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STUDIES ON THE POSSIBILITIES OF IMPROVING PLASTIC MANAGEMENT SERVICES

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ABSTRACT

Waste management is seen as a filter between the anthroposphere and the environment. Therefore, these substances must be eliminated from the products' life cycle and managed in a way that does not harm the environment or human health.

At the same time, into consideration it must be taken that a significant part of plastic products belongs to the group of long-life goods and accumulates in the anthroposphere for years. Even if some dangerous additives are forbidden or replaced with more ecological alternatives, years or decades after the manufactured goods have been produced for various application sectors, plastics that contain these kinds of substances appear in the waste streams of the above-mentioned long-life goods.

Therefore, the knowledge regarding the plastic waste quantity, the level of information of the population, as well as the citizens' attitude towards selective waste management are important aspects for the efficient design of the future action plan for plastic waste management.

This study tries to analyse the attitudes that the citizens of the "Plantelor" neighbourhood of Braila Municipality have regarding the environment and their ecological behaviour.

At the same time, we propose to obtain a perspective upon the citizen's knowledge from that area regarding the actual environmental problems and the way in which they adopt sustainable behaviours in a circular economy in order to issue a warning. This is necessary in order to create some educational programs in partnership with public institutions and to be informed about the 3R philosophy.

KEYWORDS: plastic recycling, circular economy, waste management, pollution risks, action plan

1. Introduction

In the last 30 years, plastic materials became one of the most frequently used materials for the manufacturing of a wide range of products that are used in different industrial sectors. They are usually used in the packaging industry, for manufacturing automobile parts or electronics, but also for furniture and sports equipment [1-4].

Their characteristics, like durability, strength, lightness and low price, contributed to the replacement of many products made out of traditional materials, like wood, but it also allowed creating various innovative products [1-4].

As a consequence of continuous consumption that is also rising due to the pandemic context, the increasing amounts of generated waste have drawn the attention of several environmental institutions or associations at national and international level [5-8]. Taking into consideration that the consumption per citizen is constantly increasing, the necessity of developing some population awareness campaigns regarding the environmental benefits brought by the selective collection of waste is imperative [5-8].

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Plastic waste, produced mainly out of products of petroleum processing, that is from non-renewable resources, is perceived as valuable from the point of view of material recovery [5-9].

Generally, recycling is the most used solution for solving plastic waste problems [5-9]. However, when recycling is not the most feasible solution due to its high thermal power, plastic waste is seen as a potential alternative energy source of interest [5-9].

Moreover, because plastic decomposes very slowly, it takes a lot of space in landfills to dispose of it. All of these aspects contribute to debates regarding the most efficient treatment of this waste fraction from an environmental and economic point of view [1-8].

Another important problem related to plastic products is the fact that various auxiliary substances and additives are used during polymer production and product manufacturing. [5, 6].

Among them, there are stabilizers, antioxidants, flame retardants, etc. Some of them contain or contained dangerous substances, for example, toxic heavy metals or toxic organic compounds that may cause endocrine disruption among consumers [5, 6].

After adhering to the European Union (EU), Romania had to adapt its legal regulations to EU standards, including those of environmental policy. The need to implement these standards, among others, the Directive of Packaging and Waste Packaging [10], to the Romanian law, has increased the awareness of decision-makers in Romania regarding the issue of planning and adequate development of waste management systems [9].

The recovery of material and energy from waste is seen as feasible solutions to the problem of the increasing amounts of waste, also perceived as a step towards sustainable development in modern societies [9].

However, the problems of using some dangerous substances in production and manufacturing processes, the limits regarding collecting and the quality of waste contribute to the complexity of designing an adequate managing process of plastic material waste [9].

Romania is still at the beginning of developing its own management system. Therefore, the analysis of the current situation in eliminating waste, estimating the waste quantity generated and investigating environmental problems and resource conservation issues related to plastic waste management is important in this regard [3].

Industrialization and the rise of the living standard have brought impressive amounts of waste that, unfortunately, affect the environment through climate change, have a negative impact on the fauna and flora, and last but not least, upon our health [3].

By decomposition, waste from landfills releases methane, a gas that is over 80 times stronger than carbon dioxide and when they are illegally burnt, they release high levels of carbon dioxide into the atmosphere. Both are greenhouse gases that warm the planet and change the climate [3].

It was observed that open landfills release 91% of all methane emissions from landfills and about 40% of the world's waste is burned in this way. Moreover, these gases are unseen long-term dangers for the population that cause diseases, like asthma, cancer, cardiovascular diseases, genetic disorders in new-borns, low birth weight, infectious diseases, etc [3, 5, 6].

Last but not least, due to ingesting plastic and garbage, many species of animals, birds and marine mammals are affected. Their stomach is not capable of digesting the ingested objects [3, 5-6]. The United States Environmental Protection Agency calculated that in 2017 the total municipal waste generated was 267.8 million tons. This figure increased by 5.7 million compared to 2015, while in 2019, in the European Union, 225 million tons of municipal waste were generated, that is 502 kg per person, slightly more than in 2018 (495 kg). Per capita, Denmark (844 kg) was the country that generated the most important amount of municipal waste in 2019, while Romania ranked last (280 kg) [3].

In the EU, environmental efforts have been intensified by implementing initiatives that may lead to a climate neutral Europe by 2050. Particular attention is paid to the circular economy that aims to reduce waste and ultimately reduce its impact on the environment, production and consumption, thus bringing benefits to both society and people [11].

Even if the circular economy, the latest research subject both for theoreticians and for practitioners, has different definitions, the most used one refers to reduction, reuse and recycling activities for economic prosperity and environmental quality [11].

Circular economy transforms goods and products that are no longer used in future resources for other people, thus, minimizing waste [12], and having environmental, economic and social implications for both the industry and consumers [8].

In March 2022, the European Commission presented a new Action Plan to support Circular Economy that focuses on preventing and managing waste and its purpose is to stimulate economic growth and competitiveness, as well as maintain the leading position of the Union in this field [3].

The fact is that the base policy for good waste management should be centered on the 3R principle (reduce, reuse and recycle). Attention should be paid to reducing the amount of waste before it is generated and then trying to reuse it or, if this is not possible, selectively collect it for recycling [3].

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Things are not looking too good for Romania. In May 2020, our country was threatened with the beginning of an infringement procedure by the European Commission because it did not make any progress since 2014 regarding municipal waste management. It did not comply with the decision of the Court of Justice of October 18, 2018, to close 48 illegal landfills, besides the original 68, in important cities of Romania, that represent real dangers to the population's health [3].

According to the Report of the European Commission of 2022, Romania is still struggling with waste management, having low municipal waste recycling (14%) and high waste deposit rates (70%). At the moment, Romania recycles only 15% of the collected waste, with a target of 50%, which is highly unlikely to be achieved by 2050 [3].

According to the Revised Framework Directive on Waste, that established more ambitious recycling objectives until 2035, the authorities must assure that the quantity of municipal waste from landfills is reduced to 10% or less until 2035 [3].

Measures that could lead to an improvement of the actual situation are absolutely necessary, and for this to happen people should be aware of the impact that waste can have on the environment and also the importance of reducing the waste quantity that is generated and the benefits of reusing and recycling it. It was reported that in the top European pollution-related deaths, Romania is in third place, with 19%, after Bosnia Herzegovina and Albania [3].

The transition to a circular economy depends on the way in which people and organizations adopt values and behaviours that aim to reach the "zero waste" objective and to make consumers aware of the environment, as well as the importance of sustainability at local, national and international levels [3].

But to reach this element, these practices must be known so that people understand the way in which their behavior damages the environment. The starting point for achieving education in the circular economy is represented by environmental education initiatives that ensure the development of knowledge, values and attitudes that lead to actions in this sense [3].

In order to protect the environment, reduce pollution and save natural resources, it is necessary to reduce, reuse and recycle waste. These actions are also known as the 3R, Reduce, Reuse, and Recycle, and from a simple marketing motto, it became a lifestyle for many people [3]. According to the Web of Science database, a search on the topic "plastic recycling management" presents 1921 publications between 1990-2022 with a significant increase in articles between 2017-2022 (1305 publications) [13]. However, for the topic "selective behaviour of plastic recycling", 25 publications between 2001-2022 resulted [13]. In Romania, 3 case studies were published regarding the topic of selective waste collection [3, 14, 15]. The purpose of this study is to increase public understanding and shape the community's perceptions of the dangers of plastic pollution and available solutions. Thereby, giving more power to people and organizations to take action.

Everyday plastic waste has a negative impact on the ecosystem, habitats, human health and sustainable development in the entire world. Despite the vast scale of the problem, the general public and other important stakeholders have not been adequately involved and educated about how they can become part of the solution [3].

Mass public awareness can help the way in which plastic is viewed, used and managed as waste. Education and involvement are part of the strategic action plan of the city and can include consumer awareness campaigns, business awareness campaigns, documentaries, school initiatives and clean-up activities among others [3].

The purpose is to increase the public's understanding and to form the community's perceptions regarding the dangers of plastic pollution and the solutions available, in order to give power to take action to more organizations and people. Actions community can include changes in purchasing habits and individual attitudes, increased recycling behavior and sorting, responsible practices and business processes.

2. Materials and Methods

2.1. Description of the selected location

Braila, as a county, is located in a plain area, in the South-East of Romania. It occupies small portions of Salcioara and Buzau Plain and part of Baraganul Plain and a part of the inferior meadow of Siret. To the East, Braila includes the Great Braila Island and it is a county that represents 2% of the entire country's surface. Braila's neighbours are Galati to the North, Tulcea to the East, Ialomita to the South and Buzau to the West [16]. The Braila municipality is formed of 41 neighbourhoods and it has a total number of residents of 201 414 [17, 18].

"Plantelor" neighbourhood is located in the East part of Braila and it is the last set of blocks before the city's exit to the Municipality of Galati. It is delimited in the North by Str. Plantelor, in the East by Str. Abatorului, in the South by Blvd. Dorobantilor and to the West by the Str. Calea Galati. It is formed of 9 blocks and 6 houses (1022 residents).

According to Braila's County Waste Management Plan 2020-2025 (CWMP), in Braila, the

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economic operators who carry out the activity of collecting household waste and similar to them are: AD ECO, BRAI CATA and RER ECOLOGIC SERVICE [16].

After collecting, the waste is deposited within the municipality of Braila, at the Muchea deposit. TRACON SRL is the operator that administrates this deposit until 2028. The capacity of this deposit is 2,130,710 m^3 with a number of 4 storage cells. The current occupied capacity is 1.033.857 m^3. Separate collection of usable fractions (paper, cardboard, plastic, metal) is done at the Vadeni sorting station with a projected capacity of 30,000 t/year and the recovery is done at Eco Metal Recycling SRL Galati [16].

In Braila, operators have set up platforms for separate collection of recyclable waste, equipped with 58 bell containers of 2.5 m^3 / 278 containers of 1.1 m^3 or 116 big/bag pens of 1.5 m^3, which are insufficient compared to the total number of inhabitants. This is basically where the problem starts: the fact that most of the time the population does not selectively collect. According to the CWMP, the municipal waste generation index is permanently increasing. If in 2014 the index was 280 kg/inhabitant x year, in 2018 it increased to 382 kg/inhabitant x year. Another problem is the amount of household waste collected separately. If in 2014 the amount was 3080 kg/inhabitant x year, in 2018 it increased very little to 3,299 kg/inhabitant x year [16]. According to the 2020 European Commission's Report, Romania still struggles with waste management and it has low municipal waste recycling (14%) and high landfill rates (70%). At the moment, Romania recycles only 15% of collected waste, with a target of 50% that is highly unlikely to be achieved by 2050 [3].

2.2. Description of the method

In order to carry out the research and collect data, a questionnaire was applied, in order to observe the attitude of citizens regarding the selective management of waste. The target population was the citizens that live in Plantelor neighbourhood of Braila city. The data was gathered between May-July 2022. Initially, a classical approach was attempted of distributing questionnaires among the population, but without any success, because people are mostly reserved and politely decline saying that they do not have time to answer our questions. As a result of the citizens' attitude and following the premise that people spend quite a lot of time in the online environment, I made this questionnaire with the help of https://docs.google.com/. The questionnaire was anonymous and its average completion time was a maximum of 15 minutes. Completing the questionnaire was voluntary and citizens could withdraw at any time from completing it. Also, no rewards were given for this activity. For reasons of anonymity and confidentiality, the respondents' e-mail addresses or other personal data were not collected. Plantelor neighbourhood is quite small and it has approximately 1022 inhabitants. The total number of respondents was 100 people.

The questionnaire was designed with a number of 17 questions in order to reveal the citizens' knowledge and their behavior regarding the selective collection, if they are involved in green campaigns and if they know the environmental benefits brought by selective collection.

3. Results and discussion

The results of the answers given by the citizens of Plantelor neighbourhood (Braila Municipality) are presented in Figures 1 to 17. The first questions from the questionnaire were to find the person's sex, age and level of studies of the people who completed this questionnaire. In Figure 1 (a-c), the charts are shown in the form of bars with the distribution of the answer and their percentage.

From Figure 1(a), it can be observed that people who have completed this questionnaire are 63% women and 37% men. From the analysis of Figure 1(b), it appears that 53% of the surveyed people belong to the age category of 20-40 years, 41% to the category of 40-60 years, 4% to the < 20 years category and 2% to the > 60 years category. From Figure 1(c), it can be observed that most respondents have higher studies (60.8%), 34.2% secondary studies and 5% have graduated vocational school. The second question of the questionnaire was designed to find out if the population understands what selective collection means (Figure 2).

From Figure 2, it can be observed that 51% of the questioned persons answered that the meaning is to protect the environment, 19% answered that it means recycling different types of materials, 18% answered "to contribute to the health of the population", 10% to make a civic action for the area where they live and 2% that they "do not know".

The third question is likely to find out if the population knows the meaning of the 3Rs (Reuse, Recycle, Reduce).

From the analysis of Figure 3, it turns out that 52% of the questioned people know the meaning of the 3R, 38% do not know and 10% have never heard of this terminology.

The fourth question of the questionnaire is designed to find out which are the fractions that citizens selectively collect most often (Figure 4).

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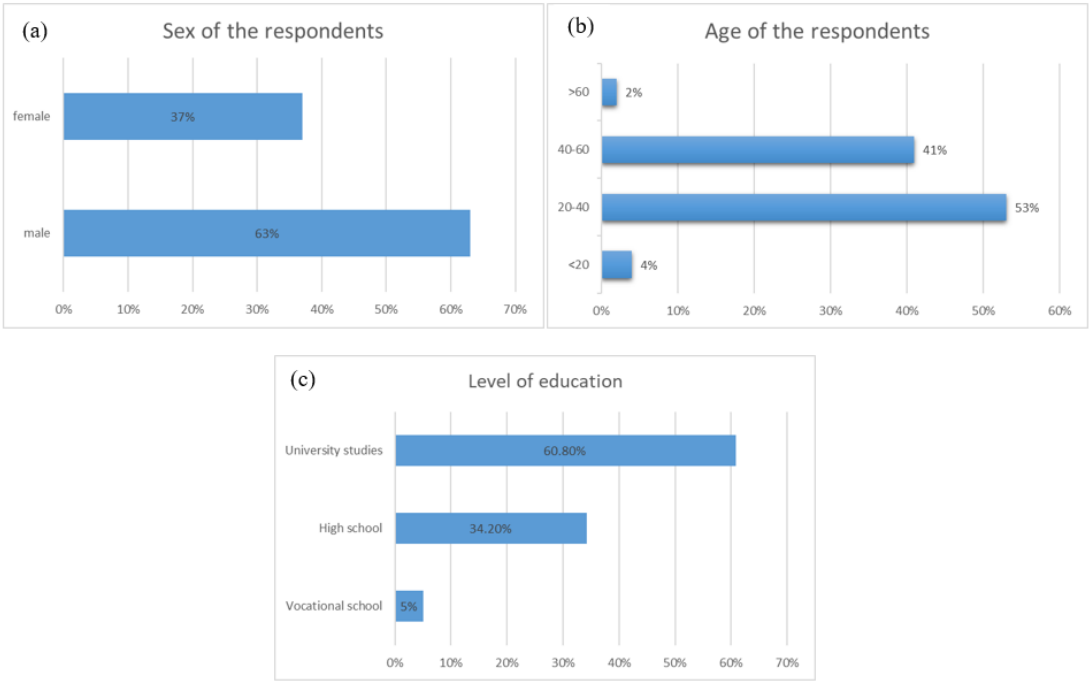

Fig. 1. *Distribution of answers for a) respondents' gender, b) respondents' age, and c) level of education*

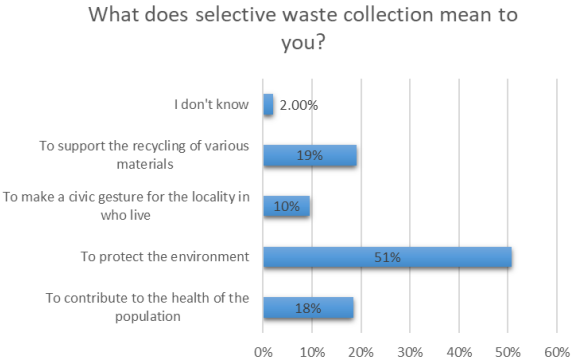

Fig. 2. *Distribution of answers for "What does selective waste collection mean to you?"*

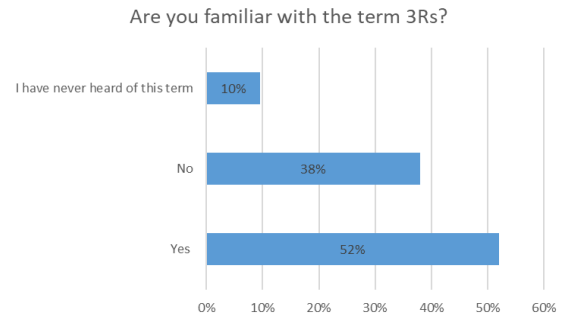

Fig. 3. *Distribution of answers for "knowing the meaning of the 3R terminology (Reuse, Recycle, Reduce)?"*

Figure 4 shows that the fraction most often collected is the fraction of plastic materials with a percentage of 50%, followed by paper, glass, organic waste and metal.

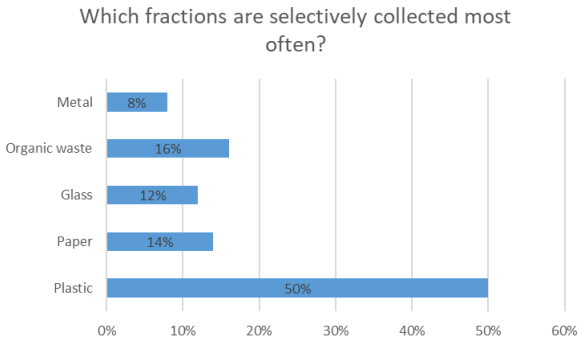

Fig. 4. *Distribution of answers for "Which fraction are selectively collected most often?"*

The fifth question is to designed to find at what time interval they do selective collection (Figure 5).

The frequency that they do this selective collection is 2-3 times per week with a rate of 41%, but it is worrying that 14% of the respondents admit that they never do this action. The sixth question is to find the people's reason who answered "Never" to question number 5 (Figure 6).

Figure 6 shows that 16% have answered "that they are not interested in this aspect", 38% answered that "they do not have where to do this thing", 29%

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that "they do not have the necessary information for this collecting system" and 17% have answered that there are no necessary conditions for selective collection at any time. These answers are worrying but they reflect reality. As mentioned before in the materials and methods section of this article, the number of bins is insufficient and the distance between houses and the collecting points is too long, thus making citizens give up the selective collection.

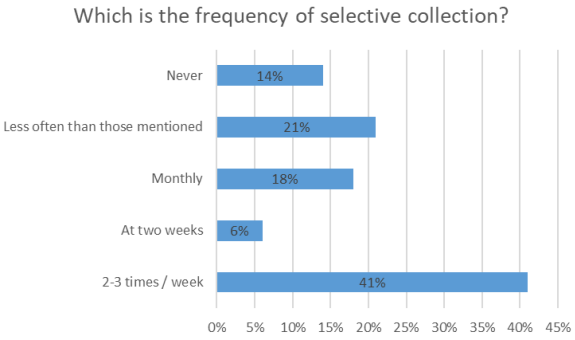

Fig. 5. *Distribution of answers for "Frequency of selective collection?"*

The seventh question is meant to clarify which of the people are in charge of waste disposal in their homes (Figure 7).

Figure 7 points out the fact that 59% of respondents say that the wife is the one who takes care of this matter, taking into consideration the fact that the highest frequency of completing the questionnaire was female. We can understand this because they are more concerned with household chores than the opposite sex.

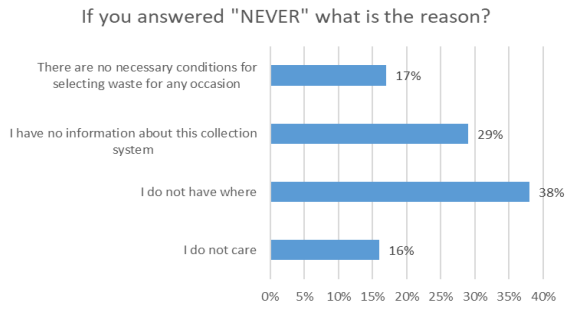

Fig. 6. *Distribution of answers for "The reason for non-selective collection?"*

The eighth question is about the fact that citizens are interested to find out what happens with their waste after it has been collected from them. This is quite an important question because knowing the route of waste makes the population aware of environmental risks and benefits, as well as appreciating the people who often deal with sorting them manually.

As we can correlate certain answers presented in Figure 8, this question confirms the population's lack of interest towards this problem. Henceforth, the high number of people who answered that they "never" do selective collection.

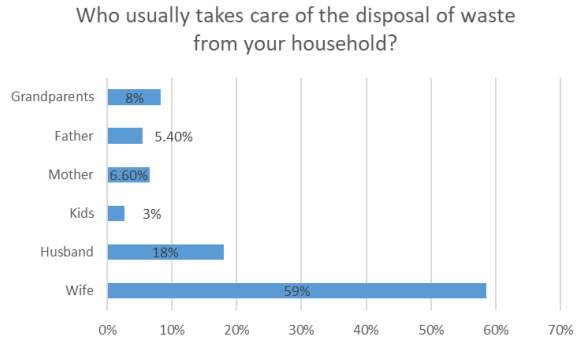

Fig. 7. *Distribution of answers for "Who takes care of waste disposal most often?"*

The ninth question is to find out if citizens know the containers' colour code (Figure 9).

Figure 9 shows that 51% of respondents have knowledge about the significance of each colour and know what type of waste must be thrown in that container. 16% answered that they do not know the colour code and 33% answered that they know some of them.

The tenth question was conceived with the purpose to find out if citizens from the chosen area for this study are aware of the risks of non-selective collection.

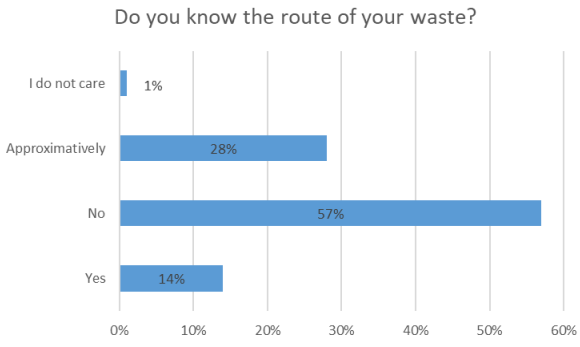

Fig. 8. *Distribution of answers for "Do you know the route of your waste?"*

Figure 10 shows that 86% of respondents answered with "yes", 13% answered with "I do not know" and 1% with no.

Until this question, we can conclude that most of the respondents to this questionnaire were females and the age category is between 20-40 years, relatively young persons, with higher education. Most people know what selective collection means, they often do it for many types of materials, but they do

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not know what happens to their waste after it has been sorted. Special attention must be given to people who do not know about this system. After the analysis of this questionnaire, 14% of respondents answered that they never did selective collection. The situation in the field (waste thrown near the bins, fractions thrown into other types of containers than the ones they should be, etc.) is much more worrying because the number of those who do not do this thing is greater.

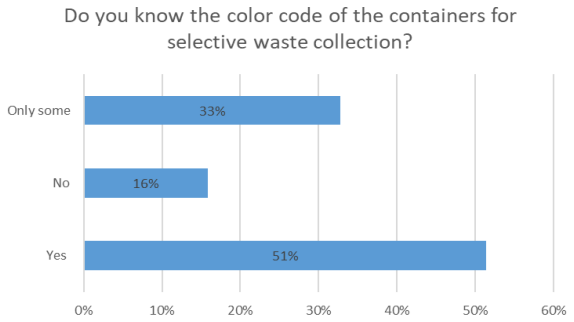

Fig. 9. *Distribution of answers for "Do you know the colour code of the containers for selective waste collection?"*

Question number 11 asked under what conditions they would accept to do selective collection. The distribution of the answers is presented in Figure 11.

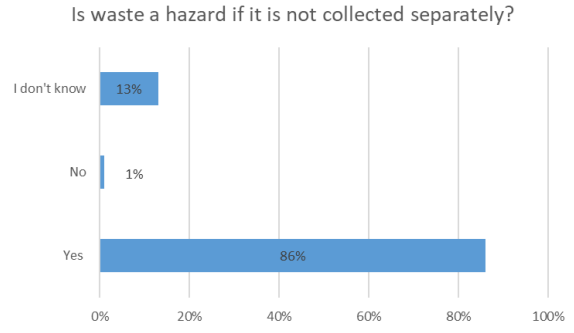

Fig. 10. *Distribution of answers for "Is waste a hazard if it is not collected separately?"*

From the analysis of Figure 11, it appears that 45% of the questioned people answered: "if there were suitable spaces arranged". This is an actual problem, as mentioned in the materials and method section. The containers distributed at the level of Braila municipality for selective collection are not enough in relation to the total number of inhabitants. A proportion of 29% answered that "if there were more collection points near their home" and a proportion of 16% answered, "if there were information campaigns on what happens after the recycled waste is collected". Is it worth noting that to this question 6% of respondents said that being penalized by an additional tax would lead them to do so and 5% answered that they would do so if recycling also had a direct social purpose.

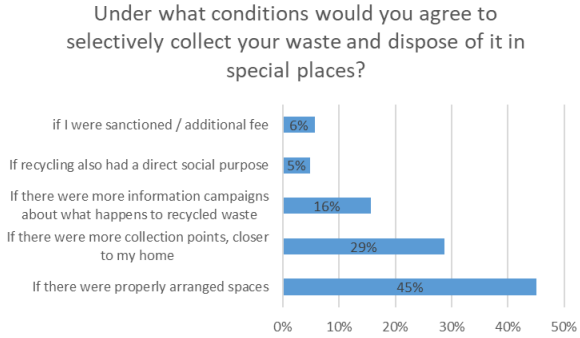

Fig. 11. *Distribution of answers for "Under what conditions would you agree to selectively collect your waste and dispose of it in special places?"*

Asked if they know the environmental benefits brought by selective collection (Figure 12), people answered 54% with "yes", 33% with "approximately" and 13% with "no".

When asked about the sources from where they found about the environmental benefits brought by selective collection (Figure 13), 45% of the respondents said the main source was the internet.

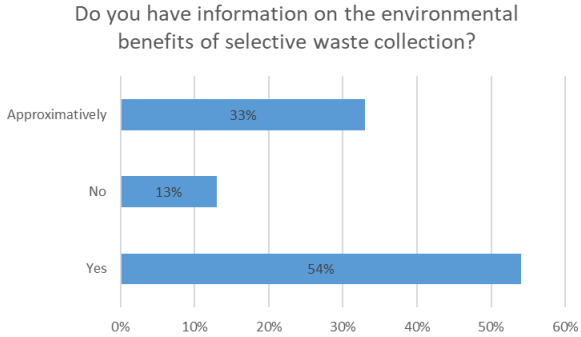

Fig. 12. *Distribution of answers for "Do you have information on the environmental benefits of selective waste collection?"*

Question fourteen (Figure 14) regarding in what way the authorities should determine the population to selectively collect, 32% answered that more bins should be available for the inhabitants, 31% answered more information programs, 19% said that those who do not selectively collect should be fined and 14% consider that the school, church and NGOs should do more information campaigns. 3% of respondents answered with "I do not know what authorities should

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do" and 1% consider that all answers should be applied in order to determine citizens to selectively collect.

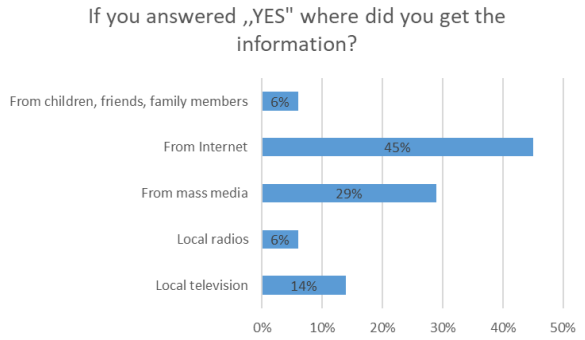

Fig. 13. *Distribution of answers for "Where did they receive information about the benefits of selective collection?"*

The statistics for the answer to question number fifteen "Are you involved in greening activities?" are given in Figure 15.

From Figure 15, it can be seen that around 55% answered that they are little involved, 22% with "no", 22 with "yes" and 1% with "I do not care". The lack of involvement from the authorities, the neglect of the citizens and other considerations only make us take a step back in the fight against our country's poor waste management and how to dispose of it. The fact is that all these actions will be reflected in the increase in product prices and sanitation fees.

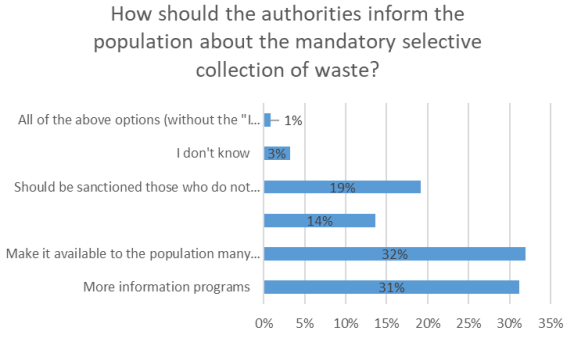

Fig. 14. *Distribution of answers for "How should the authorities inform the population about the mandatory selective collection of waste?"*

For question number 16: "From which source of information would you prefer to find out more information about the environmental projects carried out by the authorities" (Figure 16), 10% answered that they would prefer local television stations and 40% that they prefer the Internet as a communication method.

Question 17: "Would you agree that the waste collection tax be calculated according to the amount of waste you generate?" (Figure 17).

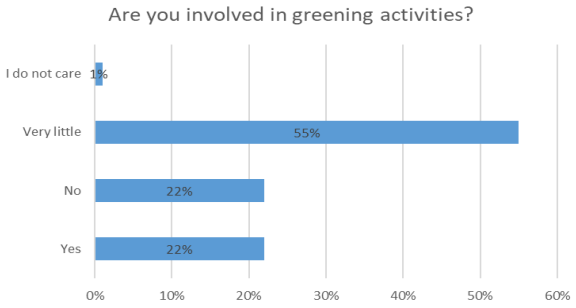

Fig. 15. *Distribution of answers for "Are you involved in greening activities?"*

Like many EU countries that have the "polluter pays" principle, this question is meant to find the citizens' opinion on this principle. From the statistical analysis of the answers presented in Figure 17, it can be seen that 54% of respondents agree with the increase of the waste collection tax according to the amount of waste they generate, 29% do not agree and 17% answered: "I do not know".

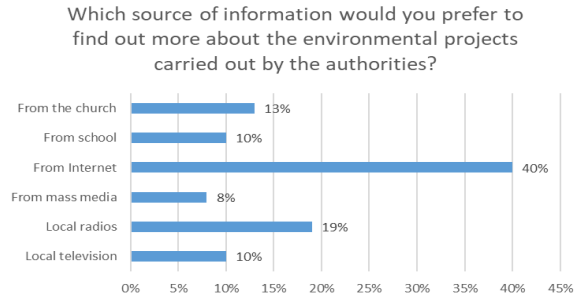

Fig. 16. *Distribution of answers for "From which source of information would you prefer to find out more about the environmental projects carried out by the authorities?"*

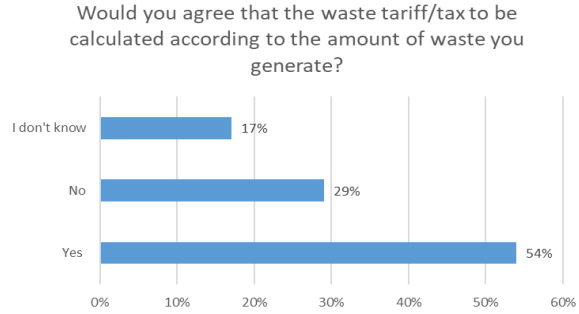

Fig. 17. *Distribution of answers for "Would you agree that the waste tariff/tax be calculated according to the amount of waste you generate?"*

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We consider that by applying this principle, citizens would be more aware/pay more attention to the amount of waste that they generate/to the way of collecting, as long as their incomes are affected.

4. Conclusions

Research on global production of plastic materials and environmental pollution showed that plastic waste is a major environmental problem. The effect of plastic waste on marine organisms, people and the environment are of public concern and calls for the need to save ecosystems and the lives within them. Despite the fact that plastic materials are used in daily life, toxic chemical substances used in production must be carefully monitored in order to ensure environmental and health safety. Reducing the community's exposure to toxic substances from plastic waste will increase the chances of a clean environment and a healthy society. There is an urgent need for government agencies and health authorities to adopt and apply environmental laws that will monitor the production, usage and elimination of plastic materials. Moreover, some harmful chemical constituents used in the production of plastics (for example phthalates, BPA, etc.) must be forbidden in consumer goods and in plastic products that are in direct contact with food, beverages and children.

From the statistical analysis of the study case, we can conclude that most of the questionnaire respondents are females. Even though the study identified gender differences through the fact that women are more aware and involved in environmental protection activities, regardless of gender, the young generation should harness their knowledge in this field and adopt these behaviours that may lead to a sustainable future. The age category is between 20-40 years, relatively young people, with higher education. Most people know what selective collection means and they usually do it for several types of materials, but they do not know what happens to their waste after it has been sorted.

Special attention must be given to people who do not have knowledge about this system. From the analysis of this questionnaire, 14% of people answered that they never do selective collection.

The situation in the field (waste thrown near the bins, fractions thrown into other types of containers than the ones they should be, etc.) is much more worrying because the number of those who do not do this thing is greater.

Although a large part of the population does selective collection only for certain fractions, it can be observed that the lack of information regarding what happens with their waste after it is collected, makes the citizens' attitude hostile towards greening activities.

For the question of how they would prefer to be informed regarding the environmental benefits of selective collection and the obligation of selective collection, respondents consider that the involvement of local authorities should be by television, Internet, churches, schools and installing more available bins for the citizens would help and improve the system.

Moreover, by raising awareness and assessing the impact of our behaviours towards the environment through education, by adopting a sustainable lifestyle, production and consumption practices, we will be able to reduce the pressure on the planet's resources.

Taking into consideration that Romania still has a lot of problems in the field of environmental protection, it is possible that this solution provided by blockchain technology, which is still in full development, will help solve these problems quickly. This technology has the potential to change social behaviours, involving more interested parties, especially citizens, and can stimulate the waste management process and lead to the ultimate goal of "zero pollution" cities.

We consider that in order to fight and reduce the persistent environmental pollution with plastic materials, we need tougher laws that must be respected and applied accordingly. This should include the need for a global convention on plastic pollution that forces plastic manufacturers to declare all the ingredients in their products and warn consumers about the potential health effects of these constituents.

Another measure would be adequate management of plastic waste through well implemented environmental management. Moreover, an emphasis should be put on educational and public awareness campaigns. And last but not least, the use of bioplastic as an alternative.

Even though the study offers some answers regarding the environmental problems that Romania faces, it is important to identify the people responsible for solving them. There are also limitations of the undertaken study, taking into consideration that the perspective of only a part of the population was questioned.

Therefore, in order to fix the deficiencies, the first solution to the waste problem is to organize awareness and educational campaigns for the population. By providing theoretical knowledge and by organizing extracurricular activities, universities, high schools, kindergartens, churches can contribute to cultivate environmentally responsible mentalities that will lead to the adoption of sustainable habits.

From this point of view, it would be necessary to carry out additional studies on the questioning of more citizens from several geographical areas and on different categories of the public. There are other variables that can influence attitudes towards

environmental protection and reuse and recycling behaviours (background, place of origin, how the legislation in the field is applied, living standard, economic status, local culture and beliefs, details about living conditions, etc.) and that can be inserted. This objective could be realized by performing subsequent qualitative and quantitative analyses that will surely lead to a better understanding of the citizens' behavior.

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