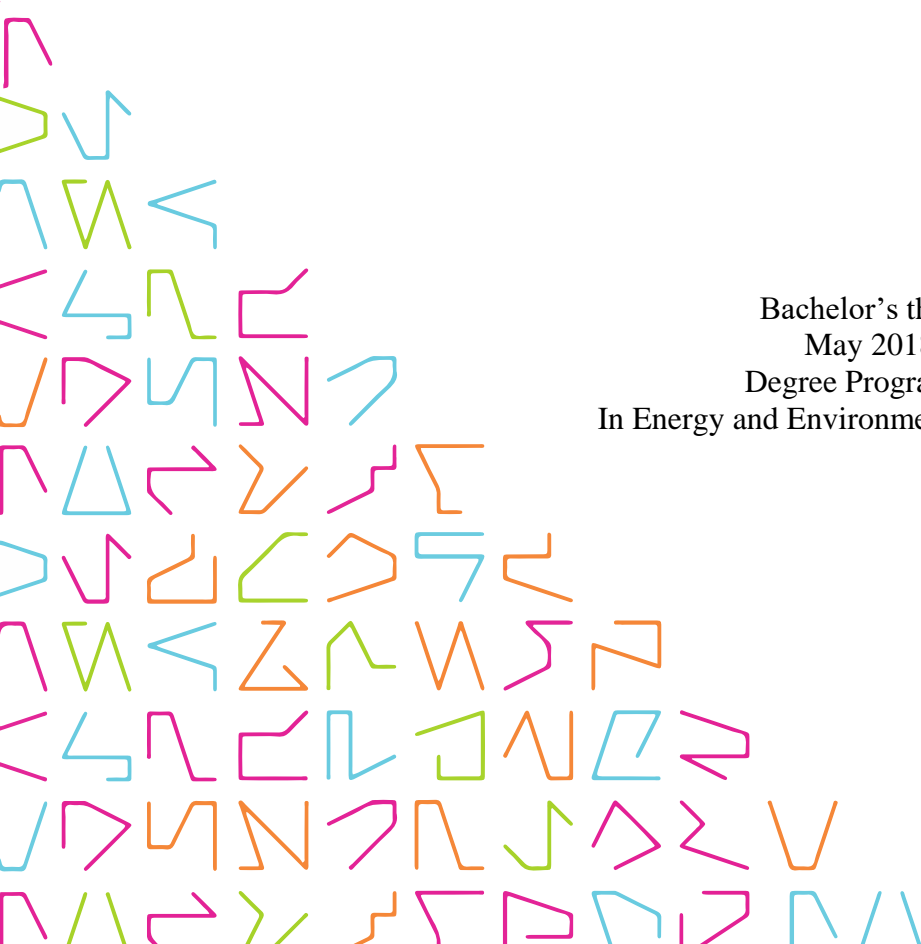


**Adaptation of Finnish practices for
plastic bottles recycling in
Saint-Petersburg, Russia**

Daria Popova

Bachelor's thesis
May 2018
Degree Programme
In Energy and Environmental Engineering



ABSTRACT

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Adaptation of Finnish Practices for Plastic Bottles Recycling in Saint-Petersburg

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In Saint-Petersburg there is no developed recycling system while waste is accumulated on landfills. Such approach does not make use of potential energy or raw material and also occupies much space. Finnish waste handling system, on the other hand, has already proved its efficiency and thus can be taken as a benchmark. The topic of interest is drinking plastic bottles and their recycling opportunities in the Russian city.

The purpose of the work was to collect data about the real recycling situation in Saint-Petersburg. The thesis will be helpful for people who are interested in the subject and who want to develop in this sphere.

The thesis is based on both research and a survey, with sample size of 120 responders. Questions concerned several topics, and through them the environmental attitude of citizens of Saint-Petersburg were investigated, their vision of the current situation and the future of plastic bottles recycling. Also Russian and Finnish waste handling systems were presented. Possible motivators and preferable environmental education were important topics to discover. The final part consists of suggestions for recycling implementation in the city basing on survey results and Finnish approach to the problem.

Saint-Petersburg citizens demonstrated their environmental concern and will for improvement. However, quite many are frustrated. Absence of common recycling system is the biggest obstacle. Besides, it should be convenient for people to separate and utilize plastic bottles. The possible solutions are either creation of the deposit based system (similar to the Finnish one) or installation of the waste containers in the close proximity.

In overall, there is a big prospective for plastic bottles handling development. The majority of responders are supporting circular economy, but they are in need for stimulation and education. The consumption rates of bottles are high and thus there is a need for a proper utilization. And even though people are welcoming a recycling system, external intervention of government or proactive organisations should pave the way.

Key words: pet bottles, recycling, waste separation, Saint-Petersburg

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1 INTRODUCTION

Globally, 90% of produced plastic is not properly utilized (Parker 2017). It stands for waste accumulation, environmental pollution and overall high level of consumption of natural resources. Circular economy is the innovative approach for waste handling, which is perceived as a useful base for production (Business Finland 2017). Undeniably, each type of material requires its own type of utilization. This work concentrates on rational plastic recycling and its prospective in Saint-Petersburg, Russia, and proposes to reader several ways how the situation could be improved.

Usage of natural plastic forms started thousands of years ago. And whereas synthetic derived plastic was initially developed less than 90 years ago, animal horns and rubber were already widely implemented in ancient times (Knight 2014).

Plastic boom started in 1930's, when first synthetic types of plastic were invented and introduced to the market. Its popularity even influenced new fashion flows, where plastic was the base of household items, and even for furniture (Knight 2014).

Plastic stepped into daily lives of people and surrounds us everywhere. The dependence of humanity on this material is remarkable. The first and foremost advantage of plastic comparing to other materials is cheap cost of production. Durability and strength of this material gained acknowledgement and, combined with affordable price, plastic is serving as a base for a wide range of consumer products. (Knight 2014).

However, among all the benefits there is one important disadvantage: plastic is one of the most difficult groups of materials in terms of recycling. Moreover, certain types of plastic are even more difficult than others, which is even more power- and cost demanding for its complete utilization (Knight 2014).

Furthermore, waste reduction has become an important issue in modern world. High production rates and constantly increasing population of the planet are followed by necessity of recycling, which is, unfortunately, not widely implemented. Plastic stays at landfills for a long time. It can affect nature in a negative way, disturbing flora and fauna. Sea

fauna suffocated by plastic bags and completely polluted forests are just two examples of such influence.

Average Russian family with 4 members produces 150kg of various types of plastic waste per year. (Ogorodnov, 2013). In other words, there is a huge need for implementation of recycling practices. Plastic comes in our daily life in many compositions, and its type dictates the recycling technology applicable for it. Big share of plastics can be recycled. Leaving them in the landfills means simply wasting the recyclable material (Kraysova 2015).

One of the objectives of this thesis is to show the current situation of solid waste recycling and plastic bottles utilization possibilities in Saint-Petersburg. The city was chosen since it is the hometown of the author. Since Finnish approach in terms of recycling has been proving its efficiency for over 20 years, it can be implemented in other countries as well and therefore will be used as an example in this work.

The experimental part of thesis is presented in a form of survey which, was carried out among Saint-Petersburg citizens, with a sample size of 120 people. It illustrates the recycling reality and the way how people perceive it. In opinion of the author, survey is an effective way to observe the recycling tendencies since similar surveys are not conducted recently, which makes obtained information even more valuable

It is worth noticing that author contacted Russian plastic bottles recycling companies in order to arrange an interview. However, unfortunately, none of the businesses contacted has demonstrated a will to assist and discuss environmental issues.

The last chapter of thesis proposes solutions to major recycling problems and it also expresses personal opinion of the author on the subject. Survey results in English language could be found in the appendix. Russian version for Saint-Petersburg citizen is presented there as well.

2 MATERIAL AND METHODS

Description of current environmental situation cannot be based only on raw facts. It is important to investigate which role environmental practices play in daily routine of Saint-Petersburg citizens.

Essential part of this thesis work is a survey, which aimed to gather information on current recycling activities and environmental concern. It also included questions about difficulties and possible motivators. Basing on the results, suggestions for improvement are made.

This thesis work is dedicated to the PET bottles recycling prospective in Saint-Petersburg. However, when talking about one fraction, the whole recycling system is taken into account. With the proper approach different waste categories can be collected and reprocessed. General questions compose the survey body, with only couple of topic specific questions.

Survey was created on Google platform. It consists of 2 general and 12 topic-specific questions, including both single and multiple-choice answer options. Sample size was not planned in beforehand. The aim was to collect as much responds as possible. Author tried to attract people by composing easily and quickly answered survey. Respondents were able to add their own answers to several questions. Also comment section was added as a place for feedback and own ideas.

3 PLASTICS

3.1 Description of plastics

Plasticity is the ability of material to undergo deformations without being destructed. Plastic products can be easily reshaped by applying heat and pressure. The material is also very light due to low-density. All these features make plastic a base for many products, including food and beverage containers (Rodriguez 1999).

Depending on the molecular structure, several types of plastic are defined. This work concentrates on the recycling of plastic bottles, so only their raw material will be in center of attention.

The most commonly used is polyethylene terephthalate. Although there are other plastic types used in food and drink industry, they concede in many aspects. Frequently the short abbreviation PET is used, because the full name is quite long and difficult to pronounce. Each plastic type has also correlation with a particular number, so PET relates to number 1 (picture 1). Producers decide on reference mark of their bottles, so it can be number in the triangle or name in letters (Encyclopedia Britannica: PET or PETE).



PICTURE 1. Polyethylene terephthalate marking (Tomia 2006)

3.2 Advantages of Polyethylene Terephthalate

First, advantage of plastic over other materials should be discussed. Polyethylene terephthalate has several outstanding qualities, due to which it is so widely implemented in

many industries. It serves as a strong barrier to oxygen, water and carbon dioxide. Secondly, the quality of surface of this material is aesthetically nice and transparent. Finally, material is resistant to physical impacts and has high holding capacity and also does not deform when filled with liquids (Plastic Packaging Facts 2018). Although glass possesses the same properties, it is heavy and fragile. Plastic bottles are easier and cheaper in transportation.

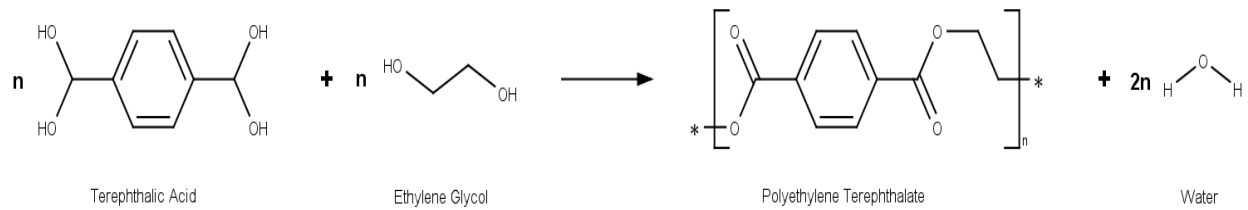
Safety is also a crucial factor, since chemicals, including harmful ones, might travel from the plastic container to its contents. That makes beverages and food dangerous for health of a human. There used to be discussions whether PET is harmless. According to current data, polyethylene terephthalate is an inert material, meaning it is the safest and the most suitable container for nutrition (UK Cancer Research 2018)

It is an interesting fact that many plastic bottles sold in stores, are designed for a single use. It does not mean literally very short life cycle of material, but it stands for necessity of proper washing and drying before using it again. Moisture may provoke bacteria growth, making the bottle's content dangerous (Harrington 2016)

3.3 Manufacturing process

Vast majority of plastics are hydrocarbons compositions, which are artificially derived through industrial polymerization (Business Dictionary 2018). During the process many monomers (small molecules) are combined into larger molecule, which is called polymer. Single polymer may include thousands of monomers in order to gain specific physical properties (Encyclopedia Britannica: Polymerization 2018). In its turn, polymers form polymer material which stands for plastic (Encyclopedia Britannica: Plastic 2018).

PET is a synthetically derived plastic from polymerization of ethylene glycol and terephthalic acid. The reaction happens with heat and catalyst presence. PET is the end product, which can be solidified for future processing or can be directly spun into fibers (Encyclopedia Britannica: PET or PETE 2018). Picture below represents the chemical reaction. As it can be seen, water is the sub product of Polyethylene terephthalate derivation.



PICTURE 2. Chemical reaction of polyethylene terephthalate production (Th.Dubach 2014)

The next step is injection molding, where raw material is molded into hollow tube called preform or parison (left object on the PICTURE 3) (ThomasNET 2018). It is worth noticing, that caps are made separately from another plastic type, either High-density polyethylene (HDPE) or Polypropylene (PP) (The Association of Plastic Recyclers 2018).



PICTURE 3. Plastic bottle parison (left) and cap (right) (Murmann 2008)

Parison is assuming the normal bottle shape during stretch blow molding process. Mandrel, thin steel rod, is injected into preform in order to fill it with highly pressurized air. Moreover, during the operation additional piece of plastic is attached to the bottle in order to maintain bottom part flat and stable. When preform takes desired shape, it is immediately set to cooling. Finally, the bottle is equipped with cups and ready to be filled with beverages (ThomasNET 2018).

3.4 Recycling prospective

According to British Plastics Federation, approximately 70% of non-alcoholic beverages are packed into PET bottles. The necessity of recycling is clear, because PET advantages turn into severe environmental issues. While this material is valued for its micro-organism resistance, it also means that it undergoes decomposition very badly. PET in nature is not really dangerous, because it does not emit any hazardous substances into the soil or water. However, it occupies land and disrupts the nature lifecycle (PET Resin Association 2018).

The recycling potential in developed countries is tremendous. Modern technologies allow to reprocess old bottles into new ones with compliance to high hygiene standards. Furthermore, recycled PET bottles are used in textile industry as fabrics or fiberfill for synthetic jackets of sleeping bags. Construction materials and even automotive parts might also be made from old drinking bottles (PET Resin Association 2018).

Recycling is a logical solution for waste utilization. Usage of old bottles as a raw material for other products saves energy and water during production process. Recycling also reclaims the production energy required for a new bottle and saves nature from contamination (NAPCOR 2018). United States Environmental Protection Agency (iWARM Widget) states that recycling of 10 plastic bottles saves enough energy in order to run 60W CFL lightbulb or laptop for around 98 and 21 hours correspondingly.

Comparing with landfill dumping, PET bottles' recycling helps to save 34'400 MJoules per one ton of recycled material (United States Environmental Protection Agency 2015, 3). Undeniably, it is worth considering old bottles as a raw material for many objects. It is wise to free the land from waste accumulation and to save resources in plastic industry (LeBlanc 2017)

4 ENVIRONMENTAL SITUATION IN SAINT-PETERSBURG

Waste recycling is an urgent problem in Russia. Landfills are taking more and more space, disturbing wild life and human inhabitancy. Waste incineration, which is most popular recycling practice in Russia, is not an appropriate solution, as burning emits hazardous substances into the atmosphere and does not reclaim energy spent on production.

Production costs are increasing annually, so do the natural resources deplete. Therefore, the alternative ways of gaining resources and energy for production have become a subject of discussion in Russia. Recycling is gaining popularity due to rational usage of resources, raw material restoration and solvation of waste handling problem.

Saint-Petersburg is the second largest city in Russia and third largest city in Europe. The region is known for innovations. Due to its location, the city is a gate for many European companies attempting to start doing business in Russia, and therefore attracts a lot of investments and knowledge about recycling practices implemented in neighbor states.

The concern about environment is steadily increasing with years in Russian Federation, especially considering constant growth of garbage on landfills. During the last decade several private recycling and incineration factories appeared, because entrepreneurs see opportunities in this sphere. Unfortunately, the recycling scheme and especially legislation is not so straight forward and has many obstacles, leading to short operation term of companies, which leave the market after year of operation (Kraysova 2015).

On the average 400kg of municipal solid waste (MSW) is accounted for each Russian citizen, which stands for the 60 million tons of total annual garbage created, majority of which finishes its lifecycle in the landfill. The overall area of the landfills has reached 4 million hectares (Moskovenko 2017). For understanding the scale of the problem, this area approximately equals to the area of Netherlands or Switzerland. Apart from official dumping, there are at least 30 thousand unauthorized rubbish huddles throughout the country (Expert 2014).

Landfill utilization seems to be cheaper than integration of a new recycling system. When the surrounding area of buildings is planned, it is profitable to create chargeable parking

spots rather than collection point (Velikorezkay 2016). There are several practices when dwellers take initiative and make contract with waste recycling points. Less waste is taken for common utilization and quite a lot of money can be saved and directed for improvement of common areas (Tishenko, 2017).

According to Russian environmental organization Greenpeace (2017), only 4% of all MSW is recycled. Plastic reprocessing rate is only one tenth from the total produced material (Kraysova 2015). On the other hand, average European recycling amount is 60% from the total produced waste (Tishenko 2017). Some countries, like Sweden, have successfully solved municipal solid waste problem, hereby almost whole produced waste is reprocessed (Official website of Sweden 2018).

In year 2014, 40 incineration and 243 recycling plants were operating (Expert 2014). However, majority of recycling plants are quite small and their profits are very moderate. PET orientated ones are usually run by enthusiasts and are just trying to make both ends meet (Kraysova 2015).

In Russia there are only several thousands people who are really separating their waste and then bringing it to special points (Kraysova 2015). They are either not being paid, or the refund amount is dramatically low. This recycling is only based on people's environmental concern, since it takes money and effort to deliver the separated waste to specialized centers. There are several volunteer organizations, which collect and handle MSW. One of them is Separate Collection. In Saint-Petersburg, waste receiving points are organized in each district once per month, and around 4000 people visit it every time (Separate Collection, Saint-Petersburg 2018). Unfortunately, this number is nothing comparing to five million inhabitants of the city. Nevertheless, it demonstrates the environmental awareness of at least some citizens.

But what is the common practice of handling household waste, where PET bottles belong? Typically, every house or apartment block has waste container without any fraction separation. Collection is organized by a company, either hired by the house council or service company responsible for the area. Company is obliged to have a license which is granted by Russian Federal Service for Supervision in the Sphere of Nature Management when all necessary papers are provided. License with service costs exceeds 2300 euros (United Lawyers 2018).

The collection activity can be allowed if the following criteria is implemented:

- Equipment for ecological situation control in the area of company practices
- Production areas which compiles with sanitary standards
- Equipment used for waste collection and utilization, employee's qualification
- Sanitation level assessment
- Constituent documents

(Vtorothodi 2018)

Collected waste may have various destinies landfill, incineration plant or recycling. Landfills are dominating, only 3-5% of MSW is transferred into energy or raw material (Kraysova, 2015).

Municipal Solid Waste also includes biowaste. With the accordance to the law, when the whole batch is contaminated with organic matter, it requires additional control while recycling, total disinfection and attention to staff protection (Engineering Chemical Technological Center 2018).

Nevertheless, establishing a plant may not be as easy as it may seem. The first obstacle is paper work. Environmental verifications, licenses, hygiene and fire safety are the essential documents. It will take time and money to get each of them. The initial expenditures starts at 400 euros, for example. Secondly, recycling equipment is expensive (at least 80 000 euros) and also requires installation. Complementary obstacles are renovation of premises and employees hiring (Rcycle.net 2018).

PET flex is the end product of the recycling cycle. Potential sales market and ways of material's realization should be considered beforehand. At the moment, the biggest recycling plants is Plarys, which is located in Moscow region. Initiators of venture are administration of Solnechnogorsk municipal area (nearby town), Coca-Cola Hellenic company and other owners of Plarys.

The company presents itself as a unique and first plant in Russia to implement bottle-to-bottle technology. Production unit is capable of processing old bottles into highly hygiene

raw material for food industry. Moreover, Plarys is cooperating with parison manufacturer Senege and plastic bottles manufacturer Europlast. However, Senege states that it utilizes only virgin flex in preforms production, meaning that their parisons do not consist any recycled parts (Plarys 2018). On the official website there is no information whether recycled flex is used for food packaging. In other words, Plarys owns progressive technology, but it seems that it is hard to find its application on modern Russian market.

The PET recovery process is quite easy. Blocks of pressed bottles are delivered to the plant. These bottles have been initially delivered to the landfill, but then extracted and taken to recycling point. Before processing, manual sorting by color and density is performed.

Second step is washing and label elimination of bottles. Many difficulties are caused by hard glue, that does not dissolve even in alkaline solutions, since there are no regulations on the chemical composition of glue in Russia. The bottles are cut into pieces called flex and afterwards melted into longitudinal cylinders. Temperature of thermal operation is about 280C°. Eventually, they are cut into granules and new products can be produced out of them.

Several PET recycling plants are also established in Saint-Petersburg suburbs. However, Plarys provides with the fulfilling information on processing, thus it was taken as an example.

On the average, weight of consumed PET bottles per Russian person is 4 kg annually (Grigoryan 2018). On a country scale the numbers are tremendous. The capacity of recycling plants is estimated to be 30% of whole consumed PET bottles. In fact, less than twice of expected amount is given a second life (Skopinzeva 2017).

5 ENVIRONMENTAL SITUATION IN FINLAND

Finland is well known for its recycling activities and green thinking. Almost every block house has containers for different waste fractions. People are risen surrounded by environmental awareness. Many actions, like returning bottles, are a habit. Contribution is made, albeit for somebody all waste recycling activities are just routine without deliberate care for nature.

According to The Finnish Innovation Fund Sitra, around 1,7 billion packaged beverages are consumed in Finland annually. Obviously, without proper handling, they would just accumulate on landfills or be incinerated, without recovering energy and raw material required for the production.

One of environmental initiatives that was mightily integrated into life of Finnish families is return of glass and plastic bottles and aluminum cans. The reason why people return these bottles is money, which is paid as deposit when purchasing packed beverages. The system was introduced to Finnish market in 1996, and since then it successfully manages the flow of beverage containers (Nurminen 2017).

Monetary benefits are an influential incent for bottles' return. But there are other favorable factors, such as convenient locations of receiving points for instance. Every grocery shop, where bottles with deposit marking can be purchased, is also obliged to organize their collection. These points are registered as return locations (Palpa: Information on return locations 2018).

As it was described before, polyethylene terephthalate is the most suitable plastic type for beverage packaging. Since they are also widely utilized in Finland, the recycling is an important issue. Thereby, PET material is meant when discussing plastic bottles processing.

There are several beverage containers administrators in Finland, however, there is one which is dominating on this market. Suomen Palautuspakkaus Oy (Palpa) is the company which stands at the head of the deposit-based recycling system. This non-profit organiza-

tion basically serves as an intermediary between all companies, which are anyhow connected to plastic bottles. The income is formed from membership fees and the sales of recycled materials. Membership fees are received from manufacturers and importers of beverage packages. Deposit based return system expenses are covered by these contributions (Palpa: Palpa briefly 2018).

Palpa carries administrative duties during collection and recycling. It is not a private company and is owned by franchising groups (for instance Alko Oy, Oy Hartwall Ab, Inex Partners Oy, etc). Pirkanmaa Center for Economic Development (Elinkeino-, liikenne- ja ympäristökeskus) monitors the recycling operations. It is worth noticing that approximately 300 million deposit euros run through the company every year (Palpa: Palpa briefly 2018).

Return systems depend on the packaging type, **therefore** glass, plastic and aluminum are handled differently. All the materials are verified by Palpa so this explains the importance of the barcode on packages which carries this information. Before any company can introduce its packaging as recyclable, bottles or cans undergo examination. Size and shape of bottle are not of less importance for getting approval (Suomen Palautuspakkaus Oy 2016).

Finland is one of leading countries of beverage containers recycling in the world. According to Palpa, 92% of purchased beverage PET bottles are returned (Palpa: Different types of beverage packing 2018). Overall, people are familiar with the collection stage of recycling system. Bottle and cans are brought to the stores and put into vending machines. It is important to keep the shape of the package not squeezed. Otherwise, it cannot be accepted, or the deposit cannot be reclaimed. When packages disappear in the machine, they are automatically sorted according to the material and then compacted to decrease the volume and save logistic costs (Suomen Palautuspakkaus Oy 2016).

Next destination of these delivered bottles is the recycling point, where beverage containers are further compressed and formed into huge blocks. In case packaging did not undergo cost counting devices, the cost will be counted directly in the recycling center.



PICTURE 4. Plastic bottles compressed blocks (Michal Mañas 2012)

Palpa evaluates deposit with the help of vending machines, counting devices on recycling points and logistics. The blocks are transported to the reprocessing plants, where glass, plastic and aluminum are recycled into new raw material.

Aluminum is melted and rolled into thin sheets, which are formed into cans. This material can be basically recycled unlimitedly, since the lifecycle of the brewery package is almost eternal (Suomen Palautuspakkaus Oy 2016). Glass is processed into new packaging and products for construction industry.

Plastic is melted and blown into new bottles of various shapes and sizes. Apart from food industry, recycled plastic is used as raw material for textile industry. The material flow is continuous. Palpa collaborates with two recycling companies Lassila & Tikanoja Oyj and Paperinkeräys Oy (Palpa: Palpa Briefly 2018). In year 2016 Palpa successfully procured recycling of 12700 metric tons of PET bottles (Nurminen 2017).

6 ENVIRONMENTAL AWARENESS OF CITIZENS OF SAINT-PETERS-BURG

Survey is a great method to collect valid data about the environmental awareness of citizens. In total, 120 people took part in questionnaire. Responders belong to different age and social groups. Hence, it is possible to make suggestion on environmental development basing on answers' summary.

Majority of participants belonged to adulthood age group (19-35 years). Among adulthood group there were approximately equal proportion of students (43) and employees (48). (figure 1 and 2).

Underage compose approximately one sixth of whole responders, while 13 second-period adults (35-55 years) and only 1 pensioner have answered the survey (figure 1).

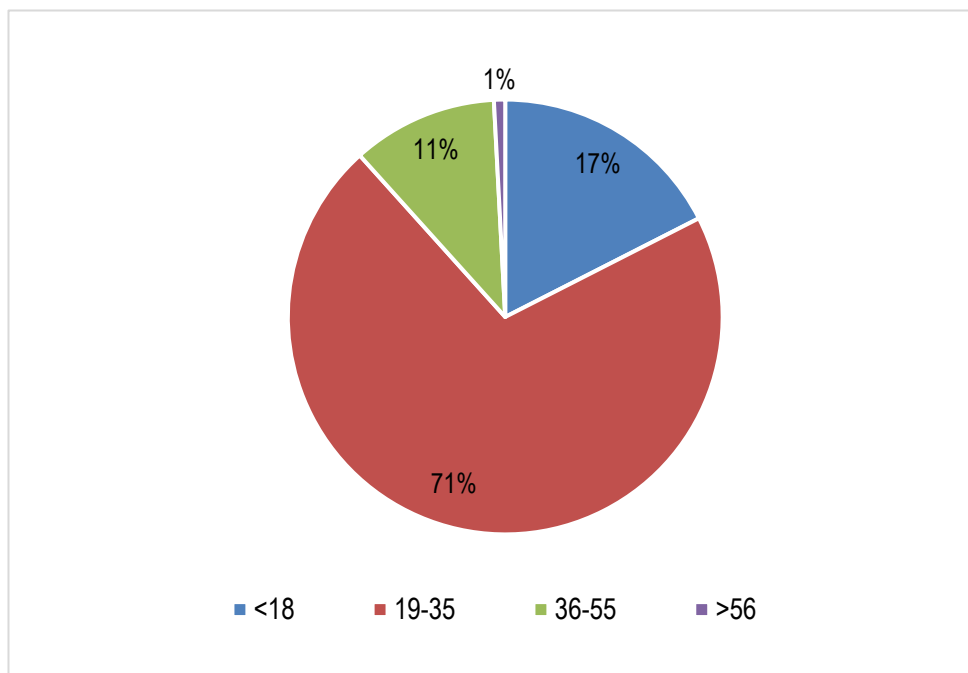


FIGURE 1. Age category of survey participants (in years)

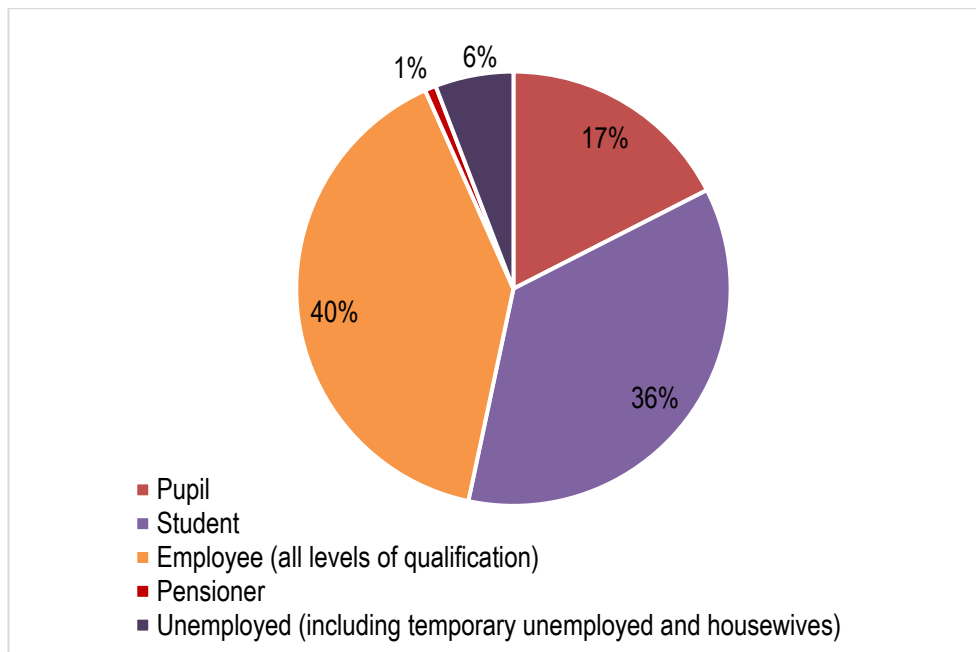


FIGURE 2. Occupation of survey participants

After checking the results of the survey author was able to make a conclusion that respondents are enthusiastic towards environmental movement. Some of them have also mentioned that they are looking forward to recycling and improving ecology. Figure 3 below demonstrates responds to the question: “In your opinion, should we pay more attention to environmental problems? (air, soil, water pollution)”. As it can be seen, the clear majority of people (97%) see a necessity for environmental sphere development. This positive attitude shows that citizens are ready for actions, but mostly probably, they need favorable conditions and clear instructions.

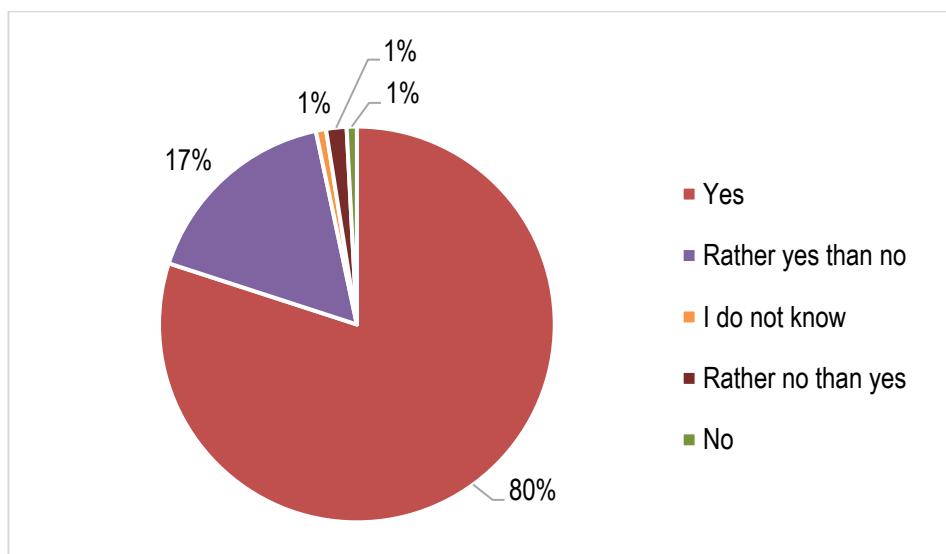


FIGURE 3. Opinions on necessity to pay more attention to environmental problems (air, soil, water pollution)

Survey shows that environmental practices play an important role in daily life of 78% responders. That does not necessarily mean that nature is always taken into considerations, however citizens are already acquainted with this issue. Economic benefits are also the reason to take care of environment. Even simple actions, like electricity or water savings, make big difference on large scale. Notably, money might be an incentive for many citizens. Environmental improvement is easier to implement when people obtain some reward or compensation. In questionnaire 14% described their environmental attitude as neutral, meaning that money is their only motivation (figure 4). That illustrates that with right approach, citizens can be involved into recycling or in any other environmental practices.

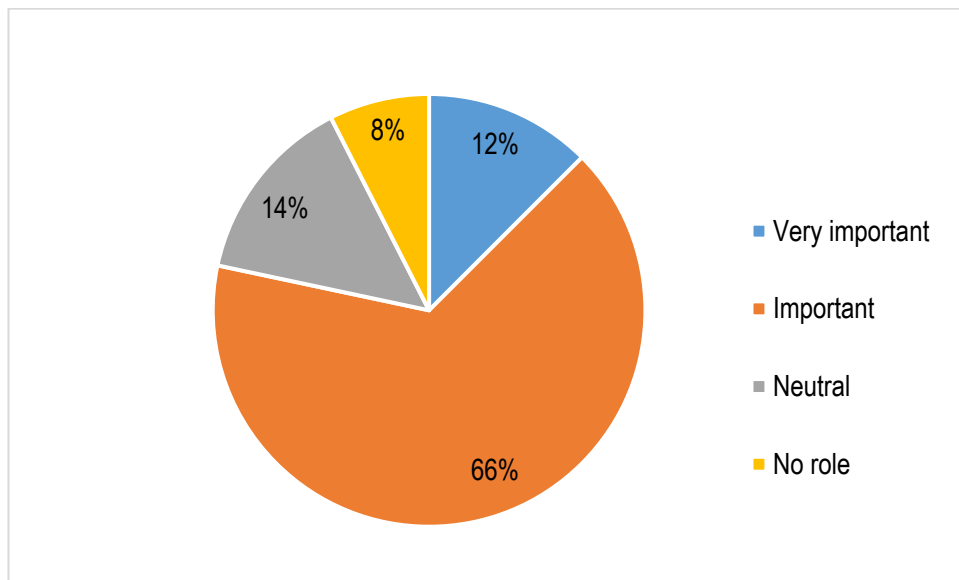


FIGURE 4. Role of environmental practices in participants' life

When it comes to motivating citizens, it is important to find the party that will be responsible for environmental education. This issue may not have single answer, and thus it was multiple-choice question in the survey (appendix 1, 1.4). Saint-Petersburg citizens did not come to one solution, but many believe that every person should be responsible for his/her environment. Again, motivation can be either environmental or monetary, but still the outcome is the same.

Nevertheless, people cannot make big changes without strong governmental support. Proper legislation, favorable conditions for environmental enterprises, and spread ecological propaganda are the good starting points. Some responders believe that there is a need for proactive companies and organizations, who will push environmental awareness to

the masses. There is also an opinion that Saint-Petersburg is in need for proactive people who will take care about environmental issues and organize a full cycle of material flow.

Decision on responsible party is not straightforward. Three responders added own opinions on the topic since there were no option close to their mind. However, the comments are the combined answers provided in questionnaire. Two people suggest that environmental improvement cannot be reached without joint efforts of government and society (or every single person). Another vision was that collaboration between enterprises and government will kick off ecological movement in Russia (appendix 1, 1.4). It is worth noticing that nobody has chosen “I do not know” answer, so people understand the problem and its solvation. To summarize, many responders are sure that environmental responsibility relies on every citizen. However, there is still a strong need for governmental control and support.

Mentality might become an obstacle during development of ecological sphere. It would be easier to introduce any green innovation when it is met positively. Otherwise, there is a need for heavy environmental education or strong motivator. Author studied citizens' opinion on how waste handling problem should be solved. Nowadays almost all waste ends up on a landfill (Moskovenko, 2017). It could be interesting to see whether citizens agree with such policy or not.

According to questionnaire, only one percent of responders would like to retain dumping system. The vast majority is looking forward to recycling, and 4% of responders would like to combine recycling and landfills (figure 5). Moreover, three people added their own comments. One supports circular economy and creating of a closed life cycle. Second suggests economical evaluation for each case and to adapt the utilization system to the local needs and possibilities. The last responder eliminates landfills, but considers incineration plant as a place to reclaim material which cannot be recycled.

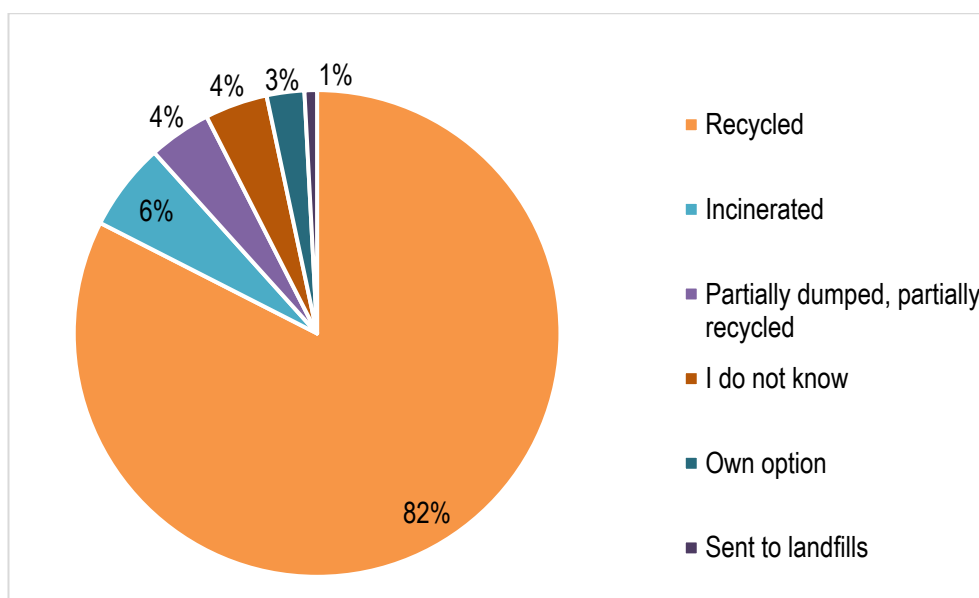


FIGURE 5. Opinions on how waste should be utilized

In previous chapter it was mentioned that separate collection is poorly developed in Saint-Petersburg and only several thousand people put effort into waste recycling. Figure 6 demonstrates citizens' awareness on the topic. In total 98 people out of 120 have at least heard about the green movement, but half of responders are unfamiliar with practical issues such as location of containers and collection points. Nevertheless, quite many people (14%) are absolutely unacquainted with the issue.

One of the biggest obstacles with separate collection is lack of citizens' trust. Frequently people are skeptical towards execution of environmental practices. Waste sorting seems useless due to belief that eventually all waste still goes to the landfill, destroying all collection efforts. Several responders are certain that rubbish from different containers eventually is taken to the landfills or incineration plant. Absence of legislative framework and Russian mentality complicates development of recycling. Responders are concerned that separate collection system cannot be integrated unless people learn about the importance of clean nature.

In other words, the separate collection conception is familiar for many citizens, but there is a long way until it will be successfully implemented. There is a need for transparent recycling system where people can ensure that their efforts are useful.

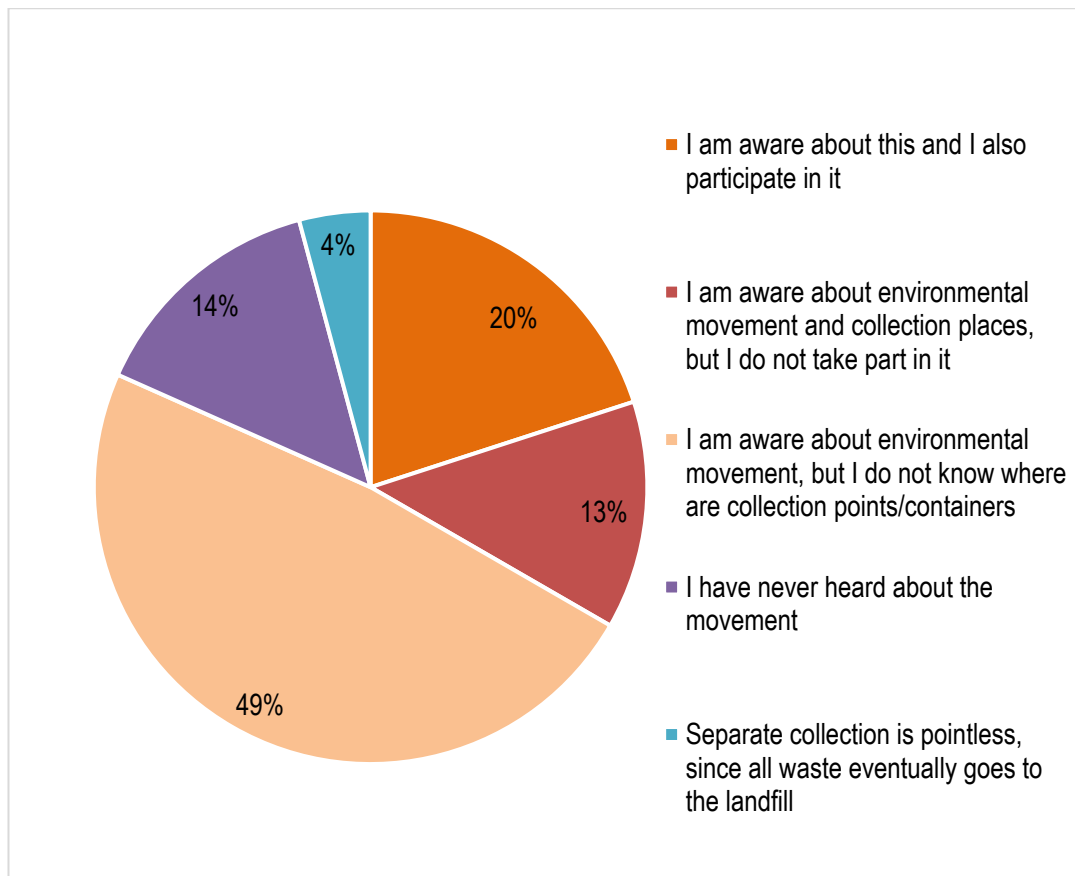


FIGURE 6. Separate collection awareness among Saint-Petersburg citizens

Now, when the current recycling situation is described, it is time to move to beverage plastic bottles' purchase statistics (figure 7). It could be observed how popular are beverages in plastic containers and their consumption rates. Notably, PET can be raw material for diverse item, but the single use bottles are in focus.

Apparently, only 9% of responders excluded PET bottles from their life. This beverage container is purchased on weekly basis by three quarters of examined citizens. Such statistics is an object lesson that recycling business has wide scope for development. Bottled beverages are essential part of daily routine for more than 32% of responders while only 2% tend to purchase PET bottles occasionally unless they do not have their own container for liquids (figure 7).

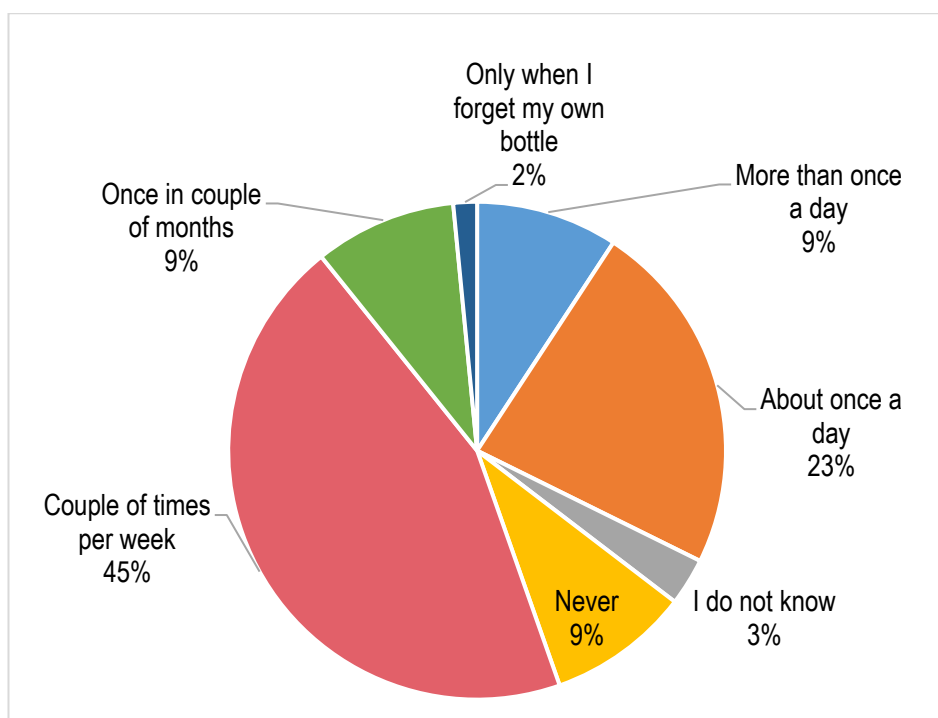


FIGURE 7. Beverage plastic bottles' purchase statistics in Saint-Petersburg

High rates of PET bottles consumption create auspicious conditions for recycling industry. Currently the situation is so that there is an excess of raw material due to small number of companies and their low recycling capacity. Life cycle of many enterprises is about one year (Kraysova 2015).

Nevertheless, even in such unfavorable conditions, some citizens still find opportunities for natural care. There are places where bottles are collected, and according to the survey, 34% of responders at least betweenwhiles are participating in this initiative. One tenth has serious approach to the recycling and separate all the consumed bottles (figure 8). Number of people what never bring bottles to recycling points includes citizens who do not purchase any plastic bottles (9% of responders) (figure 7). Obviously, there is no need to muse upon recycling when the person do not produce this waste. Hence, true “never recycle” statistics is 57% instead of 66% (figure 8).

It is good to mention that questionnaire results show one discrepancy. Initially only 20% of responders are separating household waste and aware of collection points (figure 6), but simultaneously 34% people sort bottles at least inconstantly, meaning that they already dispose one refuse category. The difference in numbers is quite big and doubts credibility of responds to both question. However, author supposes that the survey wording might be the confusion reason. Additionally, for some people separate collection

could imply for the sorting waste into many categories, not only plastic bottles. Responders do not always designate themselves as active recyclers when they treat specially only one type of waste.

Integration of a proper recycling system should consider methods for people's attraction. Creation of convenient ways for utilizing products is a very important step. Deposit based system is proven to be an efficient way of waste collection. Currently it is not implemented, yet there are places where PET bottles are taken.

Easily accessible collection places might imbue people to waste separation. As evidence, in survey bottles are more frequently returned to waste containers near the apartment. The following popular practice was to bring bottles to the collection points. But it should be kept in mind, that this particular topic involved multiple choice answers (figure 9).

Generally people tend to participate in activities which are convenient for them. Taking bottle to the container next to the door is much easier than delivering it to special point on the other end of the city. Questionnaire demonstrates (appendix 1, 1.11) that absence of bottles' containers in close proximity is the main reason for avoiding recycling. Availability and simplicity of waste separation is the key to the successful recycling system functioning. More people could be attracted by means of collection points' improvement.

Inaccessibility of waste containers is the problem originated from the poorly developed municipal recycling system. It should be modified, or better to say, created. Currently the waste is eliminated on landfills. Dumping is not the rational usage of neither the land nor the natural resources and raw materials. No improvement in the waste utilization sphere can be observed by citizens, therefore distracting them from participating in it. PET bottles is just one category out many products that could be reprocessed. Many people would like to have a broaden recycling system, because concentrating only on one particular waste type is not enough.

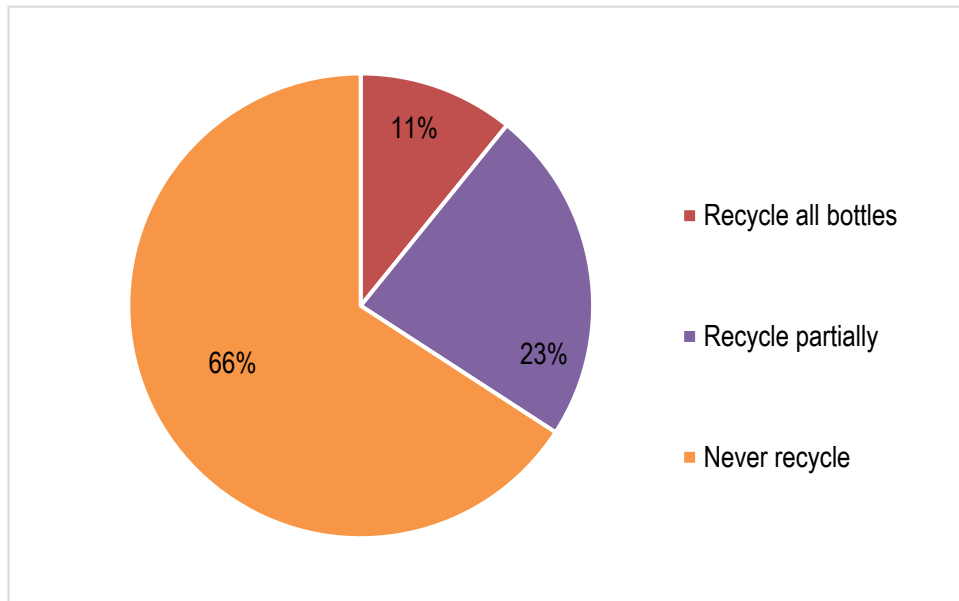


FIGURE 8. PET bottles utilization statistics in Saint-Petersburg

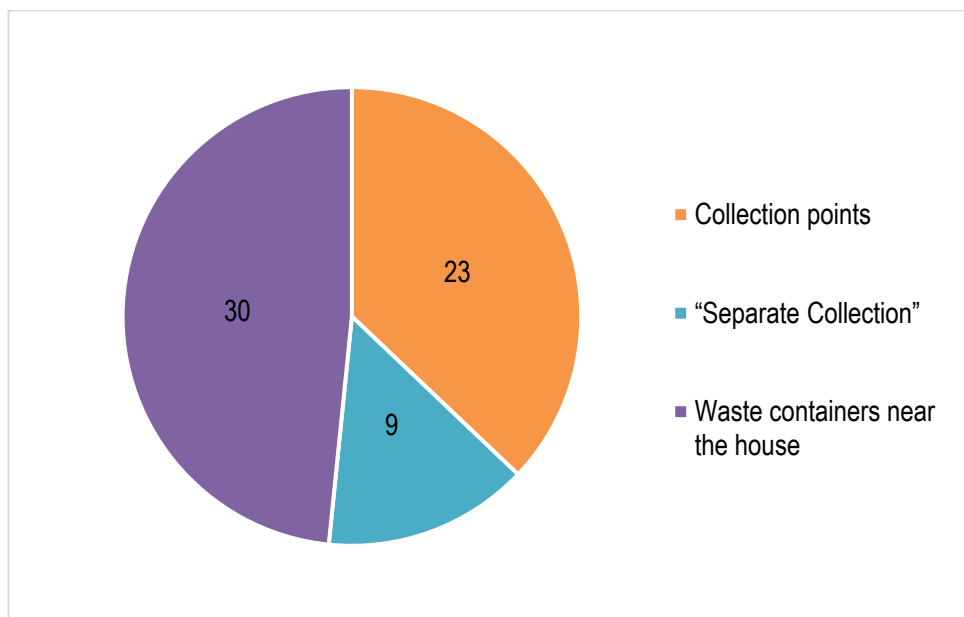


FIGURE 9. How citizens utilize used PET bottles (multiple choice answers)

Thesis work emphasizes on the plastic bottles recycling in Saint-Petersburg, but exploration of ecological situation includes many general issues, which were already discussed. The greatest stimulation for bottles recycling in Finland is deposit based system, which could be also integrated in Russian realities. Survey showed that people purchase bottled beverages very often, providing good business opportunities for potential recycling system.

In questionnaire the Finnish approach was described, and responders had to enounce their thoughts on the topic. More than 90% would adopt this practice positively/rather positively (figure 10). That is a splendid example of the citizens' environmental awareness. To be fair, deposit based system only return the paid money for the beverage container, so this is not a net income for customers. Still the system ensures that the precious raw material is recovered, and people understand why it is important. Responders' answers do not show only their attitude towards recycling practices, but also their comprehension of the topic.

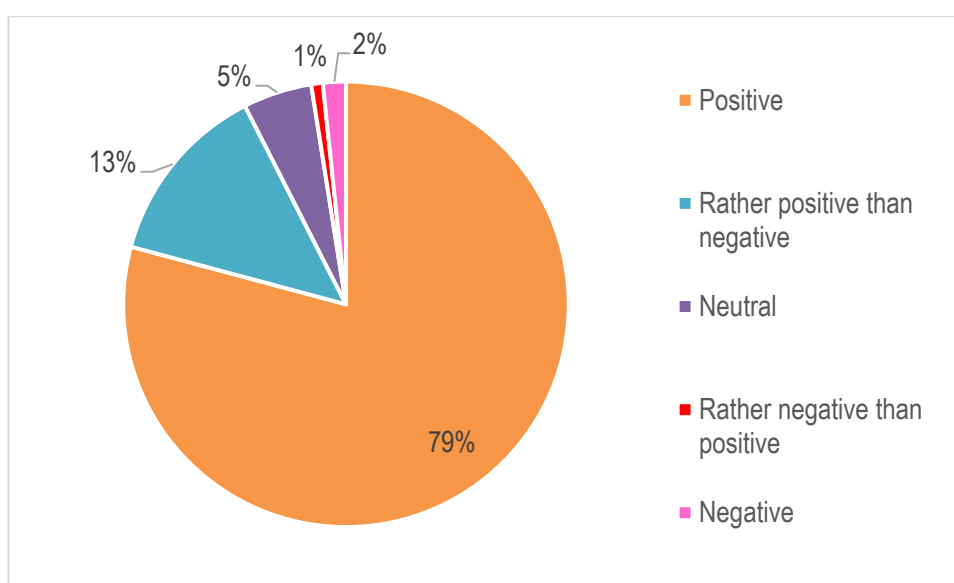


FIGURE 10. Responders' attitude towards implementation of deposit based recycling system

The phenomenon of skepticism to current recycling actions has been already mentioned. Furthermore, this becomes a stumbling block for motivating citizens. Implementation of recycling system has to be transparent. Waste handling and utilization procedure has to be clear for citizens. Necessity of gaining trust is concomitant with the development of ecological situation. People need to know the life cycle of disposed products in order to accept the new separation procedure and to start putting effort into it. A properly established system should still demonstrate its effectiveness in order to be truly accepted by the society.

The next potential threat for low environmental motivation can be characterized as “un-formed habit”. For majority of Saint-Petersburg citizens waste separation is an unusual

activity, even concerning the extraction of only one category such as plastic bottles. Absence of free time and free space at home are put forward as big obstacles for domestic recycling. Moreover, currently all waste is thrown into a bin being considered as one inseparable heap. This common practice has strong roots in the mentality. Much effort should be put in environmental education and finding solutions for convenient waste storage and elimination of at homes.

Some responders might also claim that recycling is only top of “environmental iceberg”. People with vision that recycling does not solve real ecological problems are very hard to be motivated. They do not see positive influence of this activity, and consequently refer to it as to unnecessary.

An interesting point is that one person stated that there are no difficulties in domestic waste separation, meaning that for him/her it would be very easy to obtain this habit. And even though, in this sample size only one such opinion was given a voice, on larger scale there would be quite many people who share this way of thinking.

Concluding, people revealed many reasons why separate collection might be difficult for them. Proper analysis of the problems will detect the weak points and draw solutions for recycling propagation. But it is important to keep in mind which potential motivators were suggested by the responders. The most influential factors are monetary benefits, environmental education and close proximity of waste containers (appendix 1, 1.12). These are the essential conditions for launching the successful recycling system. Undeniably, more improvement should be made, but the basic requirements has to be fulfilled anyway.

Last but not least is a necessity for environmental education which implies for explaining people why waste separation is useful and how to successfully carry it out. Many responders also mentioned their interest in learning. This survey questions provided multiple choice options, since environmental propaganda should not be narrowed to only one information source. It is difficult to suggest which information source should be developed in the first instance. Approximately the same number of voices were given to reading means (brochures, magazines, online magazine, internet newsletter), TV programs and advertisement and banners (appendix 1, 1.14). Moreover, self investigation on environmental topic seems convenient for many responders as well. Experience share and live

communication might increase environmental awareness. But probably event and lectures organization can appear to be time and cost demanding.

7 DISCUSSION

Discussion on the roots of Russian waste utilization issues are eternal. Anyway, the challenge is problems' versatility. Many spheres have to undergo drastic changes in order to launch successful recycling system. This author of the work distinguishes four problematic spots, which would be portrayed. Author will suggest improvements for PET bottles handling taking in account Finnish waste utilization system (including PET bottles reprocessing via deposit-based system)

7.1 Absence of separate waste collection

The effects of Russian waste utilization practices have been described before. All household rubbish occurs in one container. Recycling plants order plastic bottles from landfills operators, which have to sort the waste and extrude only PET packaging. The material has to be cleaned thoroughly, and logistics require more time and money than simple delivery from household waste containers to recycling plant.

Notwithstanding appearance of new PET processing factories, they experience lack of raw material. Only 10% of produced bottles will be given a second life, the rest will be taken to the landfills (Kraysova 2015).

Deficiency of raw material influences in inefficient processing and high energy costs. Proficiency can be reached with higher loading capacities, but the material resellers are increasing prices for plastic when big player appears. In the end, recycling business is not very profitable and for some new companies first months are spent in lesion (Kraysova 2015). The best way to connect plastic bottles collectors and processors is to make direct connection, or with the help of additional logistics stakeholder.

Finland is a good example of plastic bottle lifecycle. Additional deposit payment for each plastic bottle will motivate people to return money back. Introduction of such system will boost plastic bottles' collection and recycling rates. Consequently, connections between each enterprise in the bottles' life cycle should be properly established.

Second option for collection is installation of separate containers for plastic bottles in apartment buildings, business and shopping centers. Waste collection is handled on the payments of citizens, so reducing the costs would be a solution. Dwellers will experience money savings with separate beverage containers' utilization.

7.2 Absence of recycling habit

Every initiative begins with enthusiastic person with idea. In overall, 92 % of Saint-Petersburg citizens are welcoming the integration of deposit based system. They state that they will start waste separation if the comfortable conditions are provided. However, people avoid leadership in this sphere.

What can be learnt from Finland, is personal responsibility for the footprint. Learning about environmental issues since the childhood defines future interaction with nature and willingness to support green innovations (Hancock, 2011). Plastic bottle recycling is extremely easy in Finland, but the national environmental concern also carries weight.

In Russia waste separation is a nascent phenomenon. It contradicts the established way of life, where tailings are not divided into categories. Since new approach requires more effort, people can discover many disadvantages there. Survey showed that citizens are concerned that waste separation would need too much time or space. However, these statements are doubtful. For example, a big rubbish bin at home could be replaced by the one with several segments. Implementing a new habit to daily life is difficult only during the first time.

Education in sphere of environmental protection is a great issue nowadays. There are activists wide spreading information and demonstrating advantages of rational waste utilization, but their efforts are small on the country scale. Environmental education should take roots in kindergartens and schools. Theoretical information should go hand-in-hand with practical advices and examples.

Citizens feel that it is worth learning more about the environment and how the contribution can be made. Probably, ignorance in the topic leads to low participation. And though self learning is the best way for getting new information for many citizens, still there is a

obvious need for mass media interposals, for example, TV programs and brochures. Moreover, apartments' common areas are a good place for environmental posters and banners.

7.3 Absence of human resources

Recycling is a huge sphere which offers employment, however these job opportunities are not fascinating for people. This topic concerns mostly workers on the recycling plants: plastic bottles separation and washing. One of the problems, is a difficulty with job placement. Profits of recycling companies are not high enough for worthy salary. Russian mentality also plays a role, and people would like to avoid dirty jobs. On landfills and recycling plants one can hardly see a person of a Russian nationality. Usually immigrants from Middle East occupy working places (Kraysova 2015). Job duties are unpleasant, so staff turnover is still big.

As a development idea, human labor can be partly replaced with machinery. On recycling plants in Finland people mainly maintain equipment and control the process. Undeniably, big investments needed for device purchasing. Probably, governmental support for recycling operators will facilitate entrepreneurs. Easier system of subsidies and loans could be introduced.

7.4 Absence of recycling circular system

This is the main theme where Finnish practices can be fully implemented. What is really needed, it is the vicious circle between production, consumption and recycling of the PET bottles.

Everything starts with the manufacturing. The packaging should be produced with the emphasize on the following recycling. Material color and density should be designed appropriate for easy reprocessing. The raw material for manufacturing should be mostly the recycled plastic, so that the recycling companies can always find niche for product release. Returning rates can hardly reach 100%, so additional plastic providers will be involved, but their share will be tiny.

Next step is to motivate consumers. Finnish model can be perfectly applied. Vending machines can be integrated in stores and shopping centers. Motivation for package return would be deposit money. In case of installation of containers in inhabited areas, reduction of waste collection tax can be introduced.

The whole cycle of the PET bottle flow is demonstrated on the figure below. As it can be seen, the central place is for the proposed company which is analogue to Palpa. It controls material flow, returning rates, and communication between operators. Deposit payer is the company that uses plastic packaging for their beverages. In Russia, the biggest players on the market are PepsiCo and Coca-Cola (Koryakov, 2012). These are international companies, which are familiar with recycling system in different countries.

In Finland, companies without Palpa membership are obliged to pay tax of 0,51 euro per litre of package (Palpa: Information on Palpa membership 2018). By becoming a member, enterprises are exempted for that fee. Still membership should be paid, but it is more economically favorable. Russia can adopt the system. That fee could be used for recycling system administration and other operational expenses. The controlling company should be ideally non-profitable to avoid corruption (figure 11).

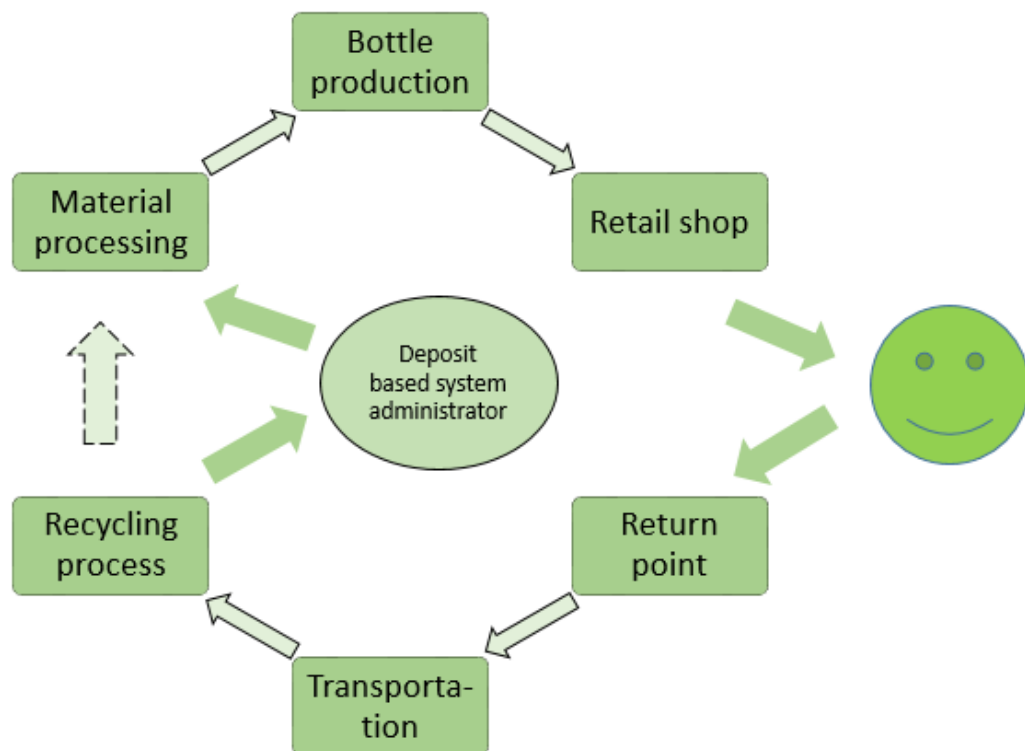


FIGURE 11. Lifecycle option of a PET bottle in a deposit based system (redrawn from Gorelova, Ivanov 2014)

8 CONCLUSION

Amount of plastics on Russian landfills is increasing with years. High production costs, absence of utilization space and environmental concern motivate for creating a closed product circle. In Russia many people see opportunities in recycling business. Plastic bottles are not waste anymore but a raw material. Statistics show that people approve environmental practices. However, it is still a long road to go before establishing a perfect recycling system.

Wise and slow integration of recycling system should be executed. All companies, which are somehow connected with plastic bottles, should be involved into the cycle. Recycling should be considered as a compulsory not supplementary activity. Fortunately, citizens have positive attitude towards recycling. Thus, favorable conditions for plastic bottles return should be organized. Environmental propaganda via different sources would be very helpful for attracting more people.

Mentality is an important aspect as well. Deposit based system benefits has to be explained for people. With the increase of environmental concern, the recycling rates will go upwards. Introduction to the new system should be well planned and may take some time to get acquainted.

To sum up, Finnish PET bottles recycling system is a good base for Russia. The efficiency and high return rate demonstrates that with right approach the plastic dispose challenge can be solved.

Of course, PET recycling is not the only problem. There are other beverage packages (aluminum and glass) that could be processed into a new product. However, the plastic recycling percentage is lower, so it could be a good starting point. Finnish waste utilization system is a great example to follow. Neighborhood country experience can help to process PET beverage containers thoroughly and with less expenditures, creating a better and less polluted environment.

REFERENCES

British Plastics Federation. 2018 PET Plastic Bottles - Facts Not Myths. Read on 12.04.2018. <http://www.bpf.co.uk/>

Business Dictionary. 2018 Plastics. Read on 30.11.2017. <http://www.businessdictionary.com>

Business Finland. 2017. Finnish Waste-to-Energy and Bioenergy offering. Presentation. <https://www.slideshare.net/>

Encyclopedia Britannica. 2018 PET or PETE. Read on 01.12.2017. <https://www.britannica.com/science/polyethylene-terephthalate>

Encyclopedia Britannica. 2018 Plastic. Read on 30.11.2017. <https://www.britannica.com/science/plastic>

Encyclopedia Britannica. 2018 Polymerization. Read on 11.04.2018. <https://www.britannica.com/science/polymerization>

Engineering Chemical Technological Center. 2018 4 myths about waste utilization. Read on 02.12.2017. <http://ect-center.com/blog/4-mifa-ob-utilizacii>

Expert magazine. Country of waste. 2014. <http://expert.ru/2014/02/11/strana-othodov/>

Gorelova, A, Ivanov D. 2014. Adaptation of Finnish model for recycling of aluminum cans in Saint-Petersburg. Degree Programme in International Business. Jyväskylä University of Applied Sciences. Bachelor thesis

Greenpeace Russia. 2017. What should we do with waste? Report. <http://www.greenpeace.org/russia/ru/press/reports/Russian-garbage-2016/>

Grigoryan, R. 2018 Victory path of a plastic bottle. Plast guru. Read on 14.05.2018. <http://plast.guru/page747401.html>

Harrington, R. 2016. Here's when you need get rid of your plastic water bottle. Business Insider. Read on 11.05.2018. <http://nordic.businessinsider.com/>

iWARM Widget. United States Environmental Protection Agency. Read on 12.04.2018. <https://www.epa.gov/sites/production/files/widgets/iwarm-skinny.html>

Knight, L. 2014. A brief history of plastics, natural and synthetic. BBC news. Read on 30.11.2017. <http://www.bbc.com/news/magazine-27442625>

Koryakov, A. 2012. Time to drink. Expert magazine. <http://expert.ru/ural/2012/25/vremya-pit/>

Kraysova, E. 2015. The most expensive waste in the world. Read on 01.05.2018. <https://republic.ru/posts/51424>

LeBlanc, R. 2017. How Long Does It Take Garbage to Decompose? Read on 04.12.2017. <https://www.thebalance.com/how-long-does-it-take-garbage-to-decompose-2878033>

Michal Mañas. 2012. Bales of crushed blue PET bottles and bales of various other plastics in Czech Republic. https://commons.wikimedia.org/wiki/File:Bales_of_PET_bottles_2.jpg

Moskovenko, V. 2017. Separate waste collection: how to stimulate citizens. <http://gosvo-pros.ru/territory/khozyaystvo/separatewaste/>

Murmann, F. 2008. PET-Preform, PET-Rohling, PETling. - Der Schraubverschluß ist aus Polyethylen (PE) gefertigt. Wikipedia Commons

NAPCOR. The National Association for PET Container Resources. 2018 Products made from recycled PET. Read on 12.04.2018. <https://napcor.com/recycling/pet-end-products/>

"Nurminen, P. 2017. Case study: Finnish deposit refund system. Presentation. Institute for European Environmental Policy's capacity building for environmental tax reform conference on 5.10. 2017. Brussels, Belgium.

Official website of Sweden. The Swedish Recycling Revolution. Read on 02.12.2017. <https://sweden.se/nature/the-swedish-recycling-revolution/>

Ogorodnov, S. 2013. Waste treasures of Russia. Read on 10.04.2018. <https://www.rbc.ru>

Palpa. 2018 Different types of beverage packing. Read on 02.12.2017. <https://www.palpa.fi/beverage-container-recycling/beverage-container-types/>

Palpa. 2018 Information on Palpa membership. Read on 02.12.2017. <https://www.palpa.fi/>

Palpa. 2018 Information on return locations. Read on 01.05.2018. <https://www.palpa.fi/retail-and-horeca/general-information-regarding-returns/>

Palpa. 2018 Palpa Briefly. Read on 02.12.2017. <https://www.palpa.fi/beverage-container-recycling/palpa-briefly/>

Parker, L. 2017. A Whopping 91% of Plastic Isn't Recycled. National Geographic. Read on 10.05.2018. https://news.nationalgeographic.com/2017/07/plastic-produced-recycling-waste-ocean-trash-debris-environment/?_ga=2.140490611.1770415965.1526328008-494982847.1526100910

PET Resin Association. 2018 FAQs - Frequently Asked Questions. <http://www.petresin.org/index.asp>

Plarys website. 2018 PET bottle lifecycle. Read on 13.04.2018. <http://plarus.ru/>

Plastic Packaging Facts. 2018 Resins and Types of Packaging. Read on 01.12.2017. <https://www.plasticpackagingfacts.org/about-plastic-packaging/>

Recycle.net. Internet magazine about recycling issues. 2018 Plastic bottles recycling plant: stable income and investments in the environment. Read on 13.04.2018. <https://recycle.net/>

Rodriguez, F. 1999. Plastic: Chemical compound. Read on 12.04.2018. <https://www.britannica.com/science/plastic/Introduction>

Ryabko, V. 2014. Secret life of plastic bottle. Greenpeace website. <http://www.greenpeace.org/russia/ru/news/blogs/green-planet/blog/51424/>

Separate Collection. Saint-Petersburg. 2018 Read on 01.12.2017. <https://www.rsbor.ru/geo/spb/>

Skopinzeva, E. 2017. We cannot go without a plastic bottle. Economics and life magazine. Read on 14.05.2018. <https://www.eg-online.ru/article/338835/>

Statistics Finland. Municipal waste by treatment method in 2002 to 2015. Read on 01.12.2017. https://www.tilastokeskus.fi/til/jate/2015/jate_2015_2016-12-20_tie_001_en.html

Suomen Palautuspakkaus Oy. 2016. Palpa beverage container return systems. Official YouTube channel. Published on 17.10.2016

Th.Dubach. 2014. Polyesterification reaction in the production of PET. Wikipedia commons

The Association of Plastic Recyclers. 2018 Caps on -Frequently Asked Questions. Read on 12.04.2018. <http://www.plasticsrecycling.org/education/faqs/caps-on>

The Finnish Innovation Fund Sitra. 2017. Deposit-based recycling system for drinks packaging. Read on 08.05.2018. <https://www.sitra.fi/en/>

ThomasNET. Data, platform and technology company. 2018 Plastic Bottle Manufacturing. <https://www.thomasnet.com/>

Tishenko, M. 2017. Income from waste. <https://russian.rt.com/russia/article/387215-razdelnyi-sbor-othodov>

Tomia. 2006. Plastic recycle logo PET, Polyethylene Terephthalate. Wikipedia commons
UK Cancer Research. 2018 Plastic bottles and food containers. Read on 12.04.2018. <http://www.cancerresearchuk.org/about-cancer/causes-of-cancer/cancer-controversies/plastic-bottles-and-cling-film>

United Lawyers. 2018 Licence. Read on 03.12.2017. <https://www.ulc.ru/licenzija-na-transportirovanie-TBO-TKO-i-musora/>

United States Environmental Protection Agency. 2015. Energy impacts. Archive document, 3

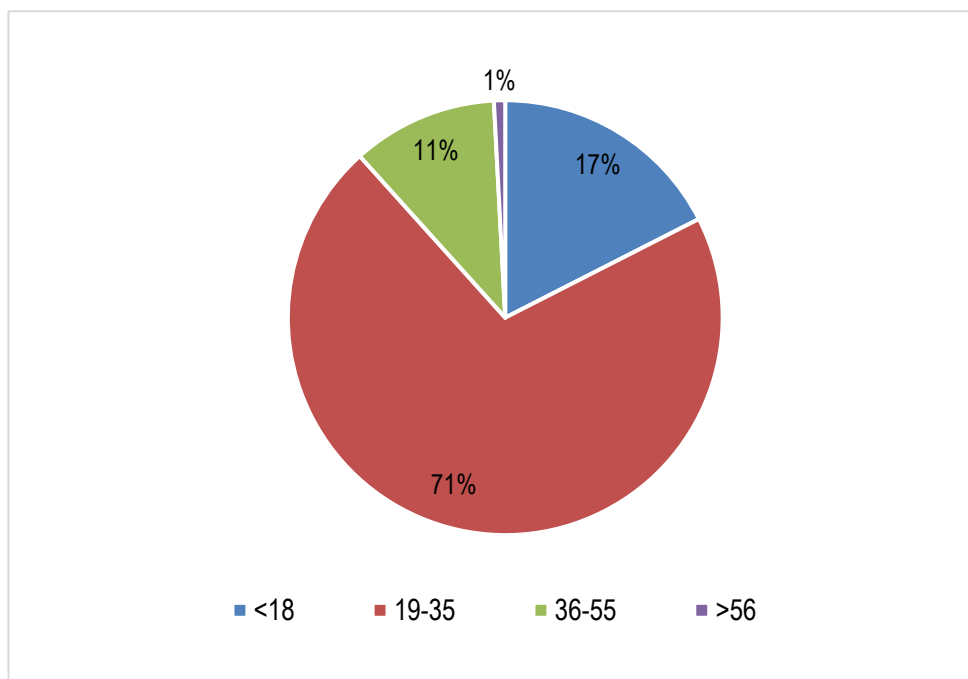
Velikorezkay, M. 2016 . Interview to RG.ru. <https://rg.ru/2016/06/06/rossiiane-gotovy-sortirovat-musor-bylo-by-kuda.html>

Vtorothodi. 2018 Ways of MSW utilization in Russia. Read on 03.12.2017.<http://vtorothodi.ru/utilizaciya/vyvoz-i-utilizaciya-tbo>

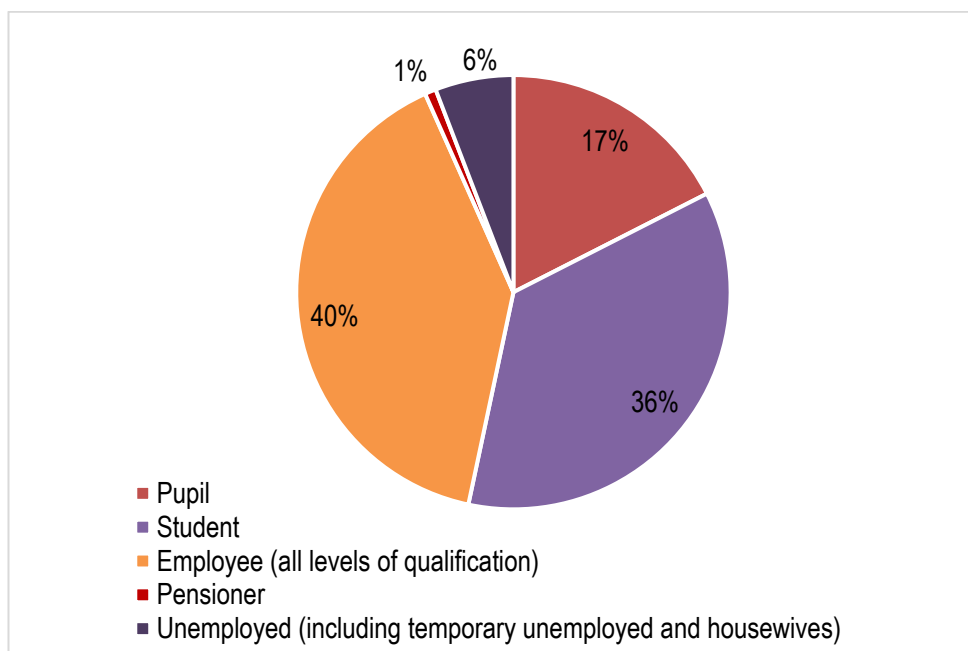
APPENDICES

Appendix 1. Survey in English with answers (translated from Russian language)

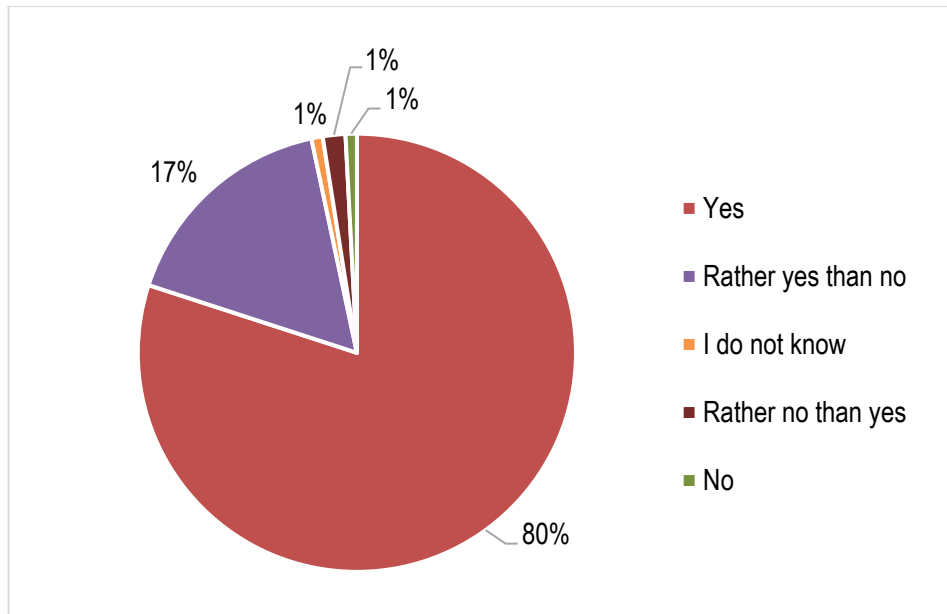
1.1 Please specify your age:



1.2 Please specify your occupation:



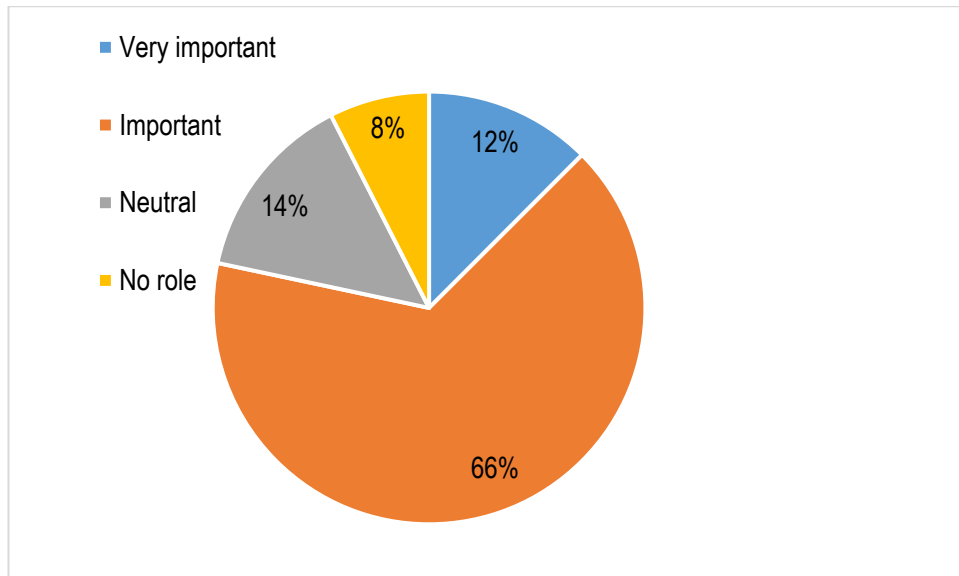
1.3 In your opinion, should we pay more attention to environmental problems?
(air, soil, water pollution)



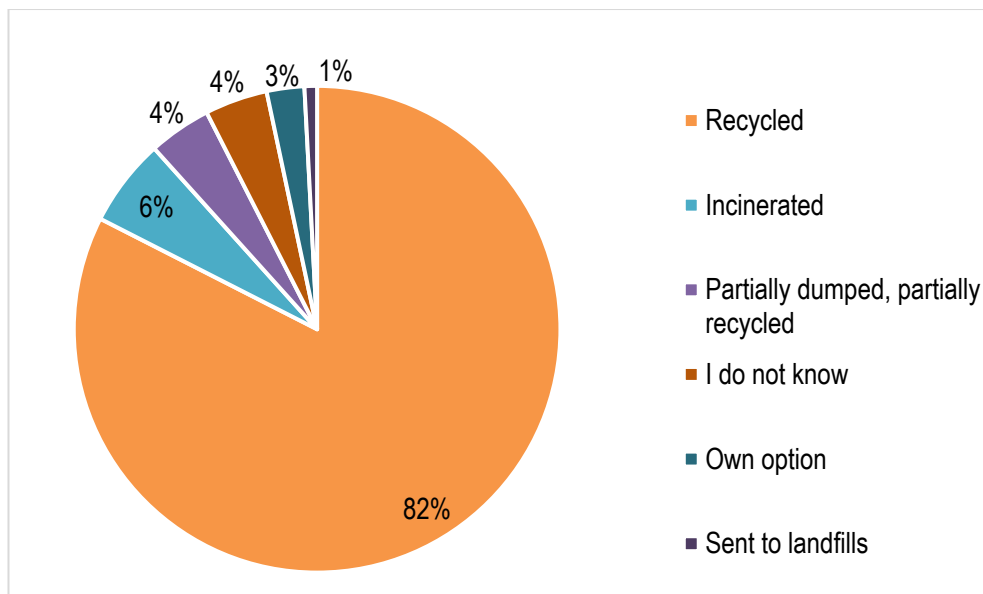
1.4 In your opinion, who should be in charge for environmental preservation and improvement?



1.5 Describe which role in your life plays environmental practices? Examples of environmental attitude are: reasonable consumption, water/electricity saving, preference to high-quality and durable goods, collecting batteries and lamps for recycling centers, utilization of eco-friendly household chemicals, purchase of eco-friendly products, etc



1.6 The vast majority of household waste are dumped, where they are decomposing in dozens of years. Recycling helps to save natural resources and clean environment from rubbish. It is also possible to incinerate the waste (hard, dry and not dangerous) in order to get electricity. In your opinion, how waste should be utilized?

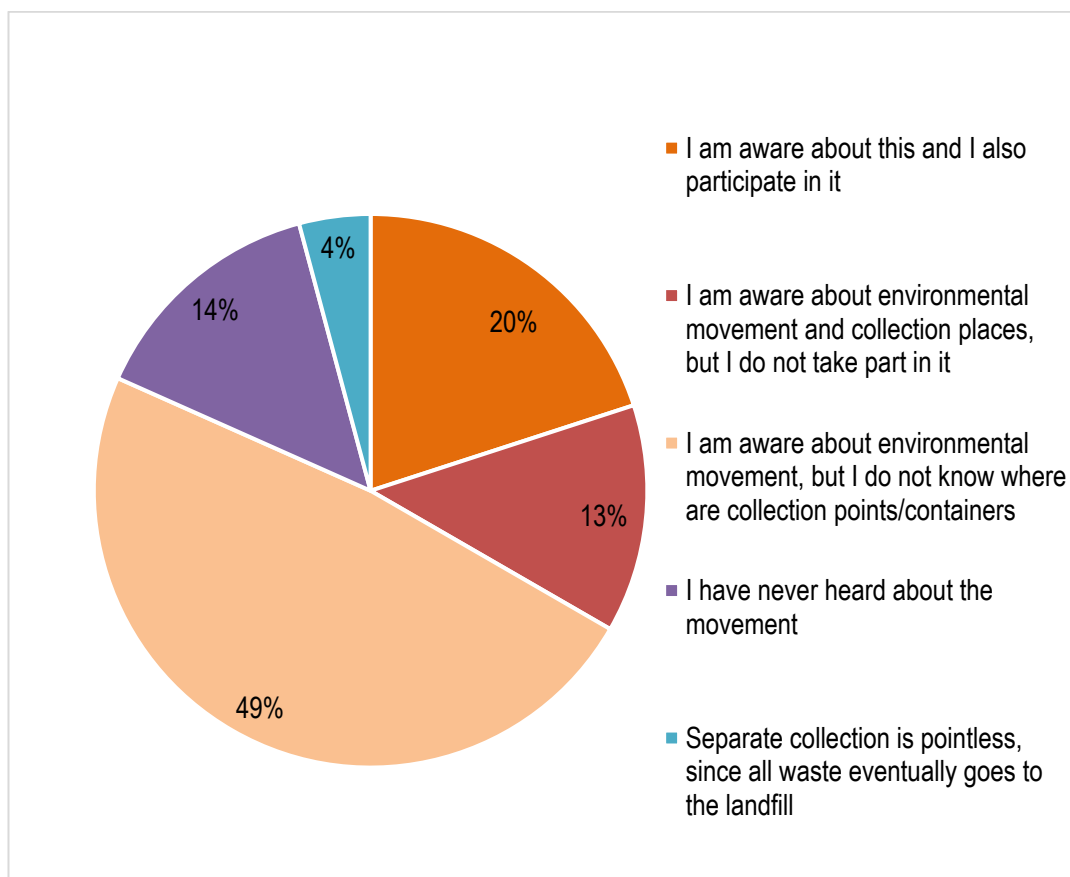


Your option: recycle as much as possible, the rest is incinerated

Your option: economical evaluation for each case

Your option: recycle and create closed life cycle

1.7 Separate collection is actively developing in Saint-Petersburg. There are waste containers near houses, collection points are established once in a month. How well are you aware of this?



Opinions given by responders, which are all included in figure under the name: “Separate collection is pointless since all waste eventually goes to the landfill”:

Your option: Useless activity, without proper legislation and ideology it would not work

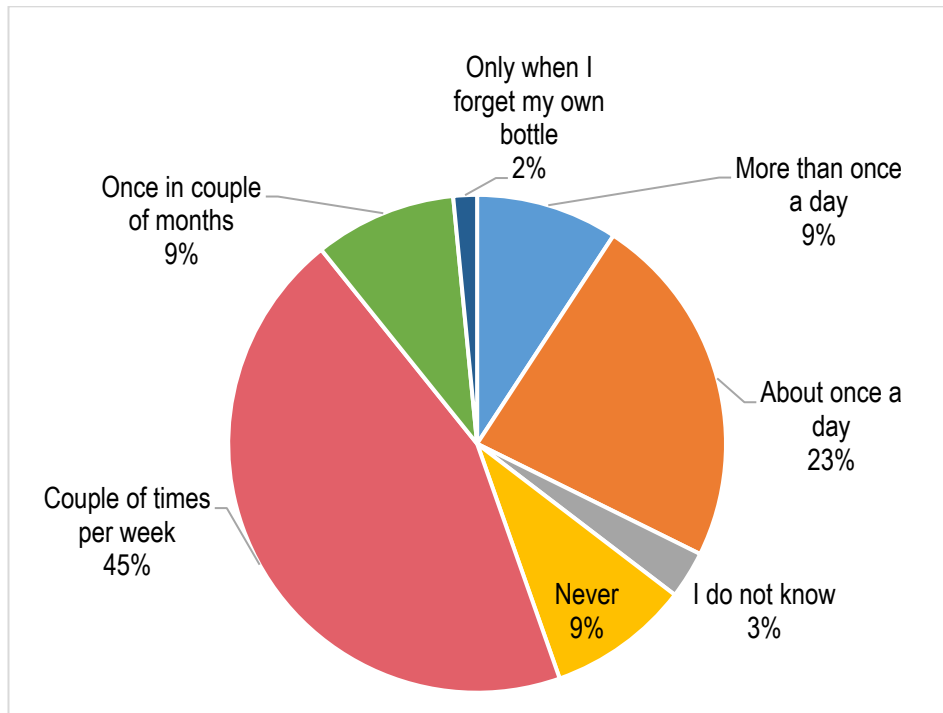
Your option: I have heard about this absurd activity and have seen how collection company is taking all separated waste in one pile

Your option: I do not see mass movement, and I am not sure that separated waste will be recycled afterwards

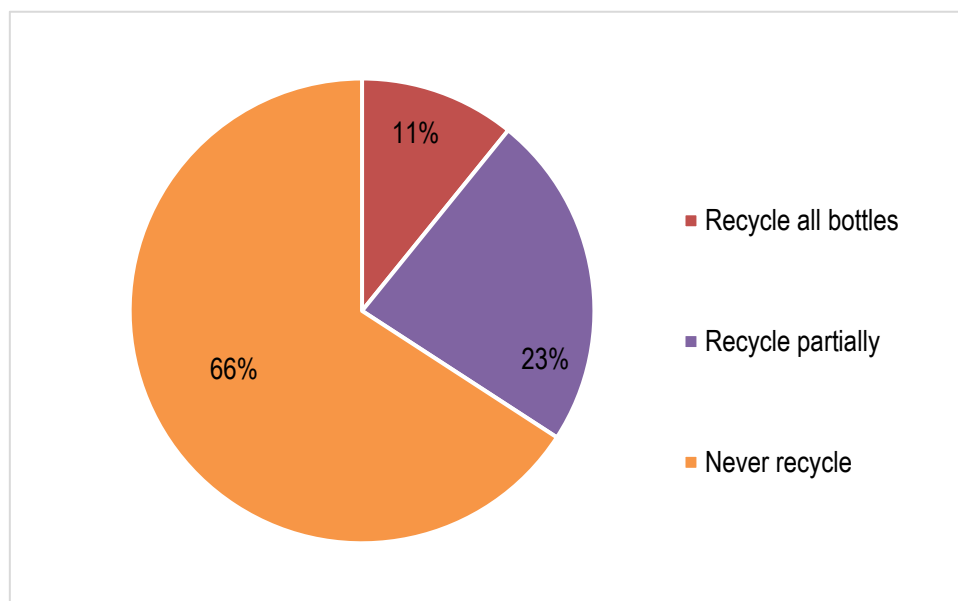
Your option: All separated waste goes to one pile and then to landfills/incineration plant

Your option: Waste separation is useless nowadays, because all waste is eventually brought to landfill

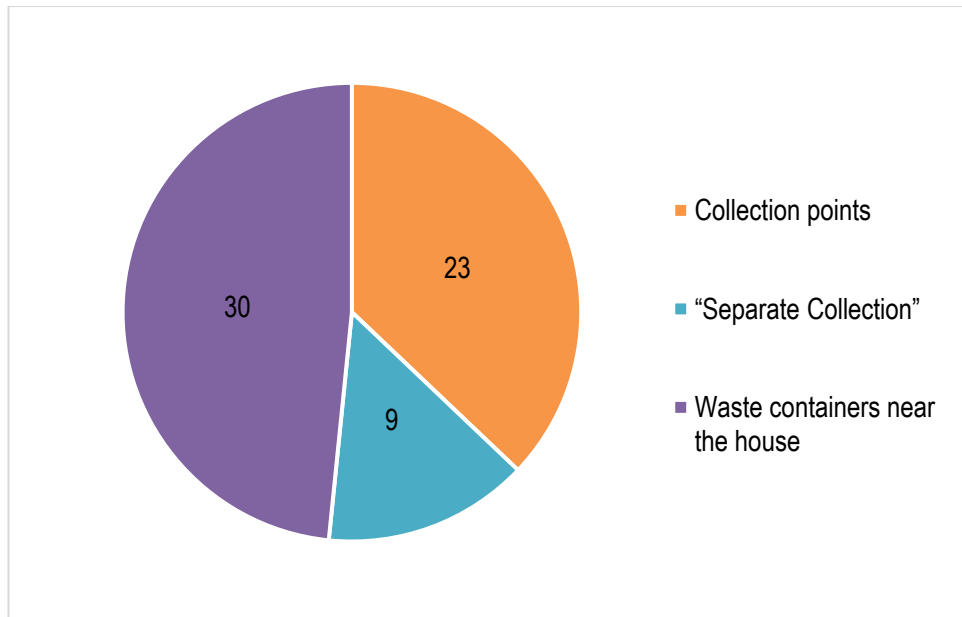
1.8 How often do you purchase beverages in plastic bottles?



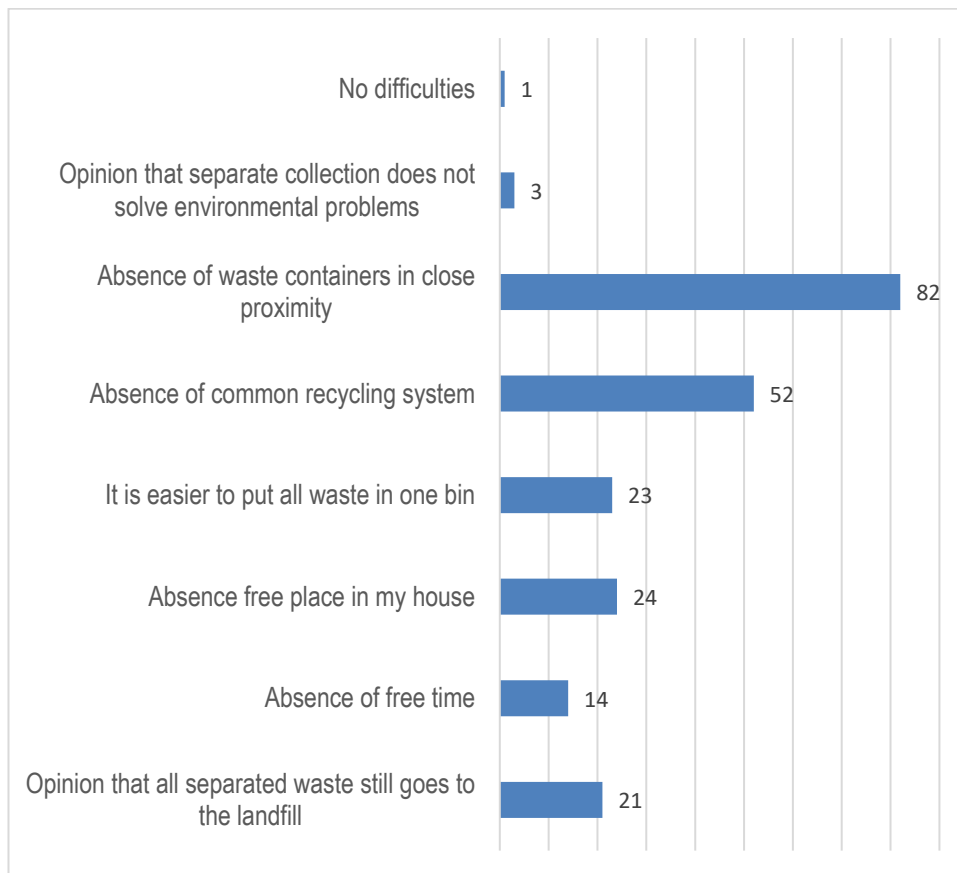
1.9 Waste can be separated into several categories, beverage plastic bottle is one of them. Bottles can be brought to waste containers (if they are near the house) or to the collection point. How do you utilize used PET bottles?



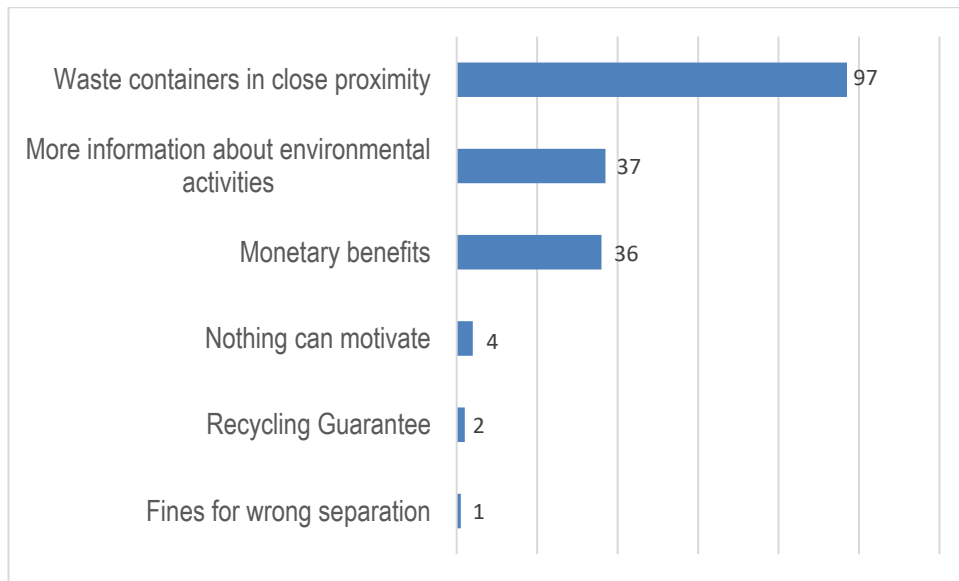
1.10 If you recycle plastic bottles, then to which collection points do you bring them?



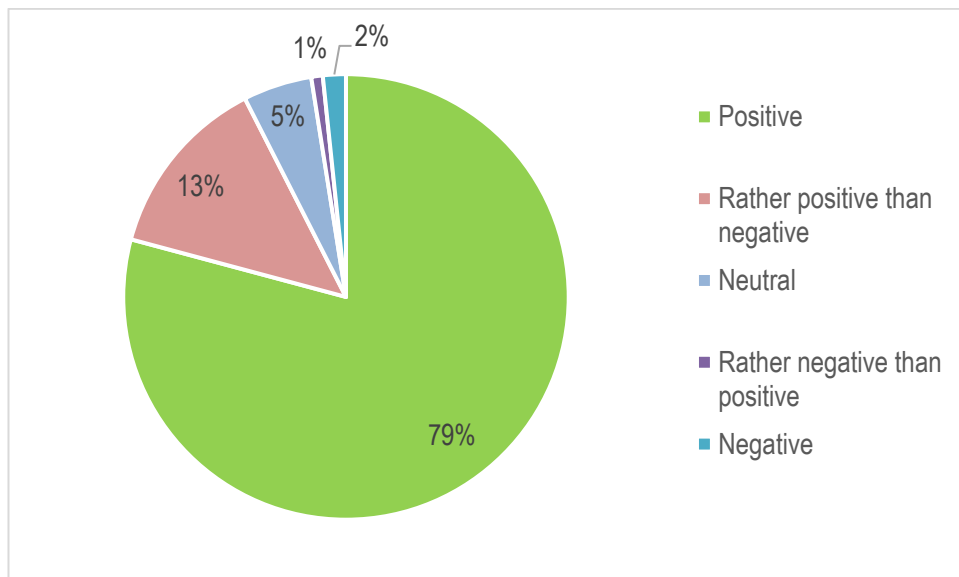
1.11 What is the biggest difficulty for you in separate collection? (multiple choice answers)



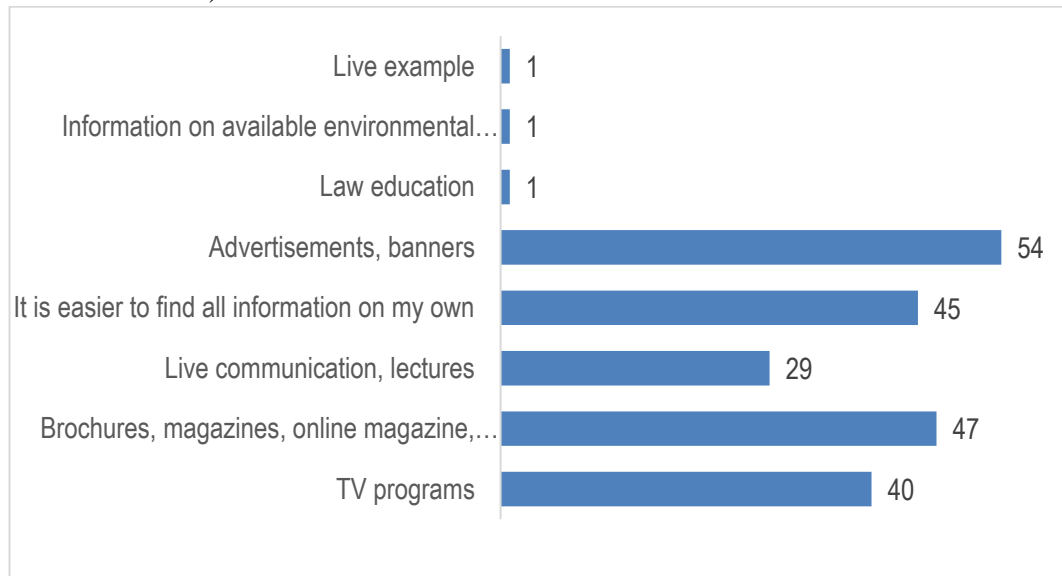
1.12 What could be your motivation for separate collection? (Multiple choice answers)



1.13 In Finland, as in many European countries, deposit based collection is utilized for plastic bottles recycling. Bottle prices has are written separately in recipe. Price depends on the bottle's weight: in Finland bottles of 0,5L and 1L cost 20 cents (15 rubles) and 40 cents (30 rubles) correspondingly. Deposit is reclaimed when returning bottles to vending machines. How would you feel if the same system is integrated in Saint-Petersburg?



1.14 What of types of environmental education do you prefer? (multiple choice answers)



Appendix 2. Original survey (in Russian language).

Переработка пластиковых бутылок в Санкт-Петербурге

Дорогие друзья! Моя дипломная работа посвящена переработке пластиковых бутылок в Санкт-Петербурге, и Ваши ответы сильно помогут в описании текущей экологической ситуации. Спасибо большое за Ваше участие и время!

Укажите Ваш возраст: *

- ☐ <18 лет
- ☐ 19-35 лет
- ☐ 36-55 лет
- ☐ >56 лет

Ваш род занятий: *

- ☐ Школьник
- ☐ Студент
- ☐ Рабочий (любой уровень квалификации)
- ☐ Пенсионер
- ☐ Безработный (в том числе временно неработающие и домохозяйки)

Считаете ли Вы, что необходимо уделять больше внимания проблемам экологии? (загрязнение воздуха, почвы, воды, и другие) *

- ☐ Да
- ☐ Скорее да, чем нет
- ☐ Не знаю
- ☐ Скорее нет, чем да
- ☐ Нет

По Вашему мнению, кто должен быть ответственным за сохранение окружающей среды? *

- ☐ Государство
- ☐ Инициативные предприятия и организации
- ☐ Каждый человек несет экологическую ответственность
- ☐ Отдельные инициативные люди
- ☐ Не знаю
- ☐ Другое...

Охарактеризуйте какую роль в Вашей жизни играет защита окружающей среды. *

Примерами бережного отношения к природе можно назвать: разумное потребление, экономия воды/электричества, отдача предпочтения качественным и долговечным вещам, сортировка отходов, сдача батареек и ламп в специальные пункты приема, использование экологически безопасной бытовой химии, покупка экологически сертифицированных продуктов, и т.д

- ☐ Очень важную. Экологические практики являются важной частью м...
- ☐ Важную. Иногда я руководствуюсь экологическими принципами
- ☐ Нейтральную. Единственная мотивация для моих экологических пра...
- ☐ В данный момент экологические практики отсутствуют в моей жизни

Подавляющее большинство отходов в России ^{*} отправляются на полигоны для захоронения, где остаются на десятилетия. Переработка материалов позволит сэкономить природные ресурсы и очистить нашу природу. Можно отправлять и на мусоросжигательные заводы, где неразделенные отходы (твердые, сухие и неопасные) сжигаются для получения электричества. По Вашему мнению, как нужно обращаться с использованным сырьем?

- ☐ Отправлять на полигоны
- ☐ Частично захоранивать, частично перерабатывать
- ☐ Перерабатывать насколько есть возможность
- ☐ Отправлять на мусоросжигательный завод
- ☐ Не знаю
- ☐ Другое...

В Санкт-Петербурге активно развивается ^{*} раздельный сбор отходов. Появляются специальные контейнеры рядом с жилыми домами, проводятся ежемесячные акции по приему различных отходов. Насколько Вы осведомлены об этом?

- ☐ О разделении отходов знаю и сам в этом участвую (как минимум, сдаю)
- ☐ О разделении отходов и мест сдачи знаю, но в этом не участвую
- ☐ О разделении отходов знаю, но о пунктах приема не осведомлен_а
- ☐ Никогда не слышал_а об этой инициативе
- ☐ Другое...

Как часто Вы покупаете напитки, включая питьевую воду, в пластиковых бутылках? *

- ☐ Чаще одного раза в день
- ☐ Примерно раз в день
- ☐ Пару раз в неделю
- ☐ Несколько раз в месяц
- ☐ Никогда
- ☐ Не знаю
- ☐ Другое...

Отходы можно сортировать на несколько категорий, и питьевые пластиковые бутылки одна из них. Можно воспользоваться контейнерами для сбора бутылок (если они установлены рядом с Вашим домом) или сдать в специальные пункты приема. Как Вы обращаетесь с использованными пластиковыми бутылками? *

- ☐ Все бутылки сдаю для переработки
- ☐ Иногда сдаю
- ☐ Никогда не пользуюсь местами сбора

Если Вы сдаете пластиковые бутылки, то куда именно:

- ☐ В пункты приема
- ☐ На ежемесячные акции Раздельного сбора
- ☐ В контейнеры, установленные рядом с домом
- ☐ Другое...

Какие сложности Вы видите в сортировке бытовых отходов? *

- ☐ Не вижу смысла в идее раздельного сбора, потому что считаю, что в...
- ☐ Нет времени
- ☐ В моей квартире/доме нет для этого места
- ☐ Удобно выкидывать в одно ведро. Пусть сортируют уже в специализ...
- ☐ Отсутствие общей системы раздельного сбора. Усилия одного челов...
- ☐ Рядом с моим домом нет контейнеров для раздельного сбора. Если ...
- ☐ Раздельный сбор отходов не решает проблем экологии
- ☐ Другое...

Что могло бы Вас мотивировать на разделение отходов? *

- ☐ Появление специальных контейнеров в близкой доступности
- ☐ Материальное поощрение (например, уменьшение тарифов на выво...
- ☐ Больше информации об экологическом движении
- ☐ Ничто не может послужить мотивацией
- ☐ Другое...

В Финляндии, как и во многих других европейских странах, действует депозитная система переработки пластиковых бутылок. В стоимость бутылки входит залог за тару, которая отдельно пробивается в чеке. Цена зависит от объема: залоговая стоимость бутылок на 0,5 литра и на 1 литр в Финляндии составляет около 15 и 30 рублей соответственно. Деньги возвращаются при возврате пустых бутылок в специальные автоматы. Как бы Вы отнеслись к внедрению такой системы в Санкт-Петербурге ? *

- ☐ Положительно
- ☐ Скорее положительно, чем отрицательно
- ☐ Нейтрально
- ☐ Скорее отрицательно, чем положительно
- ☐ Отрицательно

Какие способы экологического просвещения подходят Вам больше всего? *

- ☐ Телевизионные передачи
- ☐ Брошюры, интернет-рассылка, газеты
- ☐ Живое общение, лекции
- ☐ Всю информацию мне легче всего находить самому/самой
- ☐ Реклама, плакаты
- ☐ Другое...

Ваши комментарии+ какие ещё аспекты можно упомянуть в опросе?

Развернутый ответ
