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Transformation of the municipal waste management sector in Poland. A case study of the Świętokrzyskie Region

1. Introduction

One of the major objectives of the revised Waste Framework Directive 2008/98/EC that entered into force on 12 December 2008 was to encourage the adoption of an efficient and sustainable waste management (Florin-Constantin and Liviu 2012, p.169-180). Consequently, all EU Member States are obligated to take into account “the general environmental protection principles of precaution and sustainability, technical feasibility and economic viability, protection of resources as well as the overall environmental, human health, economic and social impacts” (Directive 2008/98/EC) while managing their waste. In Poland, likewise in many European countries, the implementation of the above-cited principles is only possible if there is a modification of the existing legislative framework for waste that encourages the divergence of waste away from landfills, strengthens legal certainty and minimizes burdens on businesses, regulators and stakeholders (Nash 2009, p. 139-149). The concept of collaborative management is considered to be one of the most efficient instruments of sustainable development of areas that are under pressure of growing production of municipal waste (et al. 2012, p.1589-1592).

The obligation to transpose the provisions of the Waste Framework Directive 2008/98/EC has given the opportunity to thoroughly revise the Polish waste legislation as to accommodate it to the sustainable waste management. Consequently, a number of legal acts regulating municipal waste management have been recently implemented in Poland. The crucial ones, giving the possibility to put forward the concept of waste – material management are as follows:

- the Act of Polish Parliament of 14th December 2012 on waste,
- the Act of Polish Parliament of 1st July 2011 amending the act on maintaining cleanliness and order in communities and other acts, and
- a plenty of decrees, including the Decree of the Minister of Environment of 28th May 2012 on the levels of reducing the weight of biodegradable municipal waste being landfilled, the Decree of the Minister of Environment of 29th May 2012 on the levels of recycling and preparing for re-use chosen fractions of municipal waste, and finally the Decree of the Minister of Environment of 11th September 2012 on the mechanical-biological processing of commingled municipal waste.

In line with the sustainability principle of the Waste Framework Directive 2008/98/EC, the focus of the new waste legislation order in Poland is to reduce environmental impacts of waste generation, to operate the waste management system at a reasonable cost and finally, to meet health and safety requirements of participants (Schluchter and Rybaczewska-Błażejowska 2012, p.311-322). Therefore, the following objectives for municipal waste management were adopted:

- to cover 100 per cent of the population by the collection of municipal waste (Act of 1st July 2011),
- to re-use and recycle at least 14, 18, 30 and 50 per cent of paper, metal, plastics and glass in 2014, 2016, 2018 and 2020 respectively (Decree of 29th May 2012),
- to reduce and recycle at least 38, 42, 50 and 70 per cent of construction waste in 2014, 2016, 2018 and 2020 respectively (Decree of 29th May 2012),
- to reduce the landfilling of biodegradable waste to levels required by the Council Directive 1999/31/EC (Decree of 28th May 2012), and finally
- to reduce the level of municipal waste landfilling to a maximum of 60 per cent by 2014 (National Waste Management Plan 2014).

In order to achieve these objectives, during 2012-2013 the municipal waste management sector in Poland was entirely re-organized.

First and foremost, following 1st July of 2013 the municipal waste management is the responsibility of local authorities. They, as the owners of municipal waste, have to organize the adequate collection, transportation and processing of municipal waste. To accomplish this difficult task, the collection services, transportation and the processing of municipal waste are the subject of compulsory tenders. The first tenders were organized and resolved before 1st of July 2013 since this was the expiry date of existing contracts for municipal waste collection signed by inhabitants with waste collection companies. In the new model of municipal waste management householders for the provided services have to pay monthly a fixed fee directly to a local council. The fee is calculated per given unit that might be a resident, water usage or the dwelling size and is relatively lower, if the municipal waste is collected selectively (Rybaczewska-Błażejowska 2013).

Secondly, the territory of Poland was divided into regions of municipal waste management. This means the area inhabited by at least 150 000 residents; the community having more than 500 000 residents might form the separate region of municipal waste management (Act of 1st July 2011). There have been established 87 regions of municipal waste management in Poland; each is or will be equipped with at least one regional installation for municipal waste processing.

Finally, to promote waste prevention and thereby to break the link between economic growth and the environmental impact of waste, the National Strategy for Waste Prevention was published in 2014. The crucial assumption of this document is the popularization of the eco-design concept understood as the design of products with the environment in mind and to assume some responsibility for the product's environmental consequences as they relate to specific decisions and actions executed during the design process (Lewis et al. 2001, p.16). In order to achieve it, a number of methods are going to be applied, such as life cycle analysis (LCA), best available technique (BAT), environmental management systems (ISO 14001 and EMAS), the polluter pays principle and finally, the extended producer responsibility for products.

2. Case-study presentation

The Świętokrzyskie Region is one of 16 Polish voivodeships, located in the southern part of central Poland, inhabited by approximately 1 274 000 people (Statistical Handbook of Local Government – the Świętokrzyskie Voivodeship 2013). The city of Kielce, concentrating around 16 per cent of the region's population, is the capital of the Voivodeship. Approximately 55 per cent of people of the Świętokrzyskie Region reside in rural areas; the average population density is 109 people per 1km². The predominant form of land use is agriculture (65 per cent of the region), followed by forestry (29 per cent of the region). The area of the Świętokrzyskie Region is very diverse in terms of topography, landscape and hydrological conditions and, hence, it is rich in various forms of nature conservation, including the Świętokrzyski National Park, covering the Świętokrzyskie Mountain.

Municipal waste management in the Świętokrzyskie Region is representative to other regions of new member states of the European Union, due to a few reasons at least:

- the generation of municipal waste in kg per capita per year is considerably lower than the European average,
- the municipal waste collection services are poorly organized,
- the process of recycling and composting of municipal waste is in the development stage,
- the predominant form of the municipal waste processing is landfilling,
- the improvement of municipal waste management was recognized as one of major objectives of environmental protection.

Considering the municipal waste generation, there was 372 855 tones of municipal waste produced in the Świętokrzyskie Region in 2012 (Waste Management Plan for the Świętokrzyskie Region 2012). Converting the level of municipal waste generation into kg per capita per year, an average person of

the Voivodeship produces approximately 300 kg of municipal waste yearly that is 14 kg less than the average ratio of municipal waste accumulation in Poland (Statistical Yearbook – Environment 2013). The composition of municipal waste in the Świętokrzyskie Region does not differ from the average composition of municipal waste in Poland. Consequently, considering the municipal waste as a potential source of secondary raw materials, the following waste categories can be distinguished:

- dry recyclable materials (paper and cardboard, plastics, glass, metals) – 30.45 per cent,
- bio-waste – 38.33 per cent,
- the remaining waste, including the fraction below 10 mm – 31.22 per cent.

Any significant alterations in the quantity and quality of municipal waste are not envisaged in the near future.

Regarding the municipal waste processing, disposal at landfill sites is the primary method of municipal waste management in the Świętokrzyskie Region. In 2010, 73 per cent of the municipal waste collected in the Świętokrzyskie Voivodeship was landfilled, whereas 27 per cent was recovered, either through material or organic recycling. The significant problem of the recycling in both Poland and the Świętokrzyskie Region is the relatively low quality of recovered materials or produced compost. Consequently, the municipal waste that does not fulfil the recycling standards is transferred to the production of refuse-derived fuel (RDF).

To fulfil the requirements of the Act of Polish Parliament of 1st July 2011 amending the act on maintaining cleanliness and order in communities and other acts, the Świętokrzyskie Region was divided into the following municipal waste management regions:

- Region 1 – inhabited by app. 150 000 people,
- Region 2 – inhabited by app. 225 000 people,
- Region 3 – inhabited by app. 155 000 people,
- Region 4 – inhabited by app. 390 000 people,
- Region 5 – inhabited by app. 201 000 people,
- Region 6 – inhabited by app. 166 000 people.
- Management of municipal waste in the above-enumerated regions will be ultimately performed in regional installations for municipal waste treatment that rely on the mechanical-biological recovery and disposal (see table 1).

Table 1. The list of regional installations for municipal waste treatment in the Świętokrzyskie Voivodeship

Name of the region	Name and location of the regional installation for municipal waste treatment	Data of opening	The maximum capacity [Mg/year]
Region 1	Jancyce 27-522 Baćkowice	in operation	66 000
Region 2	Janik 27-415 Kunów	in operation	140 000
Region 3	Włoszczowa 29-100 Włoszczowa	in operation	37 000
Region 4	Promnik 26-067 Strawczyn	2015	150 000
Region 5	Rzędów 28-142 Tuczępy	2014	60 000
Region 6	Końskie 26-200 Końskie	2015	50 000

Source: Waste Management Plan for the Świętokrzyskie Region 2012

3. Material and methods

The primary aim of the research was to evaluate the sector of municipal waste management in the Świętokrzyskie Region from the perspective of the currently being implemented model of municipal waste management in Poland. The research hypotheses put forward for verification were as follows:

1. Following the year 2012, in the long-term perspective, there will be a steady slight increase in the weight of municipal waste collected in both the urban and the rural areas.
2. The system solutions in the field of municipal waste management, being currently implemented in Poland, are planned, designed and operated in such a way as to satisfy the waste hierarchy, including the increasing levels of recycling and the reduction of bio-waste disposal.
3. The main instrument to motivate residents to take the active role in the new municipal waste management system is a financial instrument (the amount of payable fees).
4. Given the fundamental criteria of sustainable development – the environmental criterion, the economic criterion and the social criterion, the new model of municipal waste management supports the environmental effectiveness, but simultaneously leads to a number of socio-economic difficulties.

To address the research aim and hypotheses a multiplicity of study methods was employed. They fall into two categories: primary (questionnaires and non-structured interviews) and secondary (the review of literature, current legislation and numerous national and regional environmental reports). The quantitative investigation (postal and telephone questionnaires) constituted, however, an essential instrument for the data collection. The questionnaire survey, having open and closed-ended questions, was addressed to local authorities in the Świętokrzyskie Region. The group of 102 respondents (5 authorities of municipalities, 26 authorities of urban-rural communities and 71 authorities of rural communities) was investigated. The achieved response rate was 44 per cent that is relatively high and guarantees the representativeness of gathered information; 35 per cent in rural areas, 58 per cent in urban-rural areas and 100 per cent in municipalities. The interpretation of the results was based upon systematic analysis with the use of various statistical methods; the bivariate analysis, including the correlation analysis, one-way analysis of variance (ANOVA) and Kruskal-Wallis test, was the predominant one.

4. Results and discussion

Following the years 2012-2013 the system of municipal waste collection in the Świętokrzyskie Region has largely improved. In 2013, the municipal waste collection was provided to 100 per cent of the population; the selective municipal waste collection was optional. The improvements in the infrastructure have not been, however, automatically followed by raising the quantity and quality of municipal waste collected. Though no official data on the quantity and the composition of collected municipal waste in 2012-2013 has been made available yet, the author's research proved many unexpected findings. Based upon the municipal waste delivered to municipal waste treatment facilities, there are spatial variations in the municipal waste collected amid communities in the Świętokrzyskie Region. The most apparent is the difference in the quantity of municipal waste collected between urban and rural areas (see figure 1). In the first case, including municipalities and urban-rural areas, there has been an increase of municipal waste transferred to the processing since the re-organization of the municipal waste management sector in Poland, assessed at 4.4 per cent and 25.4 per cent in relation to 2012, adequately. On the contrary, in the rural areas, there has been a decrease in the municipal waste collected, namely approximately 24 per cent less municipal waste was gathered in 2013 than in 2012. The system solutions applied for the municipal waste collection and transportation in the Świętokrzyskie Region are ineffective, at times, due to various reasons; their complexity and diversity were identified, however, as the major ones (see figure 2). The collection of municipal waste in the Świętokrzyskie Region relies on one container, in the case of the commingled municipal waste collection, up to five containers, in the case of the selective municipal waste

collection. The research proved that 65 per cent of investigated communities, mainly urban-rural and rural ones apply four or five containers (bags) for the collection of municipal waste. Furthermore, municipal waste are collected with different frequency, varying from once a week up to once every three months, depending upon the type of community, type of housing and finally the type of municipal waste to be collected. The more scattered houses, the municipal waste collection is done less frequently. This is not only the problem of rural communities in the Świętokrzyskie Region, but also other voivodeships of Poland.

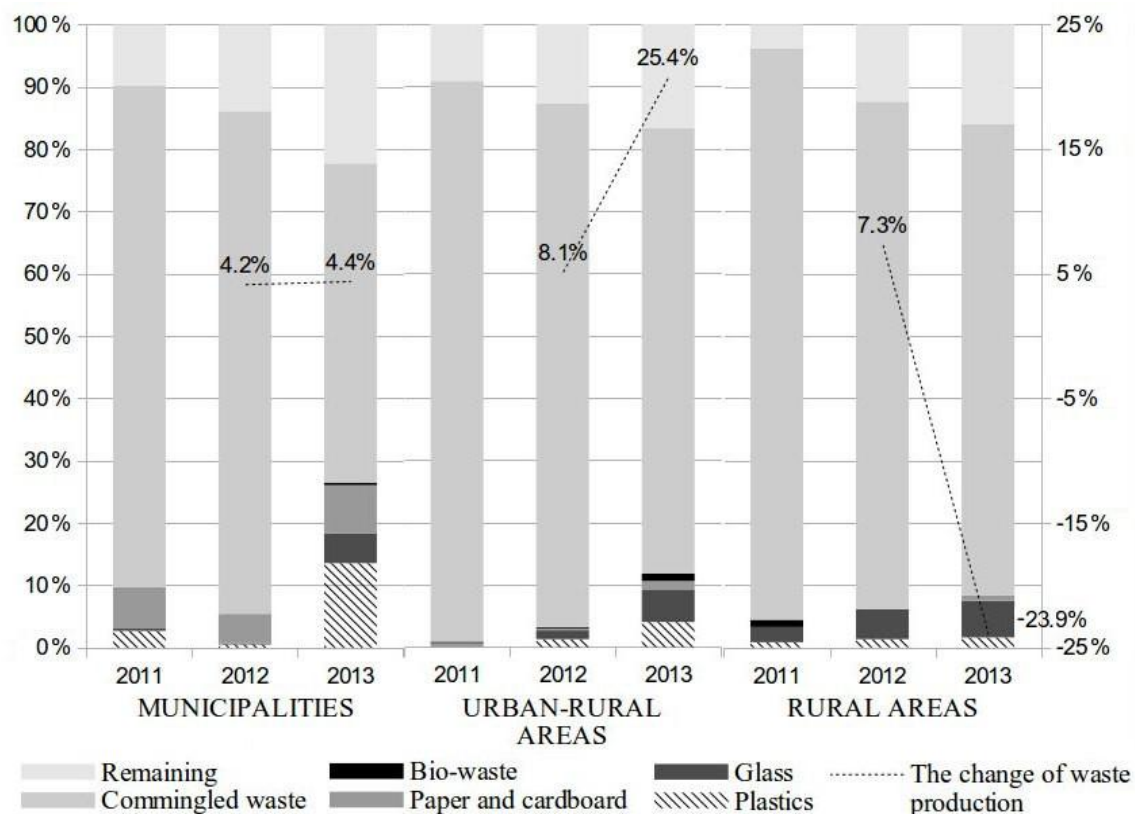


Figure 1. Changes in the quantity and the composition of municipal waste collected in the Świętokrzyskie Region in 2011 - 2013

Source: Own research upon environmental reports of the Marshal's Office of the Świętokrzyskie Region

Notwithstanding the type of the community, there is a considerable progress in the separate collection of municipal waste in the Świętokrzyskie Region in comparison with 2011 (see figure 1). Municipalities in the Świętokrzyskie Region reach the highest amounts of recovery of dry recyclable materials, estimated at 26.5 per cent, followed by urban-rural areas, 11.8 per cent, and rural areas, achieving 8.4 per cent in 2013. Plastics, paper and cardboard, and glass are the main streams of materials selectively collected at source. Additionally, in some communities, people have been given an opportunity to separately collect bio-waste, composite packaging and metals. Despite the fact that the separate municipal waste collection at source is optional, the majority of population of the Świętokrzyskie Region opts for it. The research revealed that in almost 60 per cent of communities of the Świętokrzyskie Region more than 75 per cent of the population decided to collect the municipal waste selectively, which means that not less than 62 per cent of the population of the region collect waste selectively.

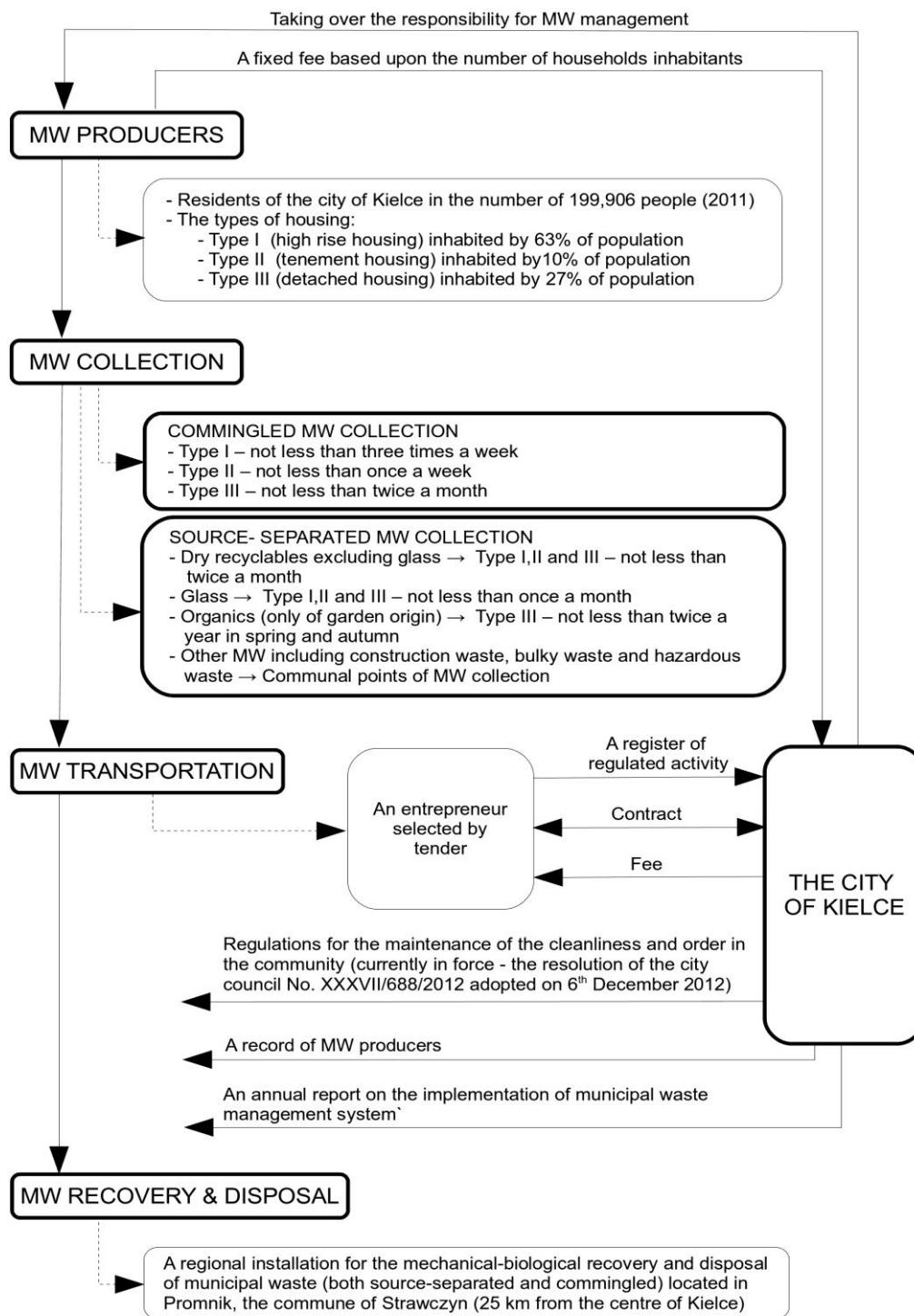


Figure 2. The model of municipal waste management – a case study of the city of Kielce, Świętokrzyskie Region
Source: Own research

Table 2. The achieved levels of re-use and recycling of chosen fractions of municipal waste in the Świętokrzyskie Region in 2012

Name of the region	The level of re-use and recycling of paper, metal, plastics and glass [%]	The level of bio-waste landfilling in relation to the weight of the bio-waste produced in 1995 [%]
Region 1	27.36	48.57
Region 2	22.29	21.05
Region 3	7.64	24.08
Region 4	10.36	55.66
Region 5	15.39	37.67
Region 6	17.56	26.26
Świętokrzyskie	16.76	35.54
Municipalities	41.43	45.05
Urban-rural areas	17.47	40.40
Rural areas	13.50	33.58

Source: Own research upon the environmental reports of the Marshal's Office of the Świętokrzyskie Region

In the Świętokrzyskie Region as in other Polish regions, there has been noted an ongoing increase of the level of re-use and recycling of chosen fractions of municipal waste, including plastics, paper and cardboard, glass and metals. There are, however, large disproportions amongst voivodeships, regions of municipal waste management and communities themselves. The average level of re-use and recycling in the Świętokrzyskie Region was equal to 16.76 per cent in 2012, but there are also regions of municipal waste management that have considerable lower results (see table 2). The worst situation was in region 3, having solely 7.64 per cent level of re-use and recycling in 2012 and thus not fulfilling the legal requirements. A slightly better situation was in region 4 where the level of re-use and recycling was estimated at 10.36 per cent and therefore, the legally required level of 10 per cent was accomplished. The predominant reason for the above disproportions among municipal waste management regions in the Świętokrzyskie Voivodeship is the difference in the infrastructure equipment for materials recovery.

Regarding the bio-waste management, a dynamic decrease of landfilling for aerobic and anaerobic processing has been observed in the Świętokrzyskie Region as well as other Polish regions. Consequently, all regions of municipal waste management in the Świętokrzyskie Voivodeship have satisfied the legally required reduction of bio-waste landfilling; the regions' average was estimated at 35.54 per cent in 2012 (see table 2). There are natural differences between regions and communities that arise, inter alia, the composition of municipal waste. Basically, the municipal waste collected from rural communities contains far less bio-waste fraction since householders do it in backyard composting containers.

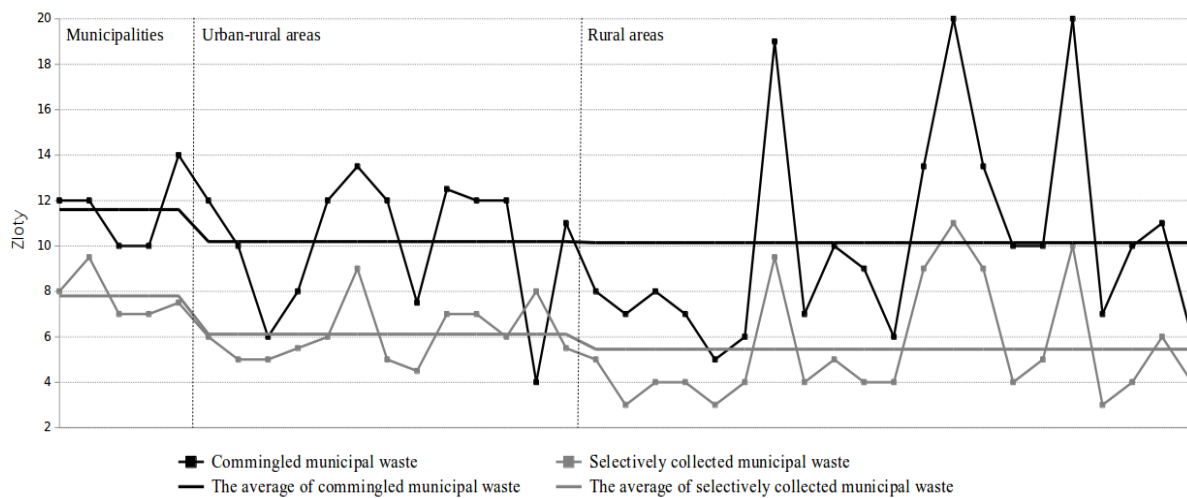


Figure 3. The fee per person for the commingled and selectively collected municipal waste in the Świętokrzyskie Region in 2013

Source: Own research

Following the recommendations of the Ministry of the Environment in Poland, the authorities of communities of the Świętokrzyskie Region differentiated the fee for municipal waste management paid by people based on the manner of the municipal waste collection. Consequently, the fee is relatively lower, if the municipal waste is collected selectively. The preferred method of the fee calculation was per resident of household. And so, the fee for the commingled municipal waste ranges from 4 up to 20 zloty per person; families having two members also pay the fee of 20 zloty (see figure 3). The average fee for the commingled municipal waste is equal 11.60 zloty per person in the municipalities, 10.20 zloty per person in the urban-rural communities and 10 zloty per person in the rural communities of the Świętokrzyskie Region. As underlined above, there is a reduced fee for the municipal waste collected selectively that ranges from 3 up to 11 zloty per person; families having two members also pay the fee of 11 zloty. The average fee for the municipal waste collected selectively is equal 7.80 zloty per person in municipalities, 6.10 zloty per person in the urban-rural communities and 5.40 zloty per person in the rural communities of the Świętokrzyskie Region. Summing up, there is 41 per cent discrepancy between the fee for the commingled and the selectively collected municipal waste on average. There is, however, a moderate correlation, estimated at the level of 0.36, between the difference in the fee and the number of people that decide to collect the municipal waste selectively. Only if the difference in the fee is below 2 zloty per person, people choose the commingled municipal waste collection. In all other cases, there is strong interest in the selective municipal waste collection, reaching even the level above 75 per cent of the population.

Considering three pillars of the sustainability, the environmental protection, economic effectiveness and social obligations, the new model of municipal waste management, being currently implemented in Poland, has its strengths and weaknesses, opportunities and threats. Aiming at the protection of the environment, a reduction of negative environmental impacts related with the municipal waste production and processing was recognized as the major strength of the new model. Consequently, 86 per cent of respondents expect further increase in the municipal waste re-use and recovery, in particular material recycling and bio-waste composting. At the same time, 45 per cent of local authorities from the Świętokrzyskie Region claim that there will be an ongoing decrease in

uncontrolled waste disposal since the whole population is covered by the mandatory municipal waste collection.

Due to limited experience with the new model of municipal waste management, it is difficult to assess its economic efficiency. Nevertheless, 24 per cent of respondents worry that there will be a progressive increase in the fee for the municipal waste collection, transportation and processing paid by residents. As the sector of municipal waste management in Poland is in the development stage, it requires large capital investments, among others for the adequate infrastructure for the municipal waste processing, and thus the dependence on external subsidies seems to be inevitable. It is only to be hoped that the revenues from the sale of secondary raw materials and energy will mitigate these costs (Bilitewski at al. 2010, p.87-109).

The greatest concern of the new model of municipal waste management is the fulfilment of social obligations. According to 22 per cent of respondents the introduction of the new model of municipal waste management will lead to the considerable consolidation of the waste collection and processing market. In the long-term, this may cause the phenomena of monopoly of the municipal waste market and, as a result, the collapse of many small family-owned companies or community run companies. At the same time, however, 20 per cent of local authorities from the Świętokrzyskie Region expect an employment growth in the sector of municipal waste management in Poland being a result of new investments.

5. Conclusions

The present research represents one of the first attempts to critically evaluate the new model of municipal waste management, being currently implemented in Poland, from the perspective of the Świętokrzyskie Region. The transition to the sustainable municipal waste management in Poland is possible, but it is very much dependent upon the manner of taking actions by local authorities. **The progressive increase in costs of the municipal waste management and the lack of relevant infrastructure for waste re-use and recycling are, at the moment, the greatest concerns of local authorities.** Due to limited experience with the new model of municipal waste management, it is strongly recommended to conduct the subsequent studies that ought to enable to explore the long-term capabilities of the above model in the fulfilment of the sustainability principle.

Summary

Transformation of the municipal waste management sector in Poland. A case study of the Świętokrzyskie Region

The article discusses the transformation of the municipal waste management sector in Poland, taking place during 2011 – 2013, upon the case study of the Świętokrzyskie Region. The pivotal assumptions of the new model of municipal waste management in Poland are: the change of the owner of municipal waste that became communities, the improvement of the municipal waste collection, transportation and processing, and finally regionalization that means the division of the territory of Poland into municipal waste management regions. The research conducted among local authorities of the Świętokrzyskie Region has revealed that the system solutions applied in the field of municipal waste management, being currently implemented in Poland, though they are not free from socio-economic threats, lead to the fulfilment of the waste hierarchy, including the increasing levels of recycling and the reduction of bio-waste disposal.

Keywords: *municipal waste, management, sustainability, Świętokrzyskie Region, Poland*

Streszczenie

Transformacja sektora gospodarki odpadami komunalnymi w Polsce. Studium przypadku województwa świętokrzyskiego

W artykule omówiono transformację sektora gospodarki odpadami komunalnymi w Polsce, odbywającą się w latach 2011-2013, na przykładzie województwa świętokrzyskiego. Do kluczowych założeń nowego modelu gospodarki odpadami komunalnymi w Polsce należą zmiana właściciela odpadów komunalnych, którym stały się gminy, poprawa efektywności gromadzenia, transportu i przetwarzania odpadów komunalnych, a wreszcie regionalizacja, która oznacza podział terytorium Polski na regiony gospodarki odpadami. Badania przeprowadzone wśród władz samorządowych województwa świętokrzyskiego wykazały, że zastosowane rozwiązania systemowe w zakresie gospodarki odpadami komunalnymi w Polsce, choć nie są one wolne od zagrożeń społeczno-ekonomicznych, prowadzą do wypełnienia hierarchii postępowania z odpadami, w tym wzrost poziomu recyklingu i zmniejszenia składowania bioodpadów.

Słowa kluczowe: odpady komunalne, zarządzanie, zrównoważony rozwój, województwo świętokrzyskie, Polska

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