



## Environmental Awareness and Knowledge of Municipal Waste Management Among Inhabitants of Eastern Mazovia

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**Abstract:** The problem of municipal waste management is one of the greatest challenges of the 21st century. Its solution requires the integrated involvement of central and local authorities as well as the public. For their actions to be fully effective, they must be accompanied by an increase in environmental awareness. The aim of the study was to assess the environmental awareness and knowledge of inhabitants of eastern Mazovia regarding municipal waste management. A survey study was carried out on a group of 262 individuals using a questionnaire. Analysis of the results showed that the surveyed inhabitants of eastern Mazovia were aware of problems associated with municipal waste management, but some of them were critical of the actions taken by central and municipal authorities to solve them. Their high level of environmental awareness and knowledge was evidenced by the fact that most of those surveyed were familiar with the principles of selective collection of municipal waste, including green and hazardous waste.

**Keywords:** municipal waste, environmental awareness, survey study



## **1. Introduction**

Waste is an integral part of the daily life and economic activity of human beings. The problem of safe waste management is one of the greatest challenges of the 21st century (Kłoś 2012, Deluga 2018). Waste management is subject to applicable laws, of which the most important in Poland are the Waste Act of 15 April 2021 (consolidated text, Journal of Laws of 2021, item 779) and the Act on maintaining cleanliness and order in municipalities of 13 September 1996, as amended (consolidated text, Journal of Laws of 2020, item 2361). The act on waste defines measures serving to protect the environment and human life and health by preventing and reducing the negative impact of waste production and management on the environment and human health, to limit the overall impact of utilization of resources, and to improve the efficiency of such utilization. The act on maintaining cleanliness and order in municipalities defines the tasks of the municipality and the obligations of property owners concerning the maintenance of cleanliness and order, conditions for carrying out activities associated with the collection of municipal waste from property owners and the management of this waste, and the conditions for granting authorization to entities providing services regulated by the act. The new waste management system and the Waste Act also impose on municipalities the obligation to build, operate and maintain municipal installations (Deluga 2018). According to Statistics Poland (GUS), 114.1 million tonnes of industrial waste was produced in Poland in 2019 (a decrease of 1% from the previous year). Its main sources, as in previous years, were mining and quarrying (63.7 million tonnes), industrial processing (27.2 million tonnes), and the generation and supply of electricity, gas, water vapour, and hot water (14.0 million tonnes). The dominant means of dealing with industrial waste produced in 2019 were recovery (48.9%) and disposal (42.9%). At the same time, 12.8 million tonnes of municipal waste was produced in Poland in 2019 (a 2.1% increase from 2018), of which only 3.97 million tonnes were collected selectively. The main source of municipal waste was households, which produced 84.5% of the total. An average of 332 kg of waste was collected per inhabitant, which was an increase of 7 kg from the previous year. A total of 7,087,000 tonnes (55.6%) of collected waste in 2019 was directed to recovery processes, including recycling – 3,192,100 tonnes (25%), biological treatment (composting or fermentation) – 1,153,200 tonnes (9%), and thermal treatment with energy recovery – 2,741,800 tonnes (21.5%), while 5,665,700 tonnes (44.4%) was designated for disposal, including thermal treatment without energy recovery – 178,600 tonnes (1.4%) and landfills – 5,487,200 tonnes (43%) (GUS 2019). The amount of waste produced is substantially influenced by demographic factors, standard of living, and environmental awareness (Spigarska 2013, Baran 2017, Przydatek 2020). Antczak (2019) indicated in order from the most influential to the least: population density; average salaries; share of indi-

viduals at working age in the general population; and the number of tourists. Kłos (2015), citing Kiełczewski, defines environmental awareness as a person's attitude towards and information and beliefs about the natural environment, as well as the value system guiding the individual's behaviour towards it. Ecological awareness determines the full understanding of the processes and phenomena occurring in the natural environment, which influences its shaping by society (Kobylko 2007, Sowa 2018). An increase in public environmental awareness, which is closely linked to environmental education, can accelerate efforts to improve the state of our environment (Pawul & Sobczyk 2011, Adamek & Ziernicka-Wojtaszek 2018). In Polish national CE action plan, recommended tasks and actions that should be taken by government and residents themselves are landfill remediation, use of selected municipal waste fractions for economic purposes, sharing products with co-users, waste recovery, remanufacturing products or components, virtual solutions in everyday life to reduce the amount of generated waste, or replacement of household appliances by items with a higher energy class (Smol et al. 2020). Also the actions in municipal waste management were indicated, such as changes in legislation, improvement in the waste management system, prevention of food waste, and education of residents about the importance of CE implementation in everyday life. Polish activity in selective waste collection and recovery should be intensified in the coming years, and the implemented legislation will serve a coherent waste economy policy and will influence selective waste collecting (Lewandowska & Szymańska 2019). These activities will contribute to directing municipal waste management towards the circular economy (Ciechelska 2018). In particular, attention should be paid to the fractions that have been weakly used so far, e.g. biodegradable wastes. The morphology of municipal waste varies depending on factors such as the type of buildings, the living standard of the inhabitants, and their habits (Rosolak & Gworek 2006, Baran 2017). Waste from urban areas contains more packaging and organic substances, while waste from rural areas has a larger proportion of ash and bulky waste. An innovative approach to municipal waste management must take into account economic and environmental aspects as well as local determinants (Baran 2017).

The aim of the study was to assess the environmental awareness and knowledge of inhabitants of eastern Mazovia regarding municipal waste management by analysing responses to a questionnaire.

## **2. Materials and methods**

The environmental awareness and knowledge of inhabitants of eastern Mazovia regarding municipal waste management was assessed by means of a survey study conducted using a questionnaire. The research was conducted from October 2019 to March 2020.

The questionnaire contained five demographic questions and 15 questions testing the respondents' awareness and knowledge. The demographic questions concerned the respondents' gender, age, living conditions, place of residence, and education. The remaining questions were grouped into those assessing the respondents' awareness of the issue and those assessing their knowledge. The survey was carried out on a random sample of 262 inhabitants of eastern Mazovia. Nearly 56% of the respondents were women. Young people up to 25 were represented in the highest numbers (85%), followed by people aged 26-40 (10%), 3% at the age of 40-60, and 2% at the age of over 60. Among those surveyed, 69% lived in single-family housing, and 31% in multi-family housing. 57% of the respondents are rural residents, including 10% of municipal villages, 12% live in cities with a population of up to 50,000, 24% are residents of cities with a population of 50,000 to 10,000, the rest are residents of cities with more than 10,000 inhabitants. Most of those surveyed, 72%, had a secondary level of education, 20% higher education, 7% vocational education and 1% primary education. Statistical analysis of the results was performed using the chi-square test.

The first four questions, aimed at assessing awareness of problems associated with municipal waste management, were as follows: 1) Is waste management a civilization problem? 2) and 3) Do central and local authorities handle waste management well? 4) Is waste sorting at your place of residence sufficiently precise?

### **3. Results**

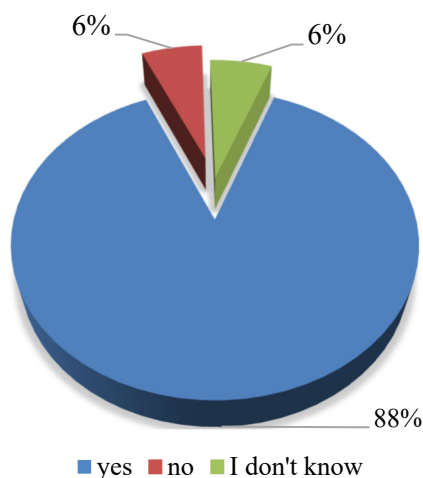
The research shows that as many as 88% of respondents considered waste management to be a civilization problem (Fig. 1), and 53% believed that central authorities do not handle it well (Fig. 2).

At the same time, 54% of those surveyed stated that the local government in their place of residence handles waste management well.

The statistical analysis showed that the living conditions of the respondents (Fig. 3) were significantly correlated ( $p = 0.03$ ) with the remaining answers to this question ('No' and 'I don't know').

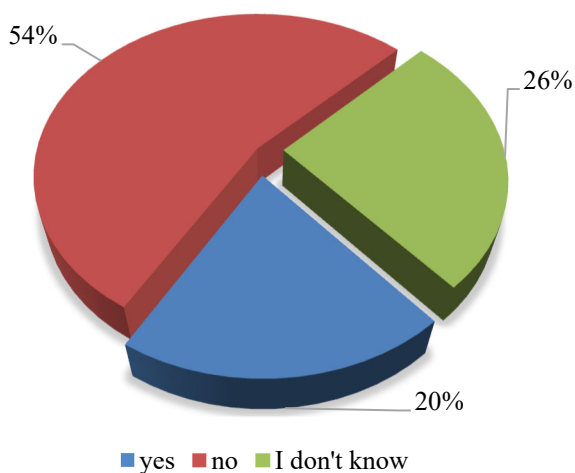
Over 52% of those surveyed stated that waste sorting in their place of residence was sufficiently precise (Fig. 4). The response to this question was significantly correlated with living conditions ( $p = 0.02$ ).

The next group of questions concerned knowledge of proper waste management. As many as 90% of respondents gave a negative response to the question 'Can hazardous waste be mixed with other waste?' (Fig. 5).



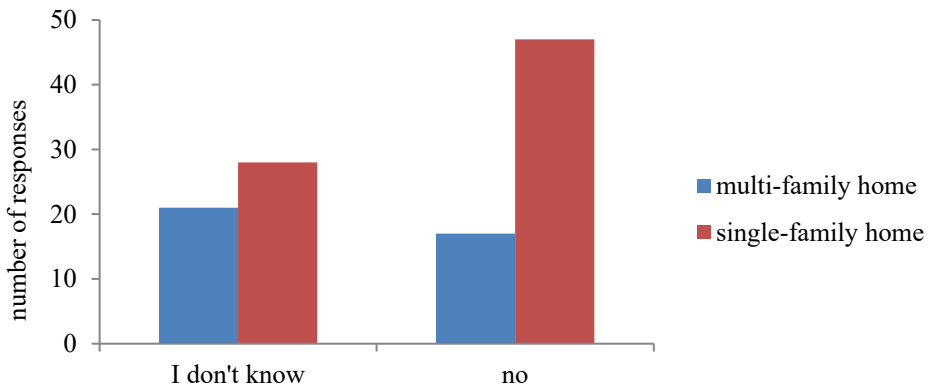
**Fig. 1.** Responses to the question regarding whether waste management is a civilization problem

Source: our own calculations based on the questionnaires



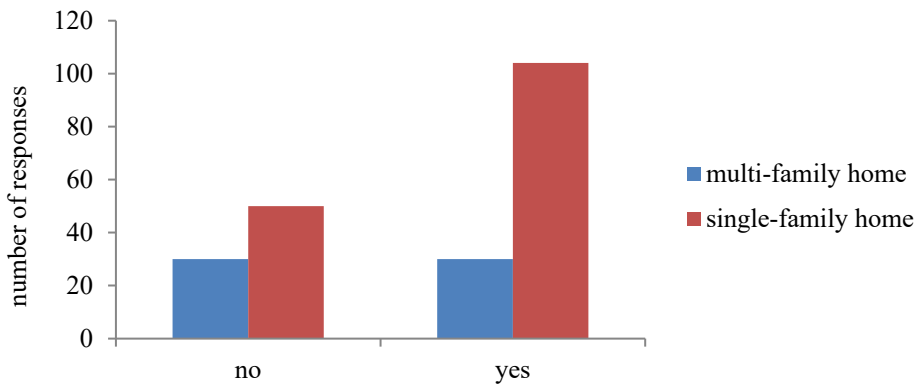
**Fig. 2.** Responses to the question regarding whether the Polish government handles waste management well

Source: our own calculations based on the questionnaires



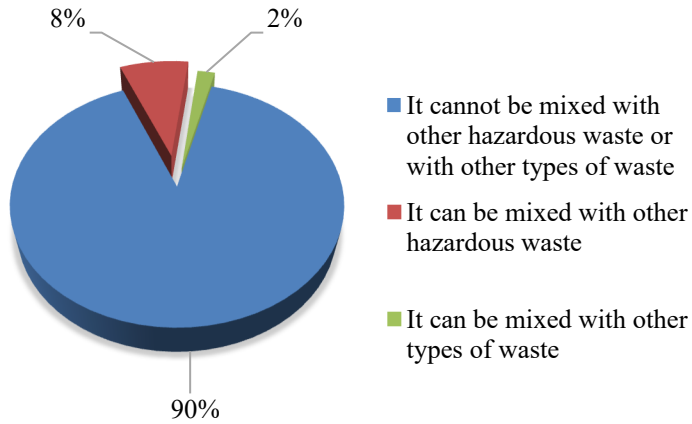
**Fig. 3.** Responses to the question regarding whether the local government in the respondent's place of residence handles waste management well

Source: our own calculations based on the questionnaires



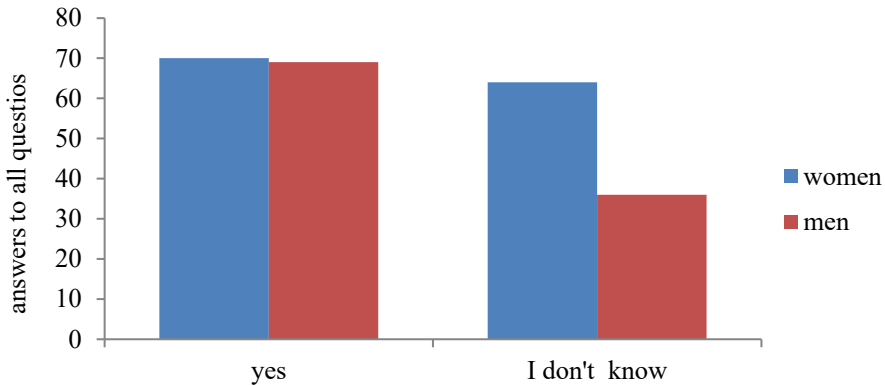
**Fig. 4.** Responses to the question regarding the precision of waste sorting in the respondents' place of residence

Source: our own calculations based on the questionnaires



**Fig. 5.** Responses to the question regarding proper handling of hazardous waste  
Source: our own calculations based on the questionnaires

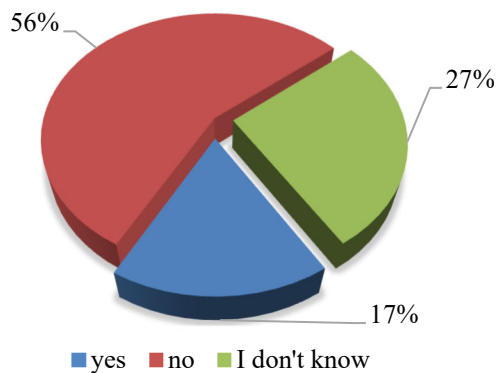
Furthermore, most people (53%) knew that the municipal council can charge lower rates for selective waste collection (Fig. 6). Nearly as many responded that they did not know. The answers were significantly associated with the gender of the respondents ( $p = 0.04$ ).



**Fig. 6.** Responses to the question regarding whether the municipal council can charge lower rates for selective waste collection  
Source: our own calculations based on the questionnaires

The next four questions assessed the respondents' knowledge on bins/bags designated for various types of sorted waste. Over 55% of respondents knew the purpose of blue bags, only a few gave an incorrect answer regarding yellow bags, and 24% did not know the purpose of green bags. In the case of white bags, 10% of respondents gave no answer.

In response to the question 'How can green waste be managed?' only 10% of respondents gave no answer, and a few indicated an incorrect answer, such as burning. The most common answers were that it can be composted and used as fertilizer and that it can be placed in a special bag for this type of waste. It is striking, however, that only 56% gave a negative response to the next question, 'Can green waste be burnt?', while as many as 17% stated that it can (Fig. 7).

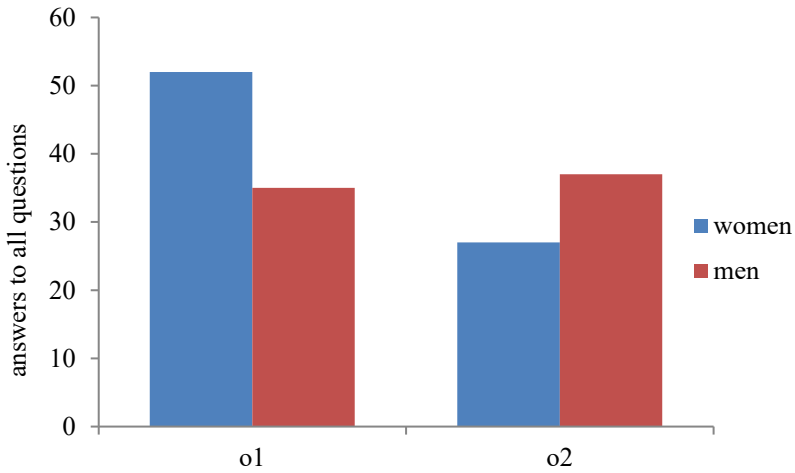


**Fig. 7.** Responses to the question regarding whether green waste can be burnt

Source: our own calculations based on the questionnaires

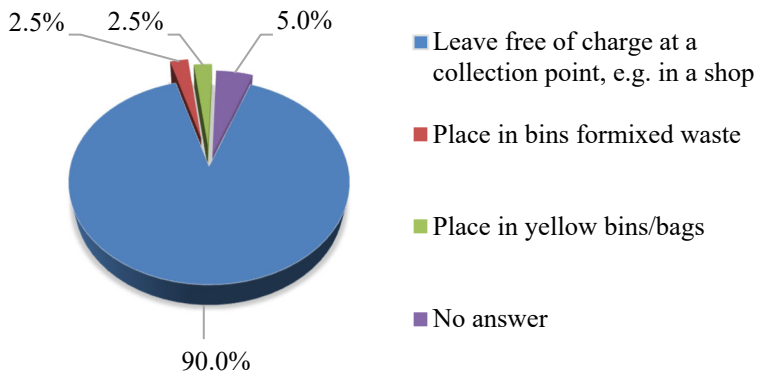
The next question dealt with the handling of waste electronics and home appliances. According to the respondents, waste electronics and home appliances (Fig. 8) can mainly be left in a specified place at a specified time (o1), handed over upon delivery of a replacement, or left in the shop when purchasing a replacement (o2). The responses depended significantly on the gender of the respondents ( $p = 0.03$ ). A few individuals suggested that this type of waste can be placed in yellow bags or bins.



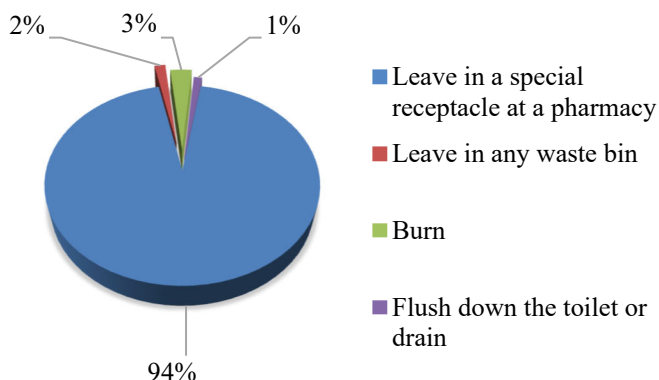


**Fig. 8.** Responses to the question (%) regarding waste electronics and home appliances  
Source: our own calculations based on the questionnaires

In response to the question regarding waste batteries and accumulators, most respondents (236 of 262 surveyed) answered that they can be left free of charge at a collection point, e.g. in a shop. Only 13 people suggested the use of yellow or black bags/bins for this purpose (Fig. 9).



**Fig. 9.** Responses to the question regarding batteries and accumulators  
Source: our own calculations based on the questionnaires



**Fig. 10.** Responses to the question regarding expired medications

Source: our own calculations based on the questionnaires

The last question in the questionnaire concerned the disposal of expired medicines. In this case, 94% of respondents were aware that they should be left in special containers located at the pharmacy (Fig. 10).

## 5. Discussion

Municipal waste is a mixture of various components, including packaging, green waste, biodegradable waste, and hazardous waste (Baran 2017). Safe management of municipal waste requires the involvement not only of central and local authorities, but of the public as well (Deluga 2018). For the integrated actions of government and the public to be fully effective, they must be accompanied by an increase in environmental awareness (Pawul & Sobczyk 2011, Alwaeli 2015, Lewandowska & Szymańska 2019). The basic components of ecological awareness are: ecological knowledge, ecological sensitivity and pro-ecological attitudes, i.e. actions taken to protect the natural environment (Kwiatk & Skiba 2017). According to Kłos (2015), the late 1980s and 1990s were a period of development of environmental awareness in Poland; on the one hand, Polish citizens were aware of the need for environmental protection, but on the other hand they were unable to draw practical conclusions from their knowledge and to apply it in practice. Environmental awareness has increased significantly in recent years, which has undoubtedly been influenced by both education and new legal regulations (Adamek & Ziernicka-Wojtaszek 2018, Deluga 2018). An important role in this transformation can be ascribed to an extensive social campaign implemented at every stage of education, concerning issues such as selective collection and management of waste and its impact on

the environment. Selective collection of waste is the first step in its reuse and in reducing the exploitation of natural resources.

The survey results indicated that most respondents (88%) were aware that waste management is a civilization problem, but only 25% positively assessed the performance of central authorities, while 54% had a favourable opinion of the performance of their local government. At the same time, 52% respondents stated that waste sorting in their place of residence was adequate. A survey conducted by Deluga (2018) among inhabitants of Koszalin found that only 10.43% of respondents considered the waste sorting system to be run efficiently (10.43%) or rationally (43.8%). Lewandowska & Szymańska (2019) shows that poor-quality collected municipal waste, which must first be sorted into renewable fractions, results from the lack of proper education of inhabitants.

Our study found that most of those surveyed knew which bags/bins were designated for various categories of sorted waste and were aware of methods for dealing with green waste, but few possessed knowledge on the potential exploitation of green waste for energy purposes. Golisz & Boryś (2020) draw attention to the possibility of utilizing waste from urban green areas in this manner. Similar results were obtained by Jakubus et al. (2016), who examined the knowledge of residents of Darłowo and Września in the field of proper municipal waste management.

The high level of environmental awareness and knowledge of inhabitants of eastern Mazovia regarding municipal waste management is also evidenced by the fact that over 90% of those surveyed knew that hazardous waste should not be mixed with other waste and were familiar with the principles governing the disposal of waste electronics and home appliances, waste batteries/accumulators, and expired medications. This is a good basis for implementing the principles of municipal waste management developed under the Polish CE Roadmap (Smol et al. 2020).

## **5. Conclusions**

To conclude, the surveyed inhabitants of eastern Mazovia are aware of problems associated with municipal waste management, but some of them are critical of the actions taken by central and municipal authorities to solve them. Most of those surveyed also possess knowledge of selective waste collection, but it is concerning that some of them did not know which bins/bags are meant for individual waste fractions. Most respondents knew the proper means of disposal of green waste and hazardous waste, including electronics and home appliances, batteries/accumulators, and expired medications.

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