rosik-Dulewska, 2010, p. 10). The basis for these strategies should be the principle known as Pay-As-You-Throw (PAYT), which emerged early this century, as an elaboration of the earlier approach of the *polluter pays principle (PPP)*, a fundamental rule in the management of natural resources, first mentioned and formulated in 1972 in the Stockholm Declaration of the UN Conference on the Human Environment.

The PPP constitutes one of the earliest and most important principles in protection of the environment. In Poland, it is included in the Constitution, primary and secondary EU legislation, also in international agreements, and is an important factor shaping the legal norms of environmental protection.

It is also a determinant of the so-called ecological justice, which in essence means that the costs of preventing pollution, of its control and the removal of the consequences of pollution should rest entirely with the entity causing such pollution, and not with society as a whole. In the private sector this means subordination to such aims, either through the observance of laws imposed by the government, or by respecting the rules introduced by this entity for its own use (Górka, Poskrobko, and Radecki, 1998).

The PAYT principle signifies a system of financing management of municipal waste, in which the number of charges related to managing waste is connected to the generated amounts of waste (Elia, Grazia Gnoni, and Tornese, 2015, pp. 188-195). Strategies of waste management involving this principle are becoming increasingly common in the systems of managing solid waste, and their main purpose is to support more sustainable – from the economic, environmental and social point of view – management of generated waste.

In the PAYT model of charges, it is key to identify the unit estimation, user identification and measurement of the amount of waste. The appropriately defined indicated values enable to conduct waste management based on the model which increases the level of complexity of the service of managing waste and allows for better possibilities of its organisation, compared with the models using a flat fee.

Additionally, such a model enables introducing innovative technological solutions in order to increase general effectiveness of the realised service of waste collection. The attractiveness of the system of charges for municipal waste management based on the PAYT model in Polish conditions was indicated by Szymańska and Wielochowski (2020, pp. 91-101). In their opinion, the implementation of charges

for waste management based on the principle of PAYT appears to be the most suitable option ensuring the reliability of payment for managing waste as well as effective support of reducing disposable packaging and creating incentives for waste segregation at source and composting.

The PAYT model is not the only tested model of shaping charges for households for their waste collection. Other models have been analysed in the literature (Di Foggia and Beccarello, 2023, pp. 1-9), whose aim is setting charges which would maximise the effectiveness of the system of payment from the viewpoint of price and advantages, understood as maximising the amount of recycled waste and minimising the amounts of stored harmful waste.

Di Foggia and Beccarello simulated the functioning of a system of charges involving splitting profit, aimed at increasing the circulation of municipal waste within the management of solid waste. They tested the effectiveness of the split-profit system empirically, by comparing the effectiveness of unit prices and the standard schemes.

Their results suggest that when using the systems of charges based on unit prices, the environmental effectiveness is significantly higher, while the cost per resident is slightly lower. Up to now, in Poland in the communes obliged to conduct the management of municipal waste, charges are made based on a flat-fee system (Table 1).

3. The System of Municipal Waste Management in Poland – The Financial Aspect

The management of municipal waste generates financial flows in the form of revenue from charges for waste collection, and expenditure constituting the cost of functioning of the waste management system. The charges for municipal waste management constitute revenue of the commune or an association of communes.

The obtained means finance the cost of the functioning of the municipal waste management system (art. 6r pt. 1aa of the Act on maintenance of cleanliness and order in communes) and cannot be used for any other purposes. Financial flows connected with the management of municipal waste are thus excluded from the principle of the material unity of the budget. For these reasons – in line with art. 6r pt. 1ab of the above-mentioned act – these flows are included in a separate bank account.

The system of municipal waste management should be financially balanced, however this can be difficult to achieve (Kotlińska, 2021, p. 258), therefore as of 26 August 2021 (Act, 2021, art. 1 pt. 18 lit. a)) it is legally permitted in Poland to create a deficit in flows related to management of municipal waste in the following conditions: 1) means obtained from charges for waste management prove to be insufficient to cover the cost of the system's functioning, including the obligatory

costs, or when 2) this is a deliberate result of the will to lower the charges for waste collection for the owners of residential properties. The municipal council may then decree to cover part of costs of the municipal waste management from its own revenue not generated from charges for municipal waste management.

The fees charged to owners of residential property for managing municipal waste (art.6j of the above-mentioned act on the maintenance of cleanliness and order in municipalities, further on referred to simply as the Act 1996) constitute a ratio of the following: number of persons residing in a given property, amount of water used in this property or the surface area of the given accommodation, and the applicable charges (for instance, in municipal communes in the period 2014-2019, in most cases (85%), the charges were set using the method of ‘per person’ – Jędrzak, 2021, p. 12).

The legislator set two kinds of such charges: either the basic rate – when the proprietor observes the rules of sorting the household waste, or the raised one in the opposite case. The legislator determines the level of the maximum rates, taking into consideration the average monthly disposable income per head (art. 6k pt. 2a of the Act). In this case, the increased charge cannot be lower than the doubled standard fee, and not higher than the quadrupled amount of it. The maximum rates of charges for managing municipal waste in Poland are shown in Table 1.

Table 1. Maximum rates of charges for municipal waste collected and selectively received in Poland 2013-2021 (according to the applied method, in PLN)

Applied method/property	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
per person (2% of disposable income)	25.40	25.98	26.80	27.72	29.50	31.96	33.86	36.38	38.38	41.23
per m ³ of used water (0.7% of disposable income)	8.89	9.09	9.38	9.70	10.33	11.19	11.85	12.73	13.43	14.43
per m ² of premises (0.08% of disposable income)	1.02	1.04	1.07	1.11	1.18	1.28	1.35	1.46	1.54	1.64
per household (5.6% of disposable income)	71.12	72.74	75.04	77.62	82.60	89.49	94.81	101.86	107.46	115.46
per holiday home within the property, or from other property used for holidays/recreation (10% of disposable income)	127.00	129.90	134.00	138.60	147.50	159.80	169.30	181.90	191.90	206.19

income)										
rubbish bag or bin – capacity 120 l (1.3%* of disposable income)	12.70	12.99	13.40	13.86	14.75	15.98	16.93	18.19	24.94	26.80
container - capacity 1100 l (3.2% of disposable income)	40.64	41.57	42.88	44.35	47.20	51.14	54.18	58.21	61.41	65.98
Disposable income per capita in the previous year	1270	1299	1340	1386	1475	1598	1693	1819	1919	2061.93

Note: * since Sept 2021 (previously 1%)

Source: Own elaboration based on art. 6k pt. 2a of the Act [20] on the maintenance of order and cleanliness in communes, and (Obwieszczenia Prezesa Głównego Urzędu Statystycznego) on the average monthly disposable income per person in general in the respective years from 2013 to 2022.

The local council (or the assembly of an association of communes) can enact a single rate of the household charge for the owners of residential properties, or alternatively differentiate it depending on the surface area of the residential property, number of persons inhabiting, the area of waste collection (rural, urban), kind of residential property. It is also possible to combine together many criteria differentiating the rates of these charges (art. 6j pt. 2a of the Act 1996).

Moreover, the assembly of an association of communes can also apply (art. 6j pt. 2b of the Act 1996) criteria differentiating the rates of charges separately for communes comprising the association if this is justified by the costs of collecting and managing waste in those units, or by the local conditions.

The actual level of the rates (standard and increased) for the fees charged for the management of municipal waste is determined by the local council (the assembly of an association of communes), following a reliable and incisive calculation of the amount which would cover the actual cost of running this system. The correctly calculated rate should therefore be correlated with the true value of the service provided and not become a source of additional income for the local government unit.

Its level may reflect the degree to which revenue from sales of recyclable materials and products prepared for re-use (an additional source of income in the system) covers the costs of the functioning of the system of municipal waste management. Within its fiscal prerogative, the commune's council (the assembly of an association of communes) can reduce the maximum rate, taking into consideration (art. 6k pt. 2 of the Act 1996): size of the population in the given commune, amounts of municipal waste generated locally, the cost of the functioning of the municipal waste

management system, and cases when property owners generate waste on an irregular basis, in particular seasonal amounts of municipal waste generated in some properties.

The legislator – in allowing communes and their associations to differentiate charges applied to managing municipal waste – points out that the costs of the functioning of this system vary in rural and urban areas, and is strictly connected with the type and density of buildings. Similarly, there is a diversified collection of payments due for the management of municipal waste and varying ecological awareness among the owners of properties in individual communes, shown by the scale of respecting the principles of sorting municipal waste.

The legislator, within the fiscal prerogatives of a commune (the assembly of an association of communes) included also the right to collect lower charges (or even abstain from their collection) from some owners of residential properties. This applies to (art. 6k pt. 4 of the Act 1996) those property owners whose income does not exceed the amount entitling them to financial benefits from the social welfare system, housing for families with many children, as well as (art. 6k pt. 4a of the Act 1996) owners of properties comprising single-family units, composting bio-waste (constituting municipal waste) in their own composter.

The level of the latter exemption has to be proportional to the reduction of the costs of the management of municipal waste generated by households, hence its correct calculation requires assessing the proportion of reducing the cost of managing bio-waste from all single-family households in relation to the remaining part of the charge, including the collection, transport and processing sorted and gathered municipal waste, as well as that collected as mixed waste from such households.

The described exemption is of mandatory nature and is independent of the selected method of calculating charges, of the number of persons residing in a given property, number of square metres of the habitable area, and the amount of used water. However, the entity exempt from payment is the owner of the single-family accommodation composting bio-waste, and not its residents.

The mandatory cost of maintaining the system of municipal waste management (art. 6r pt. 2) is incurred due to the necessity of: collection, transport, gathering, reclaiming and disposing of municipal waste; creation and maintenance of points for selective collection of municipal waste; administration of such a system; ecological education in terms of the correct processing of municipal waste.

The facultative costs (art. 6r pts. 2a, 2aa and 2b of the Act 1996) for the municipality may result from: providing households with bins and/or bin liners for municipal waste, and the maintenance of bins in the appropriate order, and sanitary and technical condition; establishing and maintaining by the commune/association of communes points to repair and reuse of products and parts of products not

constituting waste; removal by communes/associations of communes municipal waste from places not suitable for its gathering and storage according to the understanding of the Act on waste.

The source of financing these costs would be surplus revenues from charges for municipal waste management over and above the mandatory cost of the functioning of the municipal waste management system, combined with financial means obtained from such payments and not used in the previous year.

4. Methodology and Research Results

The data discussed in this section were calculated by the authors based on the charges for managing municipal waste applied in the period 2013-2021, as presented previously, as well as originating from budget reports of local government units.

The authors analysed data in budget reports prepared by individual units of local government and provided – via the regional chambers of accountancy – to the Ministry of Finance (Czerwińska-Kayzer, Kotlińska, and Kotliński, 2019, p. 71). The documents in question are: Rb-27S – reporting on the delivery of the plan of expenditure, and Rb-28S – on the execution of the planned expenditure.

These reports are prepared in accordance with the rules included in the instructions attached to the decrees issued by the Minister of Finance regarding budget reports (Rozporządzenie, 2010; 2014; 2018; 2022). The Rb-27S report concerns the execution of revenues obtained from taxes, charges and untaxed budgetary dues collected by local government units and compiled based on data from tax accounting.

The Rb-28S report concerns the execution of the planned budgetary expenditures and contains the amounts resulting from the accounting records. The data included in the reports are indicated in the scope of the plan – in amounts resulting from the financial plan of a given unit, having included changes introduced by the Act on public finances, while in terms of its execution – incrementally, from the beginning of the year up to the end of the reporting period or, in cases defined in the reports, according to the actual state of affairs as of a given date.

The unit reports are prepared by managers of the organisational units, bound by their duty to prepare them reliably and correctly from the point of the content and formal accounting requirements (§ 9 pt. 1 and 2 of the current decree regarding budgetary reporting).

The inclusion of data not in line with data included in accounting records constitutes a breach of the rules regarding public finances in Poland, as defined by art. 18 pt. 2 of the Act on violating discipline of public finance (Act, 2004). Bearing in mind the above, it should be assumed that the data provided in the analysed reports were

correct and in line with the accounting records of local government units, hence the reliability of the analyses presented in this study.

Using these reports – via the filtered data – and following the codes allocated to units of local government (Rozporządzenie, 1998), the authors selected communes and associations of communes, aiming to conduct municipal waste management, and then also revenue and expenditure in section 900 of the budget (see: Gospodarka komunalna i ochrona środowiska, chapter 90002; Kotlińska, 2021, p. 261).

However, if the indicated financial flows were classified in local government units according to different classification scales, based on which the analysed reports were prepared (which cannot be excluded), then these flows were not included in the analyses presented in this study.

The revenues were analysed based on paragraph 049, classifying fees charged for the management of municipal waste, and other paragraphs which could include the remaining revenues of the system (e.g., the already mentioned revenue from sales of recyclable materials), whereas expenditure constituting a cost of the system of municipal waste management was analysed in terms of current expenses and assets (filtering and analysing the relevant paragraphs of expenditure).

Obtaining the data selected for individual years aimed to provide information about the level of charges in Poland for each of the studied years, namely:

- 1) real and potential revenue from charges for municipal waste management,
- 2) real and potential monthly revenue from charges *per capita* for municipal waste management,
- 3) annual financial flows of the system of municipal waste management *per capita*,
- 4) cumulated balance of payments of the system of municipal waste management in local government units,
- 5) monthly balance of payments for the system of municipal waste management in Poland *per capita*, including the cumulated periods,
- 6) the level of financing the cost of functioning of the system of municipal waste management.

Analysis of data included in the Rb-27S report allowed to confirm that the real revenue from the charges for managing municipal waste showed a growing trend (in particular in the two first and two last studied years), however they differed notably from payments which could be received by the municipal waste management system if collected according to the method per resident (the method chosen since it is the most popular one) and at the maximum rate (Figure 1).

Yet, it is worth adding that the performed simulation of the amount of potential revenue from these charges did not consider revenues which could come into the

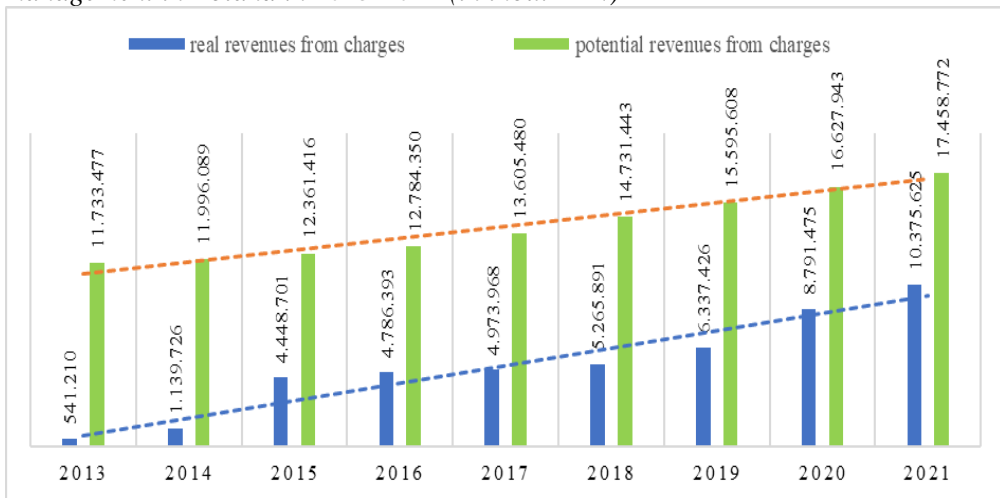
system from owners of non-inhabited properties, whereas the real revenues included those entitlements.

A comparison of the indicated values shows that a significant part of the due payments does not enter into the system, since such a large discrepancy in the revenues shown in Figure 1 cannot result only from the applied (and mentioned earlier) reductions of the charges on national or local scale. Figure 2 shows the disproportion in the monthly *per capita* approach.

Taking into consideration the maximum monthly charges for municipal waste management set per person, and the level of charges per person based on the real revenue, it can be seen that in the studied period such discrepancies were visibly reduced.

These changes in the factual condition may result from: inclusion in the system of municipal waste management also of the non-inhabited properties; collection of the majority of charges calculated at maximum rates; effectiveness of the carried-out vindication activity; charging increased rates in the situation of not meeting the requirements of sorting waste.

Figure 1. Real and potential* revenue from charges for municipal waste management in Poland in 2013-2021 (in thou. PLN)



Note: *assuming that the revenue originates only from owners of residential properties, charges per person at the maximum rate

Source: Own elaboration based on data from the Rb-27S reports for local government units at the end of Q4 in 2013-2021, taken from the website of MF (www.mf.gov.pl/sprawozdania_budzetowe - accessed 10.12.2022).

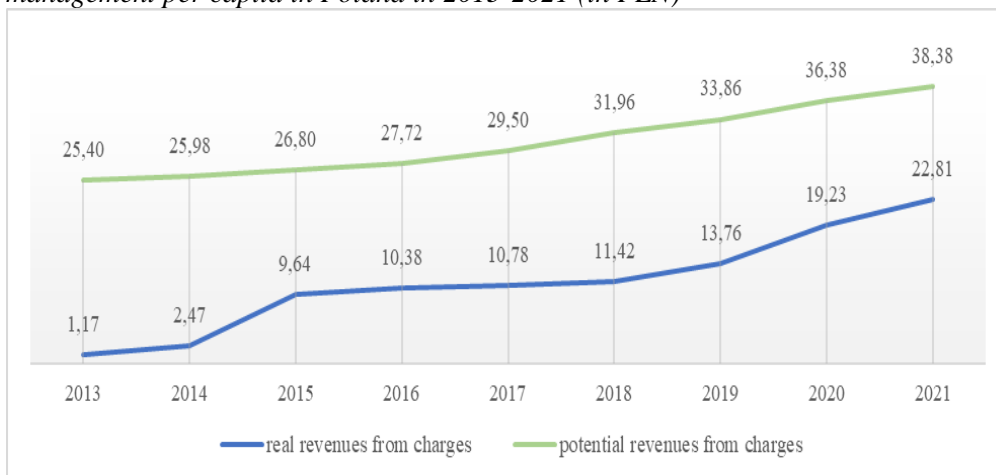
The real revenue for the system of municipal waste management is not based just on the set charges. It also includes other sources of revenue (from other paragraphs), which can be found in section 90002. The combined revenues and expenditures

constituting costs of the system of municipal waste management for the period 2013-2021 calculated per capita are shown in Figure 3.

The included data suggest that in Poland, jointly in communes and associations of communes, looking at the line of the trend, the revenues of the system are successively growing, and over the period under study increased over ten-fold per resident.

On the other hand, expenditure showed a tendency to accumulate in certain periods (undoubtedly connected with increased expenditure on assets, in particular investment linked with the construction of the appropriate facilities for the system, such as points of selective collection of waste (PSZOKs)). This almost doubled in the first year of the system functioning in its present form, both in 2020, and also in relation to 2019.

Figure 2. Real and potential* monthly revenues from charges for municipal waste management per capita in Poland in 2013-2021 (in PLN)



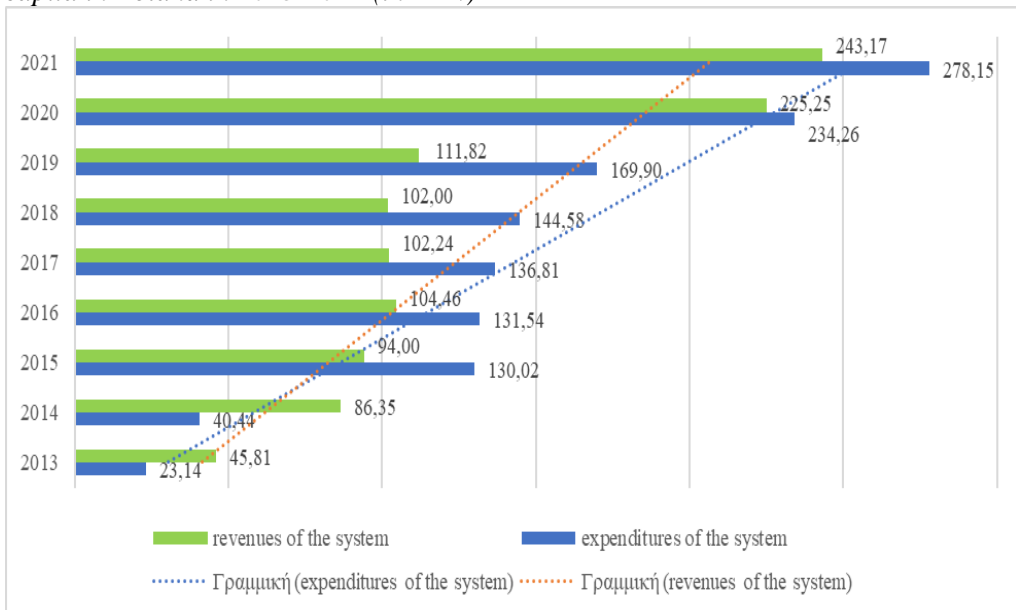
Note: *assuming that revenues come only from owners of inhabited properties, charges are made per person at the maximum rate

Source: own elaboration based on the data from the Rb-27S reports from local government units at the end of Q4 in the period 2013-2021, obtained from the Ministry of Finance (MF) website (www.mf.gov.pl/sprawozdania_budzetowe - accessed 10.12.2022).

The cumulated balance of payments for the system of municipal waste management (Figure 4), calculated with the assumption on the revenue side only of the charges for managing municipal waste, and other sources of revenue, shows that in Poland in global terms the system showed a deficit merely in the first two analysed years, and that in fact it was then very high.

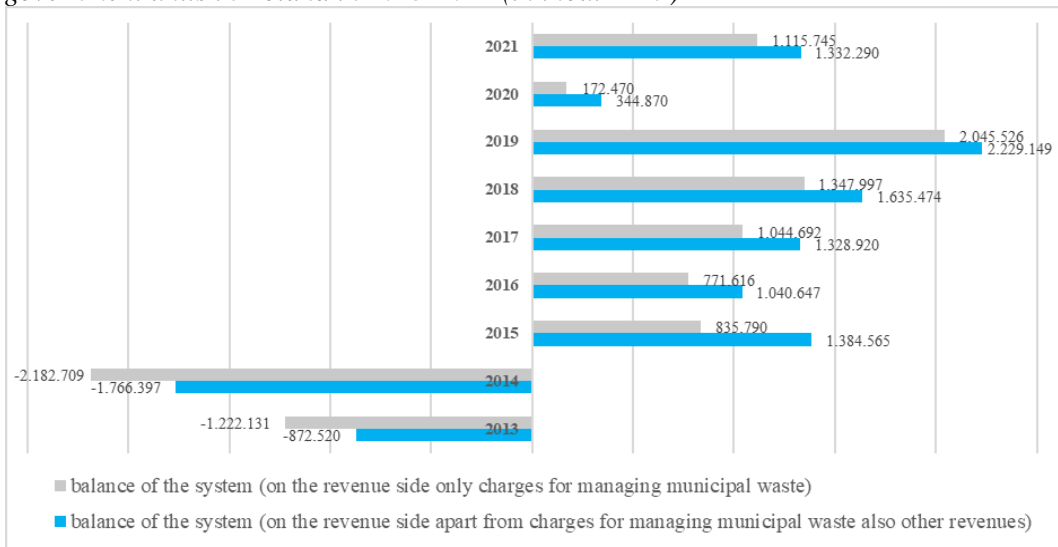
However, in successive years, there was already a surplus (the highest in 2019, and the lowest in 2020).

Figure 3. Annual financial flows in the system of municipal waste management per capita in Poland in 2013-2021 (in PLN)



Source: Own elaboration based on data from the Rb-27S and Rb-28S reports from local government units at the end of Q4 in 2013-2021, obtained from the MF website (www.mf.gov.pl/sprawozdania_budzetowe - accessed 10.12.2022).

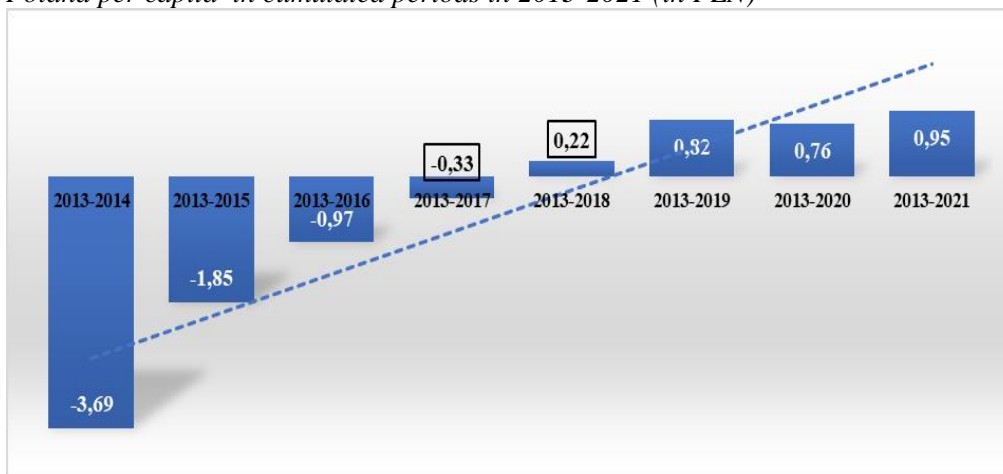
Figure 4. Cumulated balance of the system of municipal waste management in local government units in Poland in 2013-2021 (in thou. PLN)



Source: Own elaboration based on data from the Rb-27S and Rb-28S reports from local government units at the end of Q4 in 2013-2021, obtained from the MF website (www.mf.gov.pl/sprawozdania_budzetowe - accessed 10.12.2022).

In a global approach, taking into consideration the cumulated periods, the system finally reached financial equilibrium in 2018 (Figure 5), as since then the average monthly balance of the system per capita reached a positive value. After nine years of the functioning of the municipal waste management system as the responsibility of communes in Poland, the monthly balance amounted to nearly PLN 1 per person.

Figure 5. Average monthly balance of the municipal waste management system in Poland per capita in cumulated periods in 2013-2021 (in PLN)



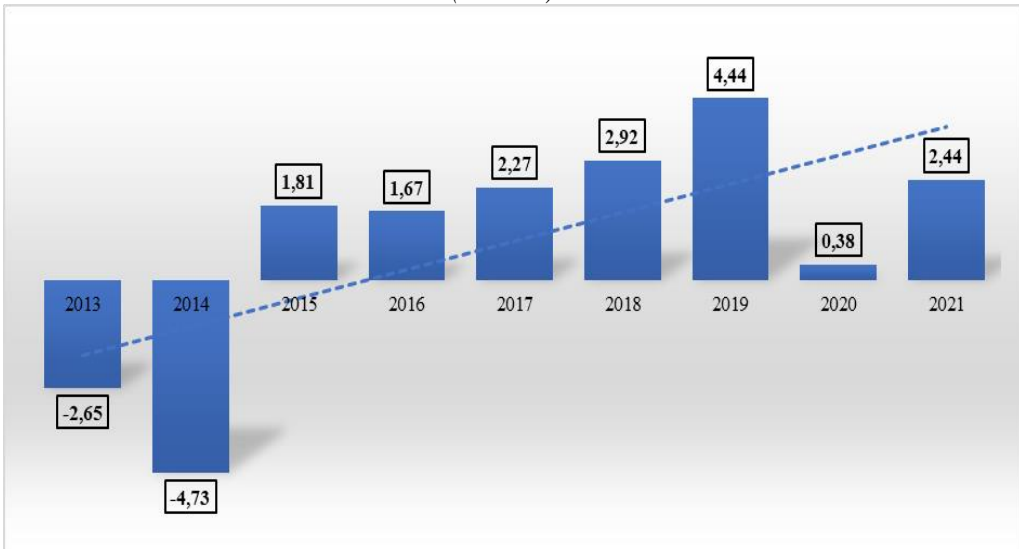
Source: Own elaboration based on data from the Rb-27S and Rb-28S reports from local government units at the end of Q4 in 2013-2021, obtained from the MF website (www.mf.gov.pl/sprowozdania_budzetowe - accessed 10.12.2022).

In the individual years of the examined period, the balance of the system *per capita* was strongly diversified (Figure 6). The highest deficit (just over PLN 4.7) occurred in 2014, while 2019 showed the highest surplus (just over PLN 4.4). The indicated values translate on a global scale into the level of financing the system of municipal waste management in Poland (Figure 7).

In Poland, taking into consideration the national scale, the highest level of financing the cost of the functioning of the system of municipal waste management was recorded in 2019, when this revenue alone financed 150% of the current costs of this system. During the next few years these values remained on a much lower level, and in 2020 the income from the waste management charges was only sufficient to cover the current costs of operating the system.

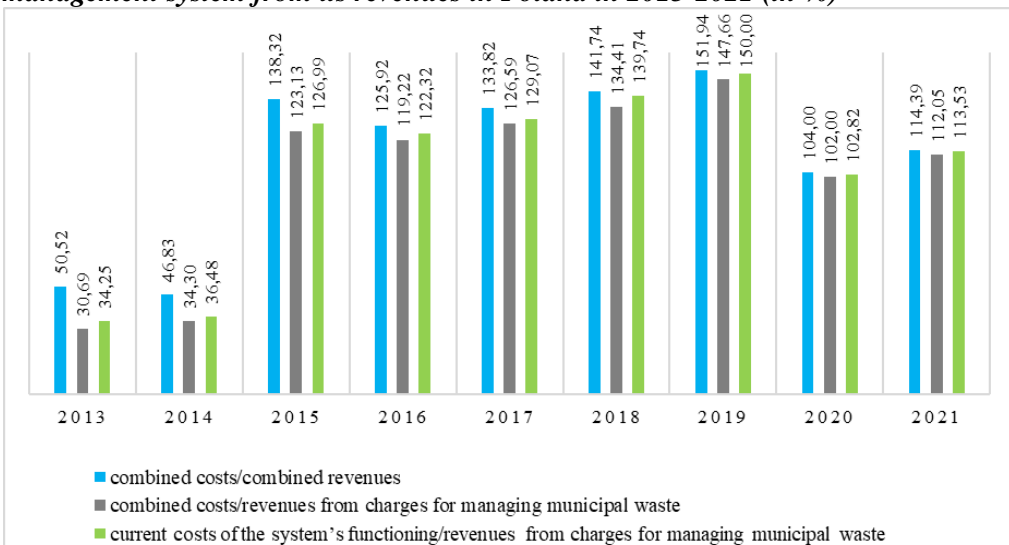
The growing cost of the system's functioning could be related to the Sars-Cov-2 pandemic (the lockdown greatly impacted on the increased amounts of generated municipal waste in the place of residence and in residential accommodation), the influx of refugees from Ukraine caused by the outbreak of the war, and the rising prices for the services of waste collection entities.

Figure 6. Monthly balance of the system of municipal waste management per capita in communes in Poland in 2013-2021 (in PLN)



Source: Own elaboration based on data from the Rb-27S and Rb-28S reports from local government units at the end of Q4 in 2013-2021, obtained from the MF website (www.mf.gov.pl/sporzadzania_budzetowe - accessed 10.12.2022).

Figure 7. Level of financing the costs of the functioning of the municipal waste management system from its revenues in Poland in 2013-2021 (in %)



Source: Own elaboration based on data from the Rb-27S and Rb-28S reports from local government units at the end of Q4 in 2013-2021, obtained from the MF website (www.mf.gov.pl/sporzadzania_budzetowe - accessed 10.12.2022).

The indicated turbulences revealed the scale of the problem related to the management of municipal waste, such as the volume of waste from persons so far 'invisible' to the system (i.e. not paying the charges but 'producing' waste), as well as clearly demonstrated how much of the municipal waste (e.g., glass bottles) could be reclaimed if collected in a different way (not as broken glass but only whole, in specialist points as practiced in other countries, e.g. Slovakia, or as was once done in Poland – bought back at a very small price in specially designated places).

5. Conclusions and Recommendations

Based on the considerations presented in this paper, it can be stated that:

1. from the moment when communes in Poland took over responsibility for the system of municipal waste management, one can observe a systematic increase in the maximum rates of charges for waste management, with the legislator introducing several regulations allowing to differentiate, reduce and increase them;
2. it was assumed that the system of municipal waste management was to achieve a balance of payments in individual communes, yet the subsequent local government practice forced the legislator to abandon this principle and provide the possibility to finance the costs (both mandatory and facultative) of the functioning of the system of municipal waste management from other municipal revenues (also in the case of targeted associations of communes);
3. the real revenue from charges for management of municipal waste showed a growing trend (in particular in the two first and two last years under study), however they significantly differed from those which could flow into the system if they were calculated per resident and according to maximum rates, and could be even higher if better executed and in line with the PAYT principle;
4. a significant part of payments due for the management of municipal waste does not come into the system as a result of not just a reduction of charged rates (both national and local) applied in individual communes/associations of communes, but also because of the 'disappearance' of some entities (residents) from this system due to them not being included in declarations, and to the non-payment of the charges, even though – as was indicated – they are the most vital but not unique source of income for this system;
5. the cumulated balance of the system of municipal waste management in Poland taken as a whole, showed a deficit only in the first two years of the communes becoming responsible for the management of municipal waste, while in the years to follow there was a surplus (the highest in 2019, and the lowest in 2020);
6. in the cumulated approach, the system finally achieved equilibrium in 2018, and in 2021 the monthly balance of the system *per capita* in communes reached almost PLN 1;
7. the highest level of financing the cost of operating the system of municipal waste management in Poland occurred in 2019 – when the revenues from waste management charges alone could cover up to 150% of the current costs of the

system, while in 2020 these revenues only slightly exceeded the current costs of its functioning.

The conducted analyses allow for the conclusion that in Poland, at a local level, greater attention and care should be given to the execution of charges for the management of municipal waste (at present this amount to 60% of the due payments).

However, the answer to the problem of growing current costs of the functioning of the system is not increasing the charges but rather – beyond the already suggested improvement in their execution – implementing the principle where the level of incurred charges would depend on the amount of produced waste (i.e., PAYT).

The results presented in this study suggest that the gap between the potential and real monthly revenues from these charges should encourage to review the existing way of calculating the rates of such charges (and as a consequence, their reduction), and to indicate those entities which in practice operate outside the system of municipal waste management, but generate waste.

Yet, tightening up the system of municipal waste management in Poland in this respect is not easy (due to the lack of duty to register one's residential address, the difficulty in verifying the credibility of submitted declarations, and the absence of a system to control the number of residents in a given accommodation in correlation with the records held by the local Registry Office) – however it is necessary in view of the announced increases in the cost of municipal waste management, mostly due to the diminishing capacity of landfills (higher charges for receiving waste) and the need to construct a larger number of incinerators (Jędrzszak, 2021, pp. 41-46).

Taking into account the above, and in particular the local conditions of conducting municipal waste management, it is necessary to carry out extended research on financial flows in this system for individual communes, including also the spatial approach, in the context of achieving the planned levels of recycling and storage of municipal waste by 2035.

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