



Assessment of effectiveness of composting process, benefits of composting on local pollution level and expected long-term environmental impact in Borski district, as well as overall effect of implementation project „Preservation and improvement of the environment in the cross-border region through composting of biodegradable waste“

DECEMBER 2017





BASELINES	4
INTRODUCTION	4
CURRENT SITUATION IN THE SECTOR	5
GOALS AND THE METHODOLOGY OF RESEARCH	5
REVIEW AND BASIC CHARACTERISTICS OF THE TERRITORY	7
BASIC INFORMATION ABOUT THE REGION	7
THE MUNICIPALITY OF BOR	7
THE MUNICIPALITY OF KLADOVO	8
THE MUNICIPALITY OF MAJDANPEK	8
THE MUNICIPALITY OF NEGOTIN	8
WASTE RECYCLING AND OTHER FORMS OF WASTE USE	8
REVIEW OF THE STATE BY MUNICIPALITIES	8
OTHER TREATMENT OPTIONS	10
BIODEGRADABLE WASTE	10
QUANTITIES AND COMPOSITION OF WASTE	10
RESEARCH OF OPINIONS OF INTERESTED PARTIES	12
SURVEY QUESTIONNAIRE	12
RESEARCH RESULTS	15
CONCLUSIONS OF THE RESEARCH	26
RECOMMENDATIONS	27



Summary

The Assessment of effectiveness of the composting process, benefits of composting on the local pollution level and expected long-term environmental impact in the Borski district, as well as the overall effect of the implementation project was conducted within the project "Preservation and enhancement of the environment in the border region through composting of biodegradable waste" which is funded by the European Union within the Interreg IPA CBC Program Bulgaria-Serbia.

The study included 101 representatives of the target groups in the Bor region and was conducted during November and December 2017.

The Municipalities of the Bor district are included in the regional system of solving the problem of waste management in the context of regional landfill "Halovo 2", which is located in Zajecar. For this purpose the Regional Waste Management Plan for the city of Zajecar and municipalities Boljevac, Bor, Kladovo, Majdanpek, Negotin and Knjaževac (below: RPUO) was created.

A waste management system was proposed within the RPUO which implies a waste collection system with two containers (a recycleable waste container and container for other mixed waste). Recycleable waste bins shall contain recycleable raw material while the bins for other mixed waste shall contain other material to be forwarded for biological stabilization treatment.

This will have a direct impact on reducing the amount of biodegradable waste that will be disposed in a landfill. The plant for the biological stabilization of the waste will be collected in a container for other mixed waste stabilization to reduce the organic content of the waste in order to meet the requirements of the EU directive on landfills. The fractions formed by this treatment represent stabilized waste to be disposed of in a landfill.

In addition to this the presented system, it's important to reduce the amount of other mixed waste at the place of origin, in order to reduce the cost of collection and transportation of waste. In addition, in this manner compost would be produced which households could use for their own purposes.

Within the realization of the stated action, a number of promotional and informative activities were realized with the objective of enhancing citizens' public awareness regarding proper waste management and reduction of generated waste quantities in the place of origin. In addition, composting equipment was procured through the action (30 composters and one mobile shredder), which were provided for use to the project target groups.

The research key conclusions are as follows:

- Nearly 60% of the surveyed persons did not take part in the project activities, and only 8 of the questioned are beneficiaries of the equipment obtained through the Project, so we consider the results representative (the obtained results are not dominated by the project beneficiary impact).
- Over 90% believe that waste presents a great or very large problem in their municipality which presents an increase of about 10% in relation to the poll conducted at the beginning of the Project realization. This indicates that the Project has succeeded in enhancing the awareness of the population on waste issues.
- In relation to the initial research, a substantial increase (by almost 30%) may be noticed with those who know what composting is and around 25% who are currently aware that composting may be done in households.
- The surveyed persons believe that around 54% of the total waste quantities generated in the surveyed households/businesses waste may be composted. This information is now even closer to the data originating from RPUO.
- The substantial level of awareness is indicated by the fact that almost 80% of the examinees believe that by composting, the amount of generated and deposited waste is reduced and around 83% and that



composting benefits the protection of the environment and around 92% of the surveyed believes that household waste compost contributes to the protection of the environment and natural resources.

- Within the Project, great attention was dedicated to the promotion and informing the local population because 78% was informed on the Project realization in their municipality.
- It is a very positive fact that around 75% of those surveyed had changed something in their approach regarding waste management in the last 12 months.
- It is encouraging information that with most of the respondents who had begun with composting, good results have been achieved and they are satisfied.
- The respondents are now more aware of the seriousness composting demands and the number of those who would prefer doing it themselves has been reduced. There is an increase in the number of those who believe the best solution is to have a specialized company collecting biodegradable waste and composting it thereafter.
- The respondents are now more informed regarding the composting equipment costs. In relation to the survey conducted at the beginning of the action, there is an apparent reduction in the number of those who believe the equipment costs more and increase in the number of persons who think the equipment costs less.
- It is encouraging information that around 68% of the surveyed persons would probably begin with composting if they received composting equipment.
- Respondents are currently more aware of the fact that biodegradable waste comprises a significant portion in communal waste collected from the local communal company and is further deposited and now the principal reason for initiating composting is the situation where the communal waste transportation service would be charged according to quantities.



BASELINES

Introduction

The evaluation of the efficiency of composting, benefits of composting for the reduction of pollution level in the local community, the expected long-term environmental impact in Borski District, as well as the overall effect of project implementation were carried out within the project "Preservation and improvement of the environment in a cross-border region through the composting of biodegradable waste" which is financed by the European Union within the framework of the Interreg IPA CBC Program Bulgaria-Serbia.

INTERREG - IPA CBC Bulgaria - Serbia Program is designed within the European strategy for smart, inclusive and sustainable growth and relevant national strategic documents. The program continues the evolution of EU cross-border initiatives, reflected in the Neighborhood Program from 2004 to 2006 and the IPA Cross-Border Cooperation Program between Bulgaria and Serbia 2007-2013. Additionally, the Program contributes and interacts with the EU macro-regional strategy for the Danube Region, designed for countries and regions that share common needs and goals within the region. The program is co-financed by the European Union through the Instrument for Pre-accession Assistance II and it is co-financed by Bulgaria and Serbia as well

The program area includes 13 administrative units: 6 districts in Bulgaria - Vidin region, Montana region, Vratsa region, Sofia region, Varna region and Vidin region, which correspond to the level of NUTS III (EUROSTAT) and are equivalent to NUTS III 7 districts in Serbia - Borski district, Zaječarski district, Toplički district, Nišavski district, Pirotski district, Jablanički district and Pčinjski district.

The program faces two main challenges in order to create a positive socio-economic environment necessary for the development of the border area:

- Investing in efficient valorization and efficient management of the territory;
- Increasing cross-border networks, interactions and connections in social, economic and environmental spheres.

This ultimate goal is the basis of the strategic framework of the Program, which points to three out of eight thematic priorities listed in Annex III of (EU) Regulation No.231 / 2014, namely:

- Encouraging tourism and cultural and natural heritage;
- Investing in youth, education and skills;
- Protecting the environment and promoting adaptation to climate change and their mitigation, risk prevention and management.

The project "Preservation and improvement of the environment in the cross-border region through composting biodegradable waste" is funded within the first Call of the Program and aims to stimulate a balanced and sustainable development of the border region through adaptation to environmental changes and smart economic growth.

The specific objectives of the project are:

- Promoting and improving the use of common natural resources and encouraging nature protection through the implementation of joint environmental protection activities;
- Raising public awareness about the reduction and reuse of biodegradable waste;



- Capacity building of relevant state authorities and stakeholders on waste reduction and re-use issues;
- Preserving and improving the quality of soil, water and air;
- Improving local environmental protection policy.

Current situation in the sector

In the modern world of industrialization, the amount of waste has become a serious danger and threat to the ecosystem's balance. Consumption of chemical fertilizers and pesticides is constantly increasing; fertile soil becomes infertile land full of waste. Disposal of waste to landfills creates conditions for emissions of gases, which are a prerequisite for the so-called greenhouse effect and global climate changes. Studies show that the greenhouse effect will increase the temperature from 1.4 ° C to 5.8 ° C. After 30 years, the Earth's temperature will be 0.3 ° -1.3 ° C higher than today. Already in the XX century temperature was increased for approximately 0.6 ° C. This stipulates taking urgent measures for reducing negative effects. The area of Vidin and Borski District is mainly rural and covered with forest, with very favorable climate and natural resources. As a result, there are significant quantities of biodegradable waste - fresh and dried leaves, grass, branches, bushes, fertilizers, food waste, etc. But in the region there is a lack of sufficient information and conditions for composting biodegradable waste and, in most cases, people use illegal dumps to get rid of "unnecessary" waste or burn it, which pollutes the land, water and air. Undeveloped awareness of composting and its advantages is the reason why this method of recycling waste is not widespread in the cross-border region. In fact, composting biodegradable waste results in a sustainable reduction of waste over a long period of time. Negative effects of human activities on the environment and on the reduction of emissions of harmful gases during transport and disposal of waste are limited, which in the long term prevents pollution of soil and water. The project contributes to the development of environmentally friendly behavior among target groups, to their active participation in environmental protection and supports cleaner and safer living conditions.

The project "Preservation and improvement of the environment in the cross-border region through the composting of biodegradable waste" proposes measures aimed at meeting the needs of target groups by providing them with an efficient, low-cost and high quality product - compost, which can increase soil fertility and improve the quality of their production. On the other hand, composting biodegradable waste results in a long-term sustainable reduction of waste.

Project activities related to sustainable waste management and composting of biodegradable waste contribute to the reduction of carbon dioxide and methane. Thus, the negative and harmful effects of human activities on the environment and climate changes are limited. Globally, the project contributes to the development of environmentally friendly behavior among target groups and their active participation in the protection of the environment.

Goals and the methodology of research

The aim of the research is to assess the efficiency of the composting process, the advantages of composting over the level of pollution and the expected long-term impact on the environment in Borski District. The assessment was carried out at the end of the project, after the completion of key project activities, in order to assess the success of the project and its impact on the environment and changes in people's thinking and behavior.

Target groups: users of equipment procured through the Project, households, farmers, decision makers at local level, local environmental protection agencies, non-governmental organizations, local stakeholders.

Territorial coverage: Borski district, Republic of Serbia

The research was conducted by the Agency K KONSALTING from Kraljevo.



The research was carried out according to the following methodology:

- Planning the research, developing a work plan and producing an "exit" survey for assessing the effects of composting,
- Approval of the "exit" survey by the Municipality of Kladovo,
- Detailed mapping of target groups representatives and selection of participants in the survey,
- Visits to the target region, contacting representatives of target groups, organizing meetings, interviewing and filling in "exit" questionnaires. 101 questionnaires were filled,
- Review, summary, processing and analysis of collected data,
- Creation of "Final Assessment" of the impact of composting on the level of pollution in the target region, with conclusions and recommendations,
- Creation of the "Final Assessment" Summary in English
- Submission of the Final Assessment and Summary to the Municipality of Kladovo.



REVIEW AND BASIC CHARACTERISTICS OF THE TERRITORY

Basic information about the region

Borski region is located in the east of Serbia, it covers an area of 3507 km² and according to the 2011 Census it is inhabited by 124,992 inhabitants.

Table 1. Population data by municipalities in Borski District

Municipality	Number of inhabitants	Percentage of urban population	The number of urban population	Percentage of rural population	The number of rural population
Bor	48615	70.26	34160	29.73	14455
Kladovo	20635	47.15	9729	52.85	10906
Majdanpek	18686	54.10	10109	45.90	8577
Negotin	37056	45.56	16882	54.44	20174

Source: Statistical Office of the Republic of Serbia 2011

Table 2. Data on the area and number of settlements in the municipalities of Borski District

Name of the city/ municipality	Surface area (km ²)	Number of settlements	City settlements	Other settlements
Bor	856	14	1	13
Kladovo	629	23	2	21
Majdanpek	932	14	2	12
Negotin	1090	39	1	38
Total:	3507	90	6	84

The Municipality of Bor

Municipality of Bor with its 856 km² (source of the Statistical Office of the Republic of Serbia for 2011) belongs to the larger municipalities in Serbia. According to the 2011 Census, 48,615 inhabitants live in 14 settlements on the territory of the municipality. The average population density of the municipality is 57 inhabitants per km², which is the highest density of population in Borski District. The population index in the entire municipality is 87.1 for the period 2011/2012. No settlement has any positive growth. The number of households is 17,103 and the average number of members per household is 2.84.

Collecting, transporting and depositing waste in the territory of Bor municipality was entrusted to PUC "3. October", which was established as a public company with the current organization on December 14, 1989. by the Decision on the establishment of the Public Utility Service "3. October".

The problem of waste in the municipality of Bor, communal and industrial, is significant, since there were no control and planning activities on the arrangement of existing waste disposal zones. The municipal waste landfill is located in the immediate vicinity of the city, in the abandoned part of the excavation, so there were no investments in its arrangement. The rehabilitation project has been completed, but the works have not yet been completed. Waste is disposed of without any prior treatment or overlaying with soil after disposal. There is a large number of uncontrolled dumpsites and large quantities of rejected waste (wild dumps) in the vicinity of the city and village settlements.



The Municipality of Kladovo

According to the 2011 Census, there are 20,635 inhabitants in the municipality. The population density is 33 inhabitants per 1 km² (Statistical Office of the Republic of Serbia RZS, 2011). The municipality is located in the far north-east of Serbia and is the last point in the east towards Bulgaria and Romania, and it also borders with the municipalities of Negotin and Majdanpek. The area of 629 km² is covered by Ključ area, which is named after the great Danube meander, as well as the parts of the Đerdap Gorge (Pečka moor - Davidovac) and Negotinska Krajina (Slatinska river - Milutinovac). The Municipality of Kladovo covers 23 settlements, 2 towns with a total of 9,729 inhabitants - Kladovo (8,869) and Brza Palanka (860) and 21 rural villages with a total of 10,906 inhabitants.

By the decision of the municipal authorities of the PUC, "Komunalac' Kladovo" operates as a public utility company from June 21 st, 1991. The activity of the company is collection and disposal of waste produced in the municipality of Kladovo, as well as the maintenance of the landfill.

The Municipality of Majdanpek

The Municipality of Majdanpek extends to 932 km², and according to the 2011 Census, there are 18,686 inhabitants in the municipality. The average population density of the municipality is 20 inhabitants per 1 km², which classifies it as the least populated municipality in Borski District. The total population index for the period 2011/2012 is negative, 78.9. The downward trend in the number of inhabitants still continues.

By the decision from 2014, the Public Utility Company "Vodovod" Majdanpek was founded. PUC " Vodovod " has been conducting the tasks of municipal waste disposal since 2014.

The Municipality of Negotin

Municipality of Negotin covers 1090 km². According to the 2011 Census, there are 37,056 inhabitants in the municipality. The average population density of the municipality is 34 inhabitants per km². The population index in the entire municipality is only 85.3 for the period 2011/2002. The number of households is 13,906, and the average number of members per household is 2.66.

According to the Law on Communal Activities ("Official Gazette of the Republic of Serbia", No. 16 / 97, 42 / 98) Municipal Assembly of Negotin, has made a decision in 2011. to maintain cleanliness, which also involves the collection and disposal of municipal waste. According to Article 10 of the Decision on maintenance of cleanliness (Official Gazette of the municipality of Negotin No. 12/2011 from May 9th, 2011), the Public Utility Company Badnjevo Negotin, as a commissioner of communal activities, has determined and defined the conditions for collecting and disposing communal and commercial waste.

WASTE RECYCLING AND OTHER FORMS OF WASTE USE

Review of the state by municipalities

The Municipality of Bor

PUC "3. Oktobar "has installed 97 wire containers for PET packaging, in the city, in Borsko Lake, as well as in the vicinity of the villages, and secured the market for this secondary raw material. Annually approximately 7,000 kg of PET packaging is extracted and this is the only form of recycling in this municipality so far. The Professional



Service of the Municipality of Bor organized the collection and purchase of cans in all urban and rural elementary schools and supported the initiative of the ecological NGO in the collection of nickel-cadmium batteries for citizens, including children through the continuation of environmental education and ensuring their transportation through PUC to recycling companies.

In the municipality of Bor, we mostly face unorganized and individual forms of recycling, in terms of self-initiative and poorly organized actions that do not encounter an adequate response from citizens. They are mainly reduced to the actions of the Roma population aimed at collecting PET packaging, cardboard packaging and old newspapers. An example of good practice was the kindergarten action called "Old Newspapers for New Toys" as well. In a few places in the city, you can find recycling of cartridges, cardboards, etc.

There is also one recycling center in Bor, where waste paper and cardboard, PET packaging, plastic, aluminum and steel cans, as well as glass are treated.

The Municipality of Kladovo

Representatives of the Roma population are dealing with waste separation at the city landfill, which is then sold to private companies engaged in the purchase and recycling of waste. The secondary raw materials market is poorly developed. There are no economic and other incentive mechanisms for the usage of waste materials. There is no separation of waste at the place of its formation by the PUC Standard, except for plastics, on the territory of the municipality of Kladovo. There is no established and developed training and awareness-raising system for waste management.

From recycling activities under the government of private sector, there is a private company in Kladovo that is working on becoming a collection center for primary recycling primarily PET packaging, PVC foils, and old paper in Timočka Krajina. A fenced recycling yard was built, with facilities and accompanying contents.

The Municipality of Majdanpek

In the municipality of Majdanpek there is an organized separation and collection of secondary raw materials from municipal waste, for PET packaging. Containers for PET packaging, 30 pieces of 2 m³, were placed in Majdanpek, Donji Milanovac, Mosna, Golubinj, Toplonica, Boljetin, Oreškovića, Klokočevac and Rudna Glava. The purchase of PET packaging is carried out by "Brzan Plast". In 2015. the quantity of collected PET packaging amounted to 4.5 tons. 576m³ of waste from public areas (grass, branches, etc.) was also disposed at the landfill in 2015. As well as 576m³ of bulky waste and the same amount of construction waste.

The Municipality of Negotin

The primary selection of PET packaging was first implemented in the municipality of Negotin in 2007. by setting up 20 wire containers. That year, a total of 5,260 t of PET packaging was separated. Within the project "Primary selection and recycling - an important step in environmental protection", which was implemented in 2008, Negotin municipality received 100 yellow wire containers for PET packaging, 100 blue containers of 1.1m³ for paper and cardboard, 500 vessels of 140 liters (250 yellow for PET and 250 blue for paper) and a press for PET packaging and paper. Since 2010. the primary selection of PET packaging has not been carried out.

Currently, 75 wire containers for PET packaging are distributed in the territory of the Municipality of Negotin.

In the territory of the municipality of Negotin, as well as in other municipalities of Serbia, the separation of discarded recyclable materials is also included at the place of formation by individual collectors, who separate recyclable materials from vessels or waste containers or at the place of final disposal of waste that is communal landfill at the expense of these organizations. The most common are metal and paper.



Other treatment options

In the territory of municipalities of importance there are no other options for the treatment of generated waste other than landfilling. Municipalities are mostly with a small number of inhabitants in which relatively small quantities of waste are produced, due to which in the previous period the possibilities of any treatment of waste have not been considered. In the following period, one central organic waste composting facility could be considered. In rural areas there is the treatment of organic waste in the form of composting at the level of individual households. When visiting the site and submitting questionnaires, companies and legal entities dealing with other waste treatment options are not identified.

Biodegradable waste

Biodegradable municipal waste is a waste gathered from households and commercial activities that can be subject to biological decomposition. Waste from food and garden waste, paper and cardboard are classified as biodegradable municipal waste. Approximately 60% of municipal waste is biodegradable. In 1995. Approximately 107 million tons of biodegradable municipal waste was produced in the EU, of which 66% was deposited in landfills.

Green garden waste has the possibility of simple composting and application for a wide range of activities: as a natural fertilizer for flower cultures, lawns, etc. While the compost produced by composting and waste from food and green waste due to much lower quality can be used as cover material at landfills, as well as for the processes of rehabilitation of landfills and other waste dumps.

According to Article 40 of the Law on Waste Management, biological treatment of waste is the process of degradation of biodegradable organic waste (paper, cardboard, garden or kitchen waste etc.) in order to obtain useful materials for soil conditioning (compost) and / or energy (methane) and encompasses in particular: composting or anaerobic digestion. Biological treatment of waste is done in accordance with the treatment permit. Biological treatment of waste is done in order to reduce the disposal of biodegradable waste to the landfill that is reducing greenhouse gas emissions and their impact on the environment. Other biological waste treatment technologies are used to reduce hazardous waste characteristics.

The Regional Waste Management Plan for the city of Zaječar and the municipalities of Boljevac, Bor, Kladovo, Majdanpek, Negotin and Knjaževac envisages the construction of a composting plant within the regional landfill in Zaječar, at the location of Halovo II, where the biological stabilization of waste vessels for other mixed waste. This will contribute to reducing the organic share of waste that is deposited in the landfill and to meeting the objectives of the EU Landfill Directive.

Quantities and composition of waste

Estimates of the quantity and composition of waste are given on the basis of information from the Regional waste management plan for the city of Zaječar and the municipalities of Boljevac, Bor, Kladovo, Majdanpek, Negotin, and Knjaževac.

Table 3: Waste quantities in municipalities of Borski District

municipality	Bor	Kladovo	Majdanpek	Negotin
Measured t / per week	162.34	126.52	73.18	190.01
Total collected t / per year	8464.61	6597.38	3815.55	9907.72
Generated quantity kg /st per day	0.66	0.98	0.83	1.14
Generated quantity kg /st per year	239.80	357.04	302.10	417.75
Total generated waste for the whole municipality t /per year	11658.08	7367.51	5645.09	15480.05
Number of service users	35298	18478	12630	23717



Population coverage by utility services%	72.61%	89.55%	67.59%	64.00%
--	--------	--------	--------	--------

Source: Regional Waste Management Plan for the city of Zaječar and the municipalities of Boljevac, Bor, Kladovo, Majdanpek, Negotin Knjaževac

When it comes to comparing waste composition across municipalities, it is possible to notice a great diversity in relation to the representation of different categories of waste, especially when it comes to organic waste fractions, that is, "other biodegradable waste" and "garden waste". Organic fractions are most common in all municipalities, the biggest amount of garden waste is recorded in Negotin (37.53%). The smallest amount of garden waste was recorded in the municipality of Majdanpek (8.24%). The highest values of other biodegradable waste were recorded in Majdanpek (40.36%) and Bor (39.67%), and the lowest in Negotin (29.12%).

Table 4: Composition of waste in municipalities of Borski District

municipality	Bor	Kladovo	Majdanpek	Negotin
Garden waste	12,06%	24,55%	8,24%	37,53%
Other biodegradable waste	39,67%	29,94%	40,36%	29,12%
Paper	4,24%	4,65%	3,93%	2,78%
Cardboard	5,78%	5,31%	3,67%	3,26%
Composite materials	1,07%	1,13%	1,45%	1,16%
Glass	3,02%	4,93%	4,60%	2,42%
Packaging and other metals	0,75%	0,49%	1,16%	0,44%
Aluminum cans	0,40%	0,21%	0,60%	0,21%
PET bottles	4,89%	5,89%	4,58%	3,14%
Plastic packaging waste	1,18%	1,04%	1,32%	0,95%
Plastic bags	10,89%	5,70%	7,13%	4,11%
Hard plastic	1,77%	1,27%	1,47%	1,08%
Textile	2,32%	3,34%	2,04%	1,63%
Diapers	5,31%	3,41%	5,70%	3,31%
Construction waste	0,49%	1,30%	1,39%	0,29%
Electrical and electronic waste	0,08%	0,13%	1,55%	0,03%
Medical waste	0,02%	0,20%	0,00%	0,01%
Leather	0,22%	0,22%	0,16%	0,17%
Wooden items	0,13%	1,52%	1,95%	1,23%
Other waste streams	0,33%	0,75%	1,01%	1,61%
Fine elements <10mm	5,42%	4,02%	7,69%	5,51%

Source: Regional waste management plan for the city of Zaječar and the municipalities of Boljevac, Bor, Kladovo, Majdanpek, Negotin and Knjaževac



RESEARCH OF OPINIONS OF INTERESTED PARTIES

Survey questionnaire

1. How do you assess the problem of waste in Your municipality?
 - Waste represents a major problem
 - Waste represents a big problem
 - Waste does not represent a big problem
 - Waste does not represent any problem at all
2. Do you know what waste composting is?
 - Yes
 - I am not sure
 - No
3. Can composting waste be conducted in the household?
 - Yes
 - No
 - I don't know
4. What do you think, what percentage of the waste produced in your household / business facility is made up of compostable materials? _____%
5. Do you think that composting generally reduces the quantity of waste?
 - The quantity of produced waste is reduced
 - The quantity of produced waste has not been reduced, but due to composting, the quantity of deposited waste has been reduced
 - Yes, the quantity of deposited waste has been significantly reduced
 - Composting does not contribute to reducing the quantity of deposited waste
 - I do not know / I'm not sure
6. Do you think that composting helps protect the environment and natural resources?
 - Yes, composting helps protect the environment and natural resources
 - Composting is a way of forming and strengthening the ecological awareness of the population
 - Composting has a negligible positive impact on the environment
 - Composting has no impact on the environment
 - Composting has a negative impact on the environment
 - I do not know / I'm not sure
7. Do you think composting in the household helps preserve the environment and natural resources?
 - Yes, compost from households directly helps protect the environment and natural resources
 - Yes, compost from households indirectly helps protect the environment through the design and improvement of environmental awareness of the population
 - Household compost has no impact on the environment
 - Compost from the household has a negative impact on the environment
 - I do not know / I'm not sure
8. Do you know that the project "Preservation and improvement of the environment in the border region through the composting of biodegradable waste" has been implemented in your municipality?
 - Yes
 - No
9. If you do know, how did you learn about the project and benefits of composting?
 - From the media
 - From project informative materials
 - From relatives and friends
 - From the project team
 - From the project website
 - From the cross-border cooperation program website
 - Other
10. Have you been involved in some of the project activities (more than one answer is possible)?
 - I participated in an information conference
 - I participated in training
 - I participated in informative days



- I participated in other public events regarding the project (press conferences, informative meetings, others)
 - User: I use pilot equipment for composting / shredding
 - I did not participate in project activities
11. Do you think that due to the project "Preservation and improvement of the environment in the border region, through the composting of biodegradable waste" there was a reduction in the quantity of waste?
- The quantity of generated waste is reduced
 - The quantity of generated waste has not been reduced, but due to composting, the quantity of waste that is deposited in landfills decreases
 - Composting does not help to reduce the quantity of waste that is deposited in landfills
 - I do not know / I cannot judge
12. Has anything changed and what in Your waste treatment approach in the last 12 months (it is possible to give up to 3 answers)?
- I am trying to reduce the quantity of waste that I generate
 - I started composting the waste I generated
 - I started with collecting and a separated disposal of generated waste
 - I am trying to recycle and reuse waste
 - Nothing has changed in the treatment of waste
 - I do not think such events have a positive impact and affect the treatment of waste
 - Other
13. Have you tried to compost waste after receiving information about it within the project?
- Yes, I've tried and the result is good
 - Yes, I've tried, but the compost is still not ready
 - Yes, I tried, but it did not work
 - No, because I do not have the right conditions (space, equipment)
 - No, because there is not enough knowledge
 - I did not get any information / I'm not familiar with the project
14. If you are doing composting, what do you do with the compost?
- I use it for personal needs in my household.
 - I sell it to interested parties
 - Other
15. If you do not compost waste, what are the reasons for that (it is possible to give up to 3 answers)?
- I do not know how to compost.
 - I do not have the appropriate compost vessels.
 - I do not have an appropriate place to do it.
 - I do not have time.
 - Compost has an unpleasant smell and attracts insects and rodents.
 - I do not think I would have any benefit from it.
 - I do not consider it important
16. Would any of the following affect you to start composting biodegradable waste (rank by importance from 1 to 4)?
- Payment for disposed waste by quantity by the utility company.
 - Introduction of financial incentives for composting biodegradable waste.
 - Free distribution of composting vessels.
 - Obtaining information on composting easily and quickly
17. What do You think how much money is needed to purchase composting equipment?
- _____
18. If you were offered to receive composting equipment free of charge, would you begin to compost biodegradable waste generated in your household / business facility?
- Yes • Probably yes • Probably no • No
19. Do you think that after the implementation of the project, there will be new interested parties that will start composting biodegradable waste?
- Yes, there will be many
 - Yes, there will be a few
 - No, there will not be any
 - I do not know / I cannot judge

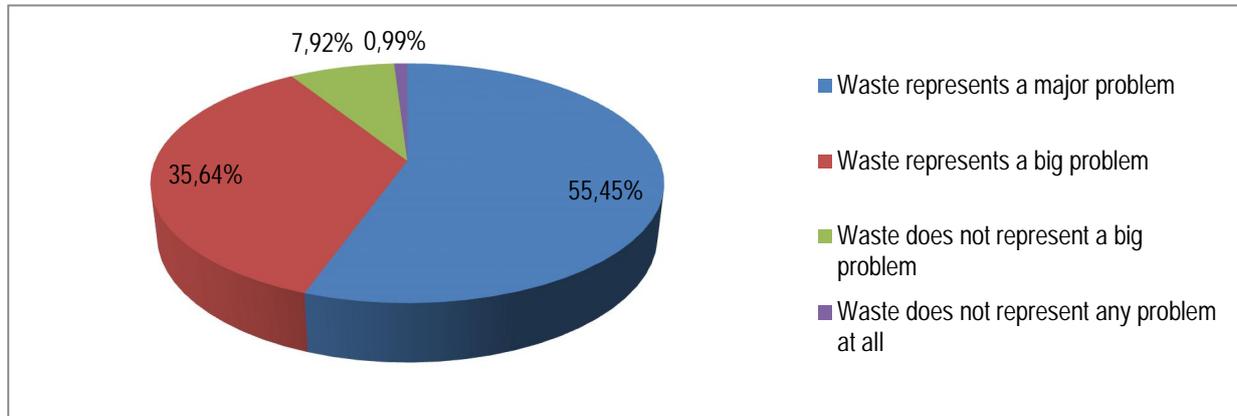


20. If your settlement began with organized composting of biodegradable waste, which way would suit you the best?
- Decentralized - each household / business facility has its own compost vessel.
 - A centralized composting plant that would be located in the settlement where inhabitants would transport biodegradable waste.
 - A specialized company that collects biodegradable waste from You to compost it.
21. Your gender?
- Female
 - Male
22. Your level of education?
- High / Higher
 - Medium
 - Elementary
23. Age - How old are you?
- Up to 25
 - Between 25 and 35
 - Between 35 and 45
 - Between 45 and 55
 - Over 55



Research results

Question no. 1. How do you assess the problem of waste in your municipality?

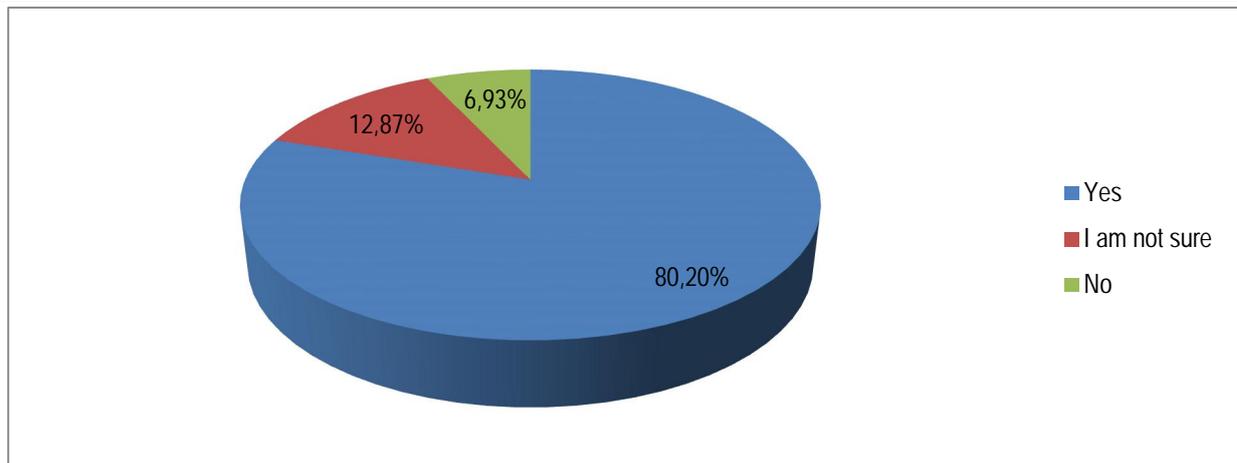


Comment:

The majority of respondents consider that waste is a problem, and as much as 55% of them think it is a major problem, and 36% think it is a big problem. In total, over 90% of respondents consider that waste is a big or a very big problem in their municipality.

Regarding the structure of respondents, it is noted that more of older respondents consider waste as a problem in their municipality. Compared to the survey conducted at the beginning of the project implementation, an increase by approximately 10% is noted in respondents who believe that waste represents a very big problem, while the number of those who consider that waste does not pose a problem is increased by approximately 9%. Generally, a trend of increasing awareness of waste issues among respondents can be noticed.

Question no. 2. Do you know what waste composting is?



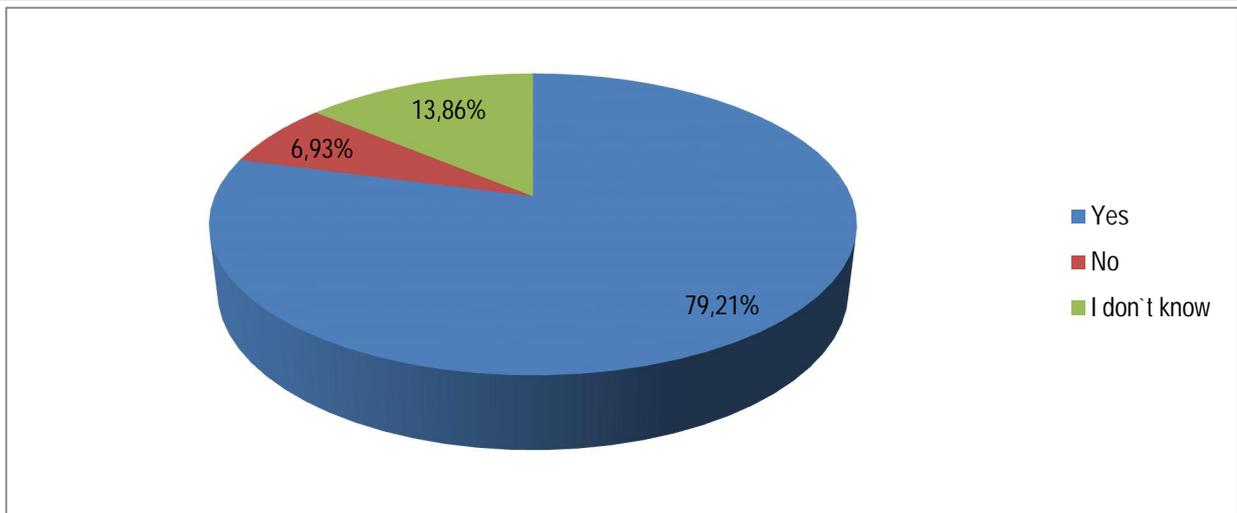
Comment:

The largest number of respondents (approximately 80%) answered that they know what is composting, followed by approximately 13% of respondents who are not sure what is composting, and finally, approximately 7% of respondents do not know what composting is.

Compared to the research carried out at the beginning of the project implementation, the increase by approximately 29% is noted in the number of respondents who know what composting is, the number of those who are not sure is reduced by approximately 17%, as well as the number of those who do not know what composting is by approximately 11 %.



Question no. 3. Can composting waste be conducted in the household?

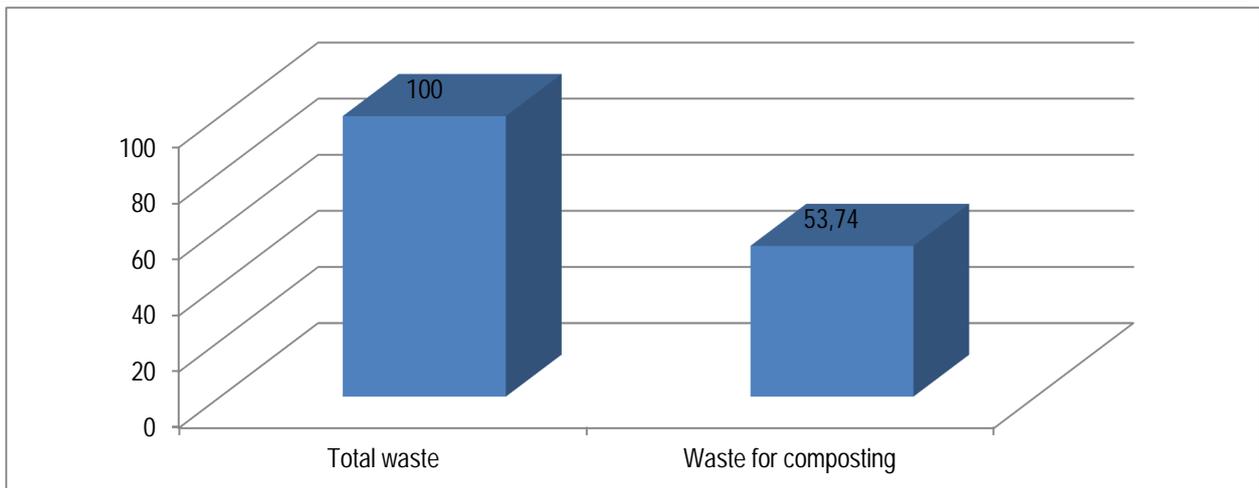


Comment:

For this question, the correct answer was the first option and the largest number of respondents (approximately 79%) responded accordingly that is that composting of waste could be conducted in the household. After that, approximately 14% of the respondents answered that they do not know whether composting of waste can be conducted in the household, and approximately 7% of the respondents stated that composting of waste ca not be conducted in the household.

Compared to the survey conducted at the beginning of the project realization, there is an increase in respondents who know that composting of waste can be done in the household by approximately 25%, while the number of those who do not know is reduced by approximately 3% and the number of those who are unsure by 22%.

Question no. 4. What do You think, what percentage of the waste produced in your household / business facility is made up of compostable materials?



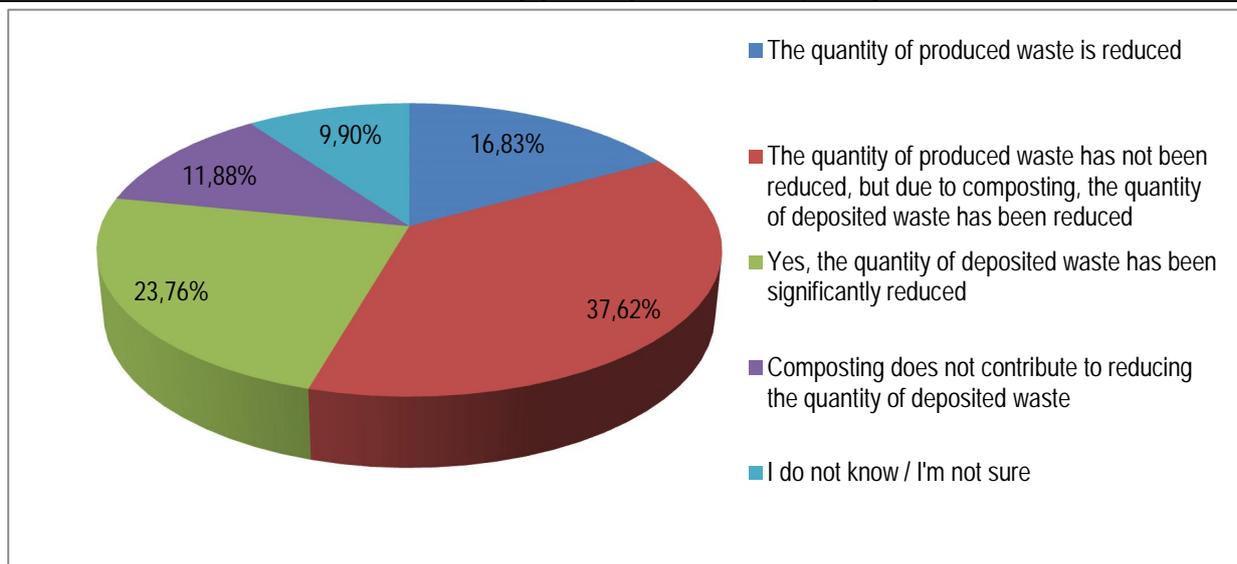
Comment:

Of the total amount of waste generated in surveyed households / business facilities, according to respondents' opinion, approximately 54% of waste is made up of compostable waste.

In a survey conducted at the beginning of the project implementation, respondents felt that approximately 42% of the total amount of waste generated in surveyed households / business facilities is made up of compostable waste.



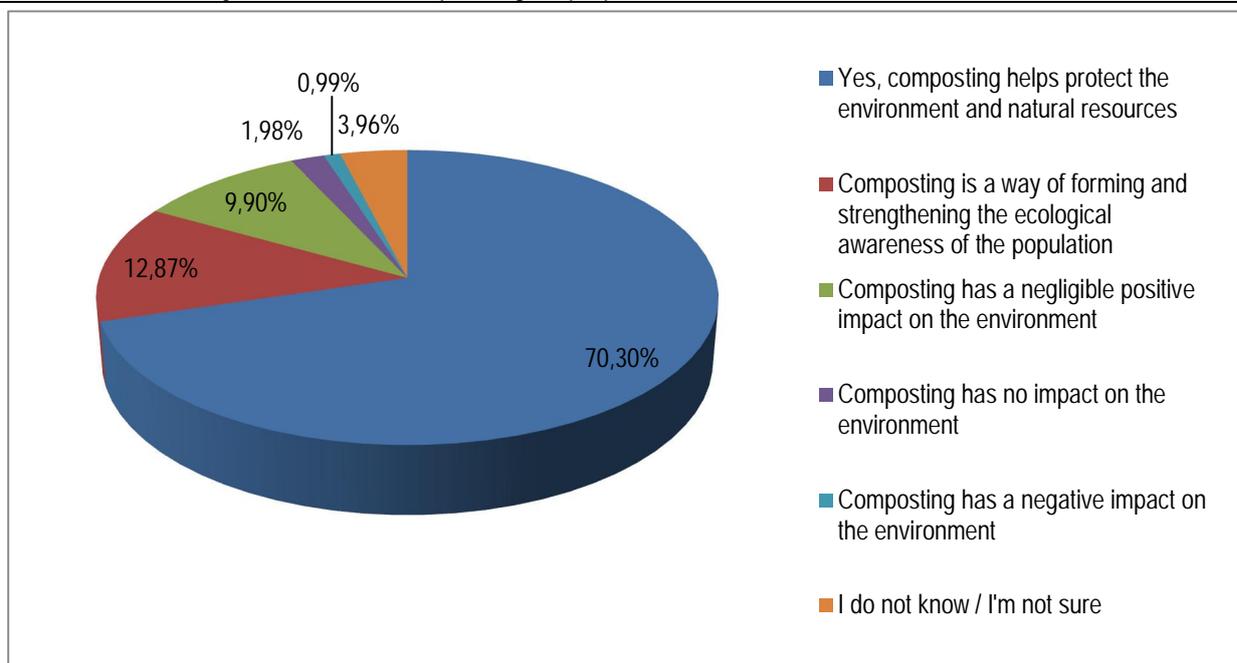
Question no. 5. Do You think that composting generally reduces the quantity of waste?



Comment:

The largest number of respondents (approximately 80%) thinks that composting contributes to waste reduction, while approximately 12% of respondents consider that it does not contribute, and approximately 10% of respondents are not sure.

Question no. 6. Do you think that composting helps protect the environment and natural resources?

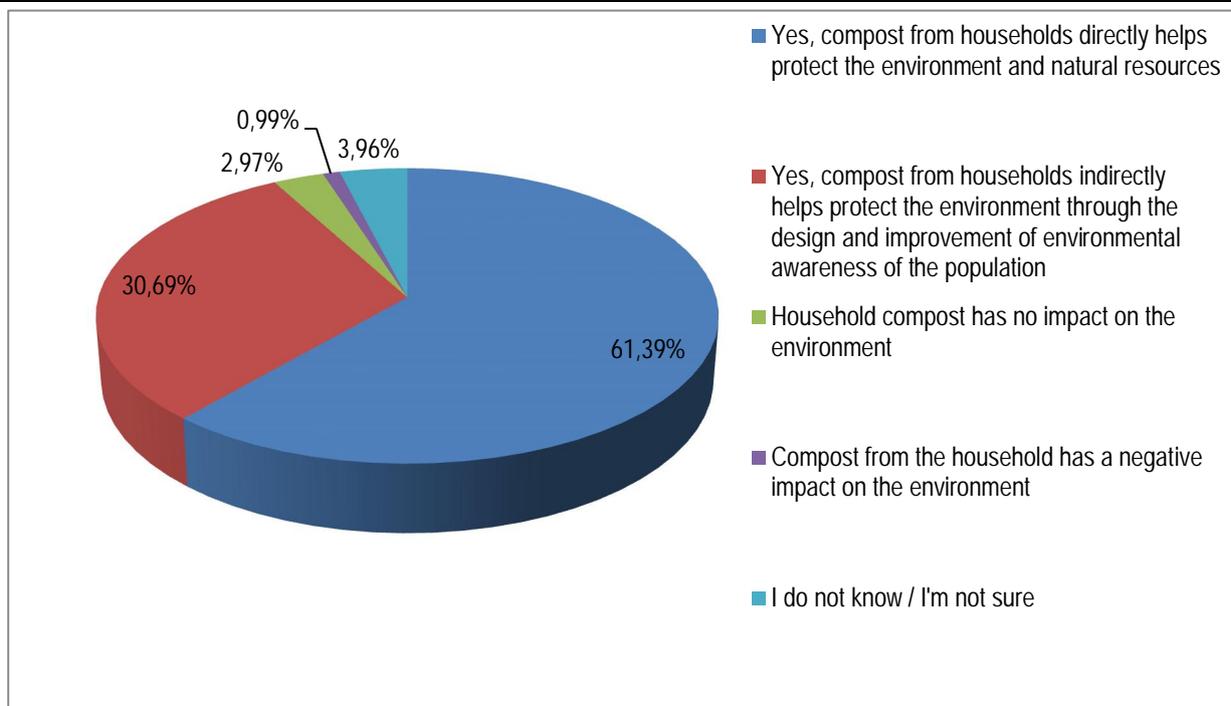


Comment:

The largest number of respondents (83%) thinks that composting helps protect the environment and natural resources. However, there is a significant number of respondents (approximately 10%) who think that composting has a negligible environmental impact, while less than 3% of respondents think that composting has no impact or has a negative impact on the environment.



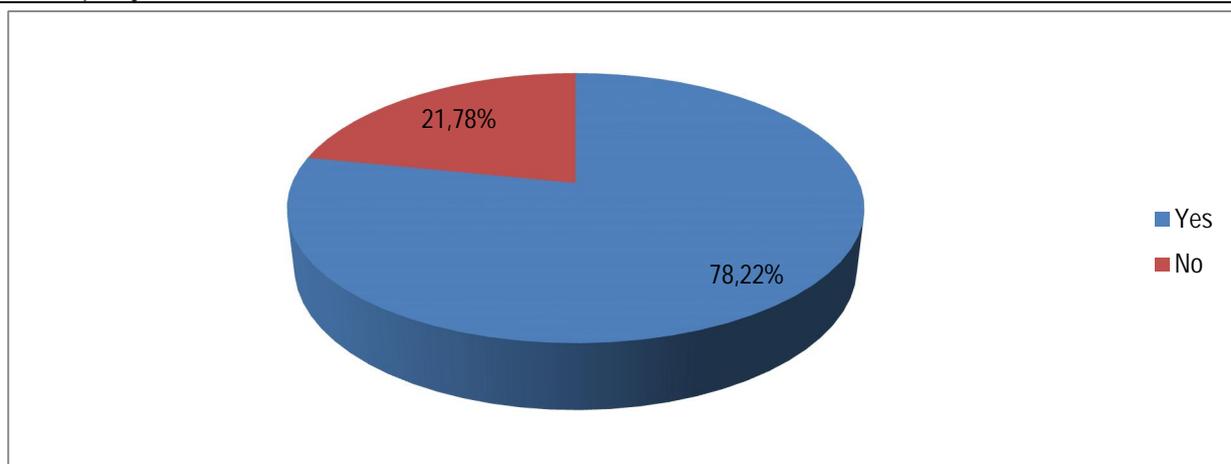
Question no. 7. Do you think composting in the household helps preserve the environment and natural resources?



Comment:

Similar to the previous question, the majority of respondents (92%) think that compost from households helps protect the environment and natural resources. Also, approximately only 4% of respondents consider that compost from households has no environmental impact or has a negative impact on the environment.

Question no. 8. Do you know that the project "Preservation and improvement of the environment in the border region through the composting of biodegradable waste" has been implemented in your municipality?

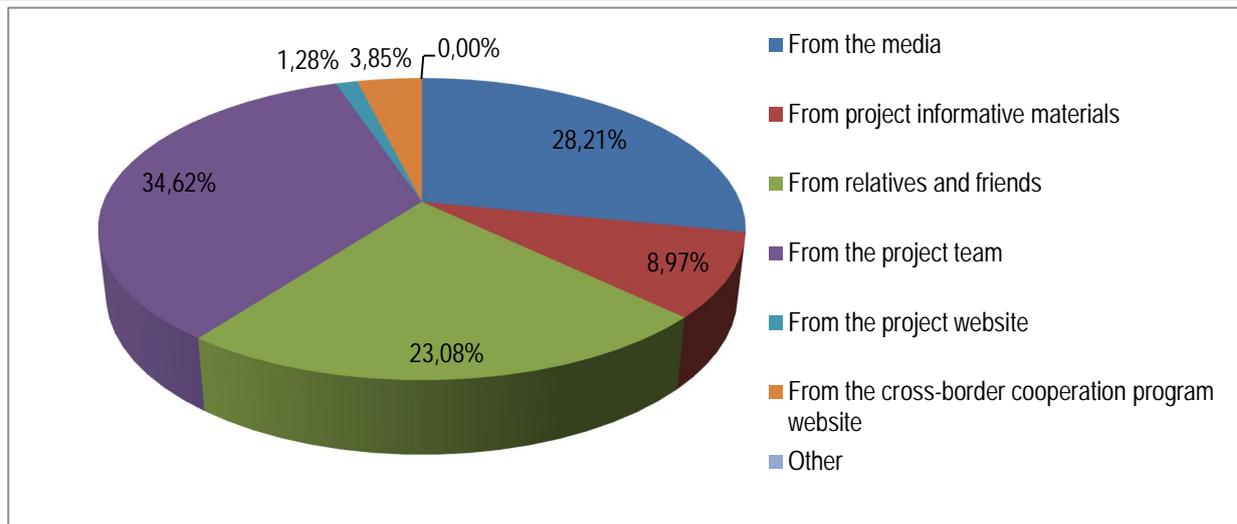


Comment:

The largest number of respondents (approximately 78%) understood that their municipality implemented the project "Preservation and improvement of the environment in the border region through composting biodegradable waste"?



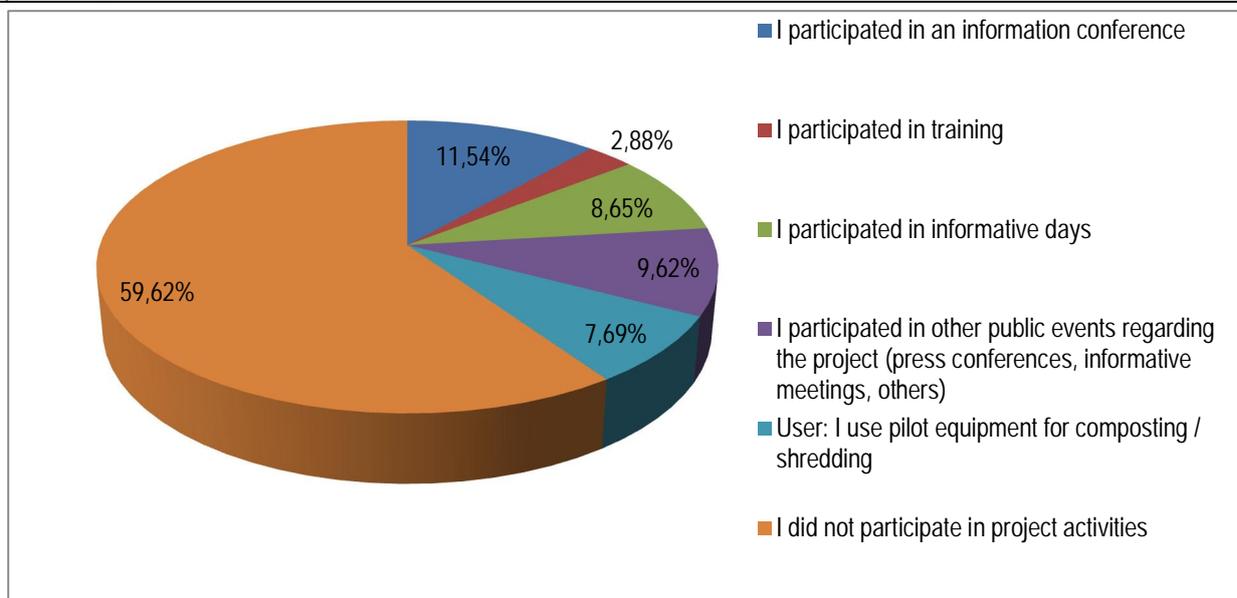
Question no. 9. If you do know, how did you learn about the project and benefits of composting?



Comment:

Sources of information on the project and the benefits of composting are diverse. Approximately a similar number of respondents received information from the project team (approximately 35%), from the media (approximately 28%) and from relatives and friends (approximately 23%). A slightly lower percentage was informed via information materials (approximately 9%), while approximately only 4% of respondents were informed through the internet presentations of the project and programs of cross-border cooperation.

Question no. 10. Have you been involved in some of the project activities (more than one answer is possible)?

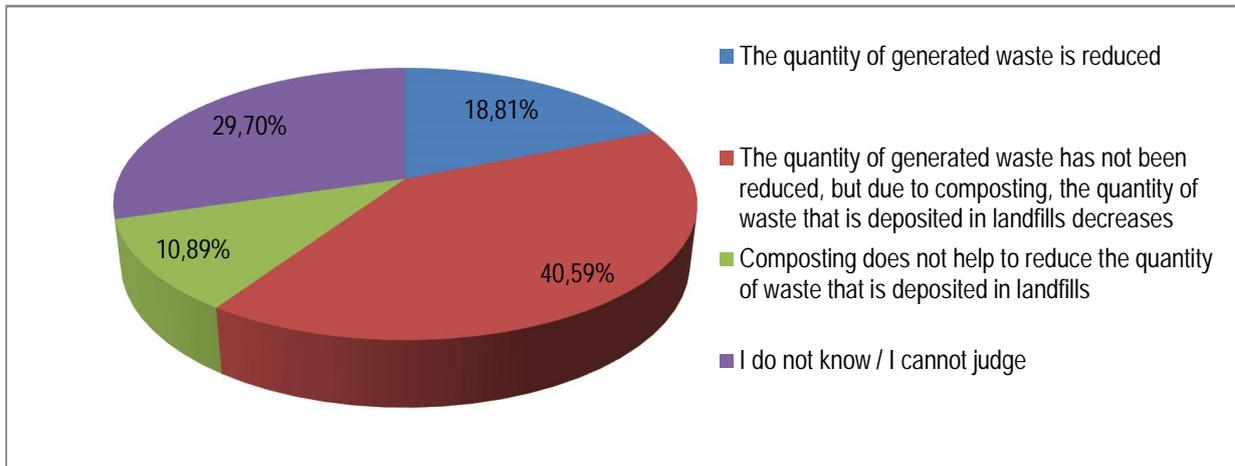


Comment:

The largest number of respondents (almost 60%) did not participate in project activities. Project beneficiaries comprise approximately 8%, while approximately 12% of respondents participated only in the information conference. Approximately 10% participated in other public events, approximately 9% participated in information days and approximately 3% in training.



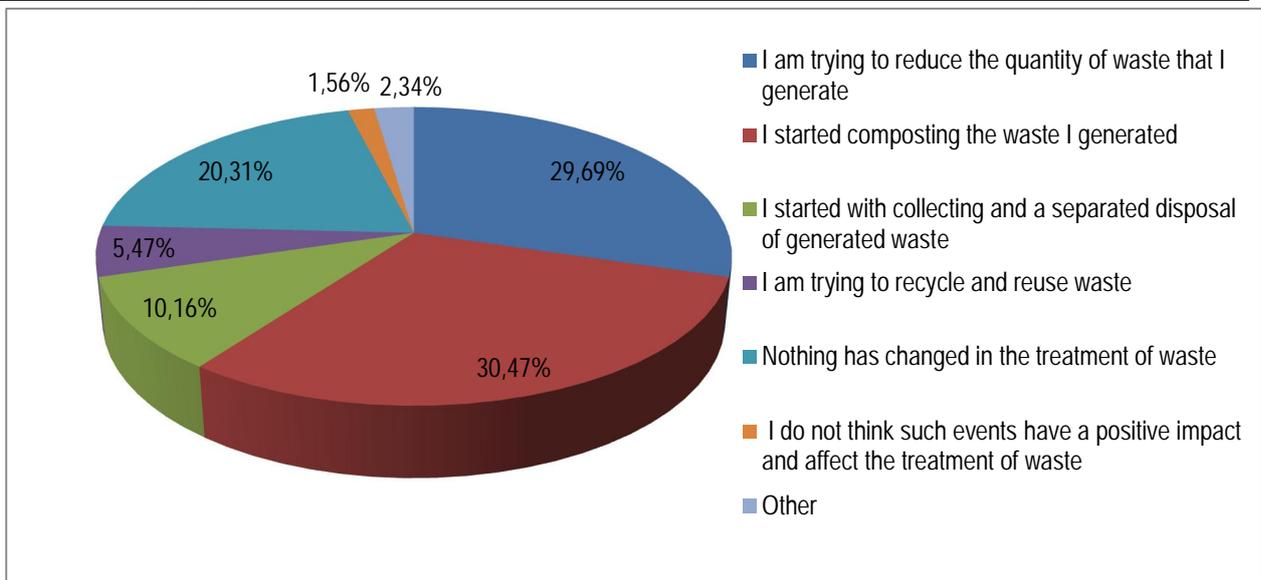
Question no. 11. Do you think that due to the project "Preservation and improvement of the environment in the border region, through the composting of biodegradable waste" there was a reduction in the quantity of waste?



Comment:

The largest number of respondents (approximately 75%) has changed something in their approach to waste management that is most of them (approximately 30%) are trying to reduce the quantity of waste they generate, approximately 30% started to compost waste, approximately 10% started to separate waste and about 5% are trying to recycle waste.

Question no. 12. Has anything changed and what in Your waste treatment approach in the last 12 months (it is possible to give up to 3 answers)?



Comment:

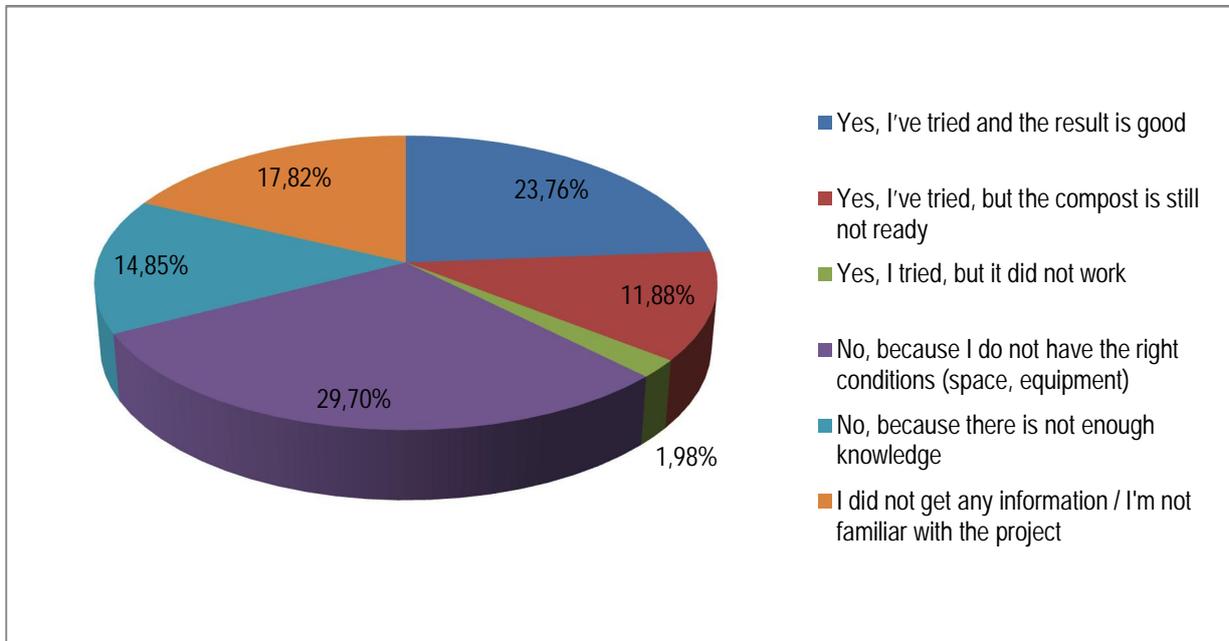
The largest number of respondents (approximately 75%) has changed something in their approach to waste management that is most of them (approximately 30%) are trying to reduce the quantity of waste they generate, approximately 30% started to compost waste, approximately 10% started to separate waste and about 5% are trying to recycle waste.

Regarding the structure of the respondents, it is noticed that the changes are more prevalent for women, people with high / higher education and younger respondents.





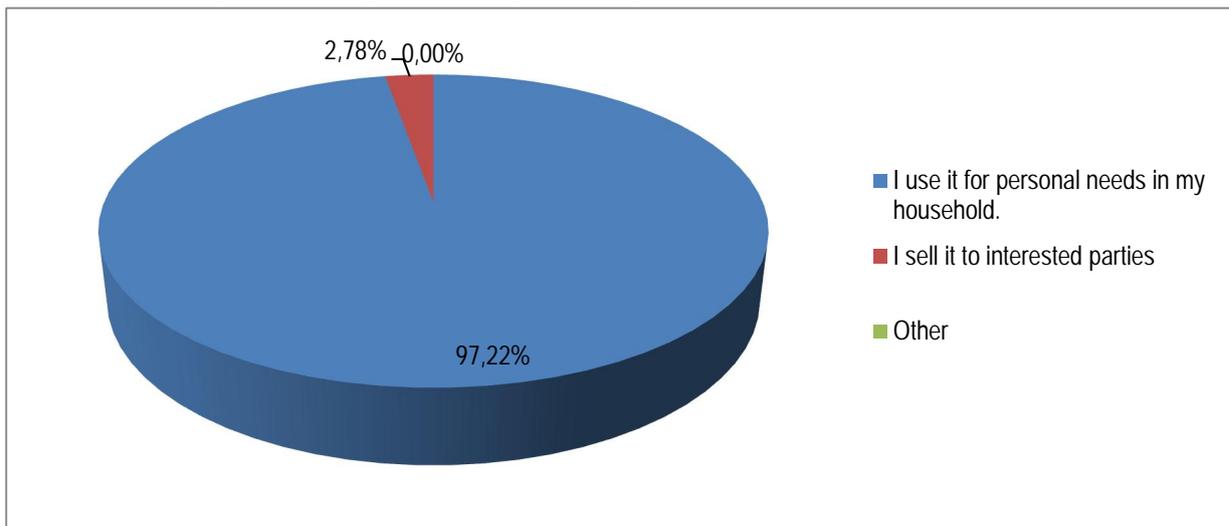
Question no. 13. Have you tried to compost waste after receiving information about it within the project?



Comment:

A total of 38 respondents stated that they tried to compost waste. Out of this number, 24 were satisfied with the result, in 12 respondents compost is still not ready while in 2 respondents composting failed. On the other hand, out of 45 respondents who did not try to compost, 30 said that there were no proper conditions, and 15 of them did not have enough knowledge.

Question no. 14. If you are doing composting, what do you do with the compost?

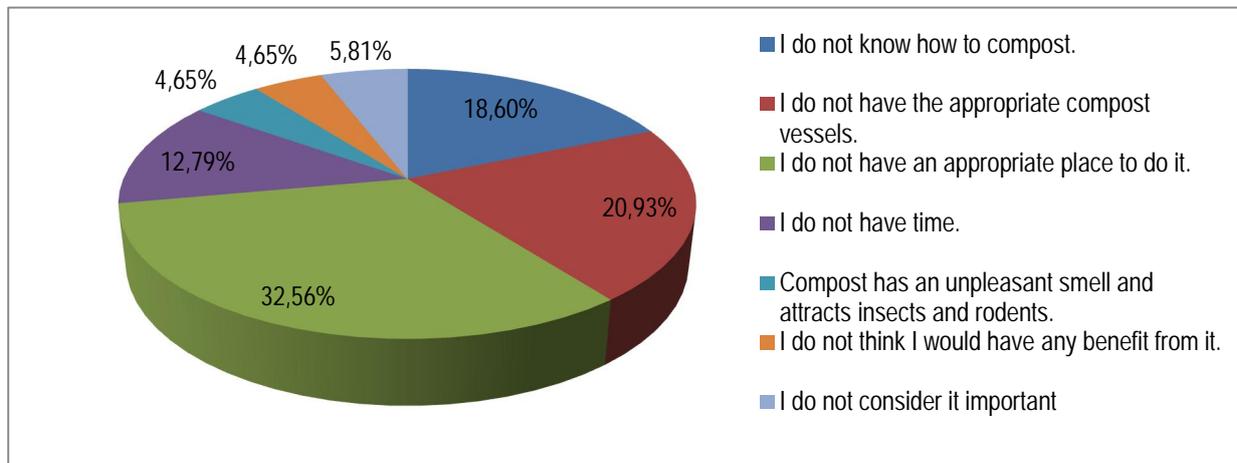


Comment:

Almost completely (approximately 97%) respondents state that they use compost for their own needs, and only approximately 3% sell compost to interested parties.



Question no. 15. If you do not compost waste, what are the reasons for that (it is possible to give up to 3 answers)?

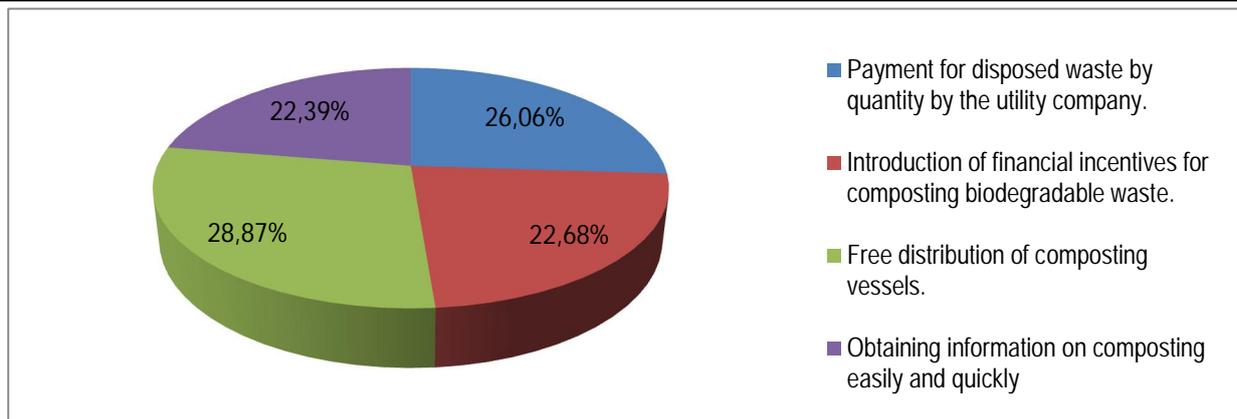


Comment:

The largest number of respondents (approximately 33%) say that there is no proper place to compost waste, then approximately 21% say that there are no suitable vessels, approximately 19% think that they do not know how to compost, approximately 13% of the respondents do not have time, 6% do not consider it important, and according to 5% of respondents, they think that they would not have any benefit, or that compost smells bad and attract insects..

Compared to the research carried out at the beginning of the project, the reduction of those who do not know how to compost is noted (by approximately 20%), the number of those who do not have a suitable place or do not have the appropriate vessels is approximate, or they find that they would not benefit or that the compost has an unpleasant smell, while the number of those who say they do not have time have increased by approximately 12%.

Question no. 16. Would any of the following affect you to start composting biodegradable waste (rank by importance from 1 to 4)?



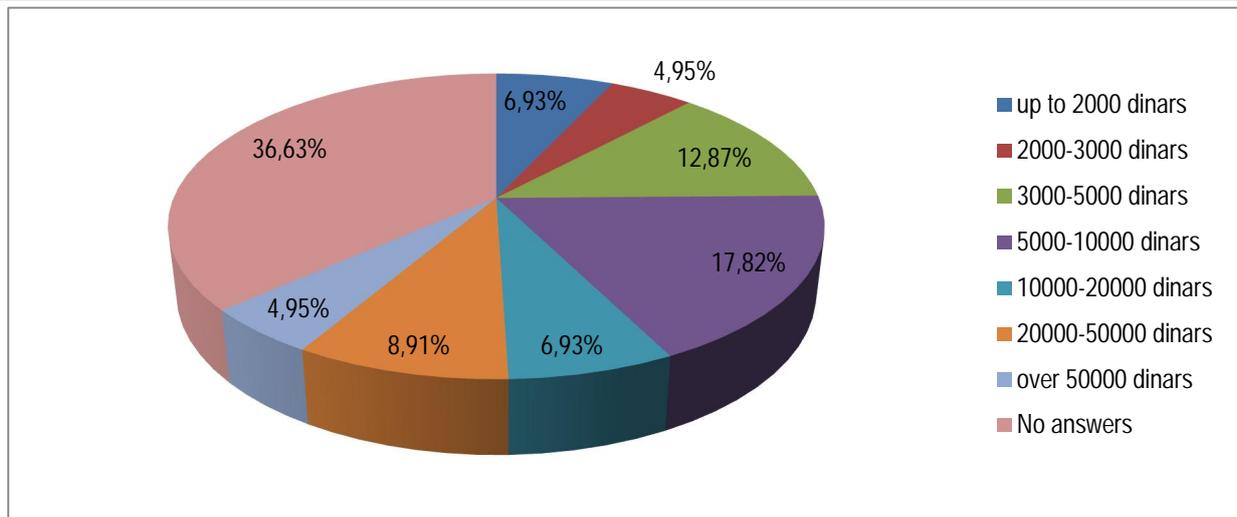
Comment:

This question required ranking from 1 to 4, so the total number of responses when multiplied by rankings amounts to 710. Received answers are very approximate. Of the total number of responses, the greatest impact on the start of composting (approximately 29%) would be achieved by a free distribution of vessels, then (approximately 26%) by the payment of disposed waste by quantity, approximately 23% by introducing financial incentives for composting biodegradable waste and approximately 22% by obtaining information on composting easily and quickly.





Question no. 17. What do you think how much money is needed to purchase composting equipment?

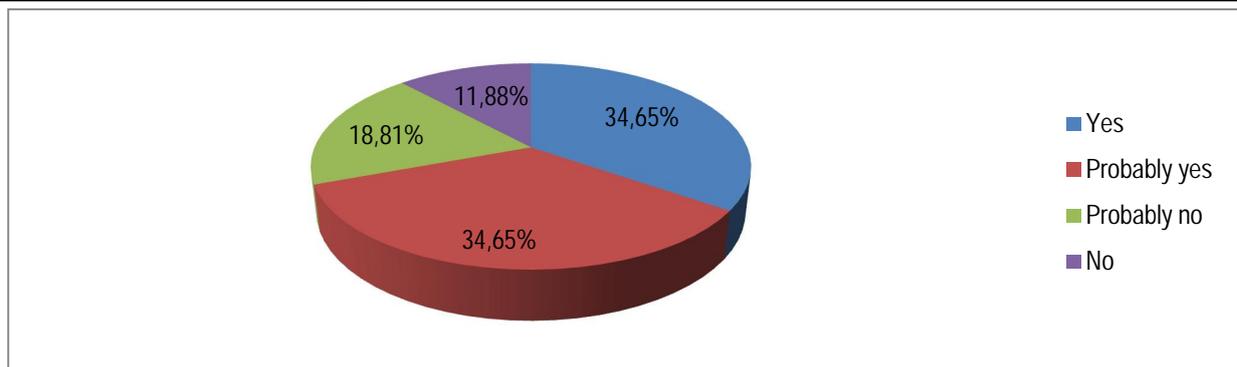


Comment:

The largest number of respondents (approximately 36%) did not answer this question, or they were not familiar with the prices. Among those who responded, the largest number of respondents (approximately 18%) replied that the composting equipment costs between 5,000 and 10,000 dinars; followed by 13% of respondents who think that composting equipment costs between 3,000 and 5,000 dinars; then 9% of respondents who think that composting equipment costs between 20,000 and 50,000 dinars; and 7% of respondents who think that the composting equipment costs between 10,000 and 20,000 dinars that is up to 2,000 dinars, then about 5% of the respondents consider that the composting equipment costs between 2,000 and 3,000 dinars or over 50,000 dinars.

Compared to the research conducted at the beginning of the project, there is a reduction in those who think that the equipment costs more, and the increase in those who consider the equipment costs less.

Question no. 18. If you were offered to receive composting equipment free of charge, would you begin to compost biodegradable waste generated in your household / business facility?



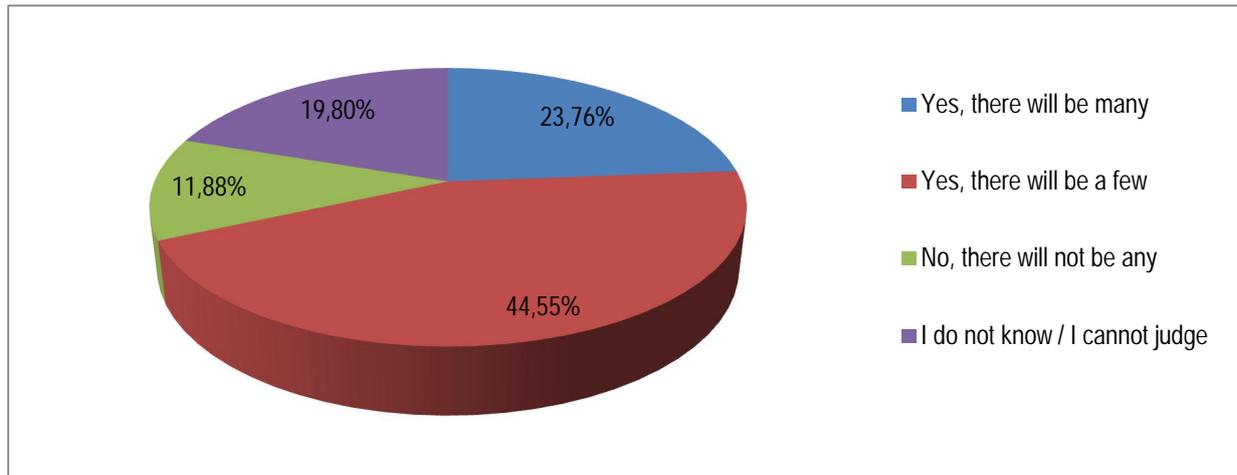
Comment:

The largest number of respondents (equally – approximately 35%) would probably begin composting if they got composting equipment that is they would certainly start composting if they got composting equipment; then approximately 19% of the respondents would probably not begin composting, and eventually approximately 12% of the respondents would not begin composting.

Compared to the research conducted at the beginning of the project, there is a reduction in those who are indecisive (from 60% to approximately 53%) and an increase in those who would certainly start (by approximately 12%) and a reduction of those who would certainly not start by approximately 5%.



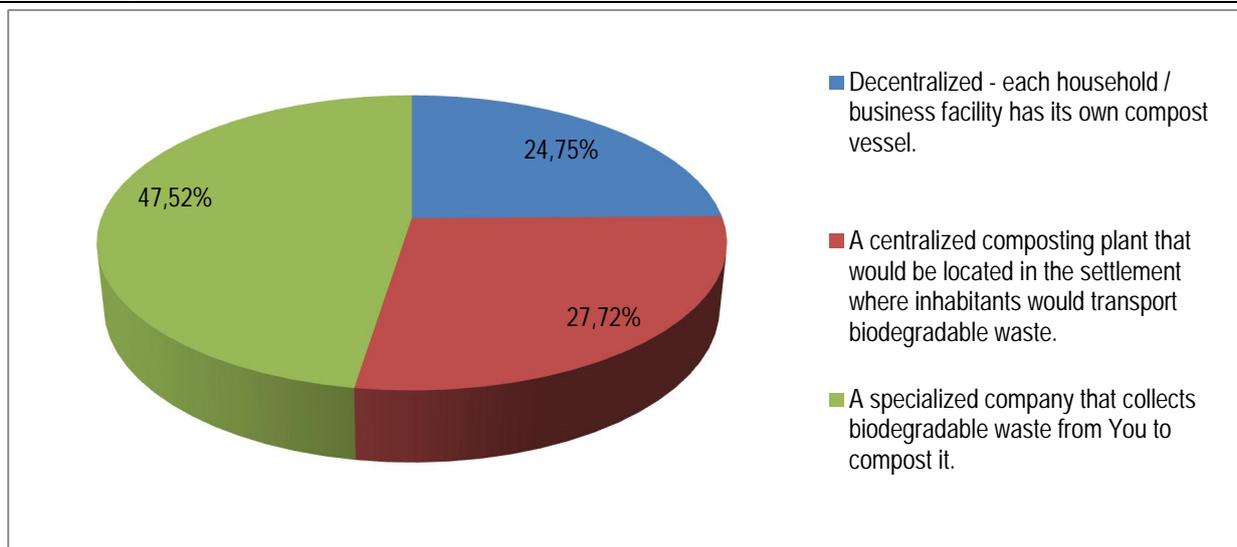
Question no. 19. Do you think that after the implementation of the project, there will be new interested people who will start composting biodegradable waste?



Comment:

The largest number of respondents (approximately 45%) believe that there will be several people who will begin composting in the future, approximately 24% think that there will be many, approximately 20% cannot assess and approximately 12% of respondents consider that people will not be interested in composting in the future.

Question no. 20. If your settlement began with organized composting of biodegradable waste, which way would suit you the best?



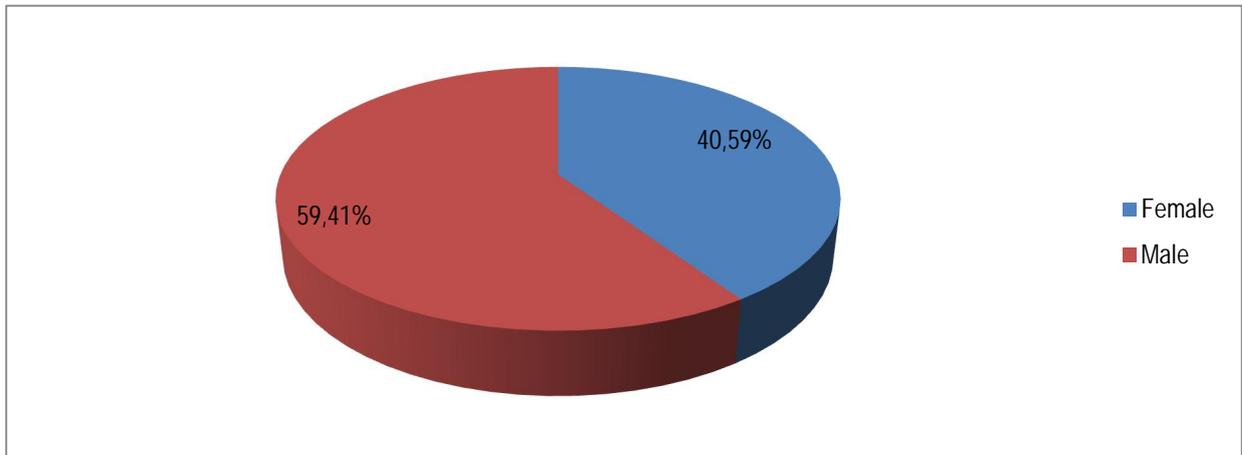
Comment:

The largest number of respondents (approximately 47%) in case they are doing composting would feel most suitable with a specialized company which collects biodegradable waste and then composts it, followed by approximately 28% of respondents who consider that the best solution is the central plant in which the inhabitants themselves would transport biodegradable waste and finally, approximately 25% of those who would feel most suitable if each household would have their own composting vessel.

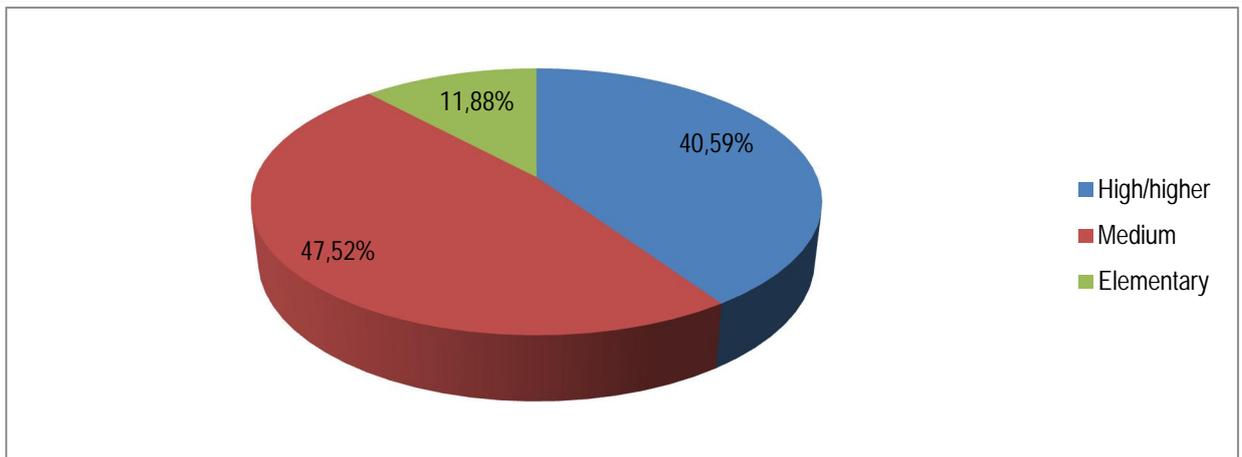
Compared to the research carried out at the beginning of the project, there is a reduction of those who would feel most suitable to do it themselves (by approximately 8%), and the number of those (by approximately 7%) who think that the best solution is that a specialized company collects biodegradable waste and then composts it.



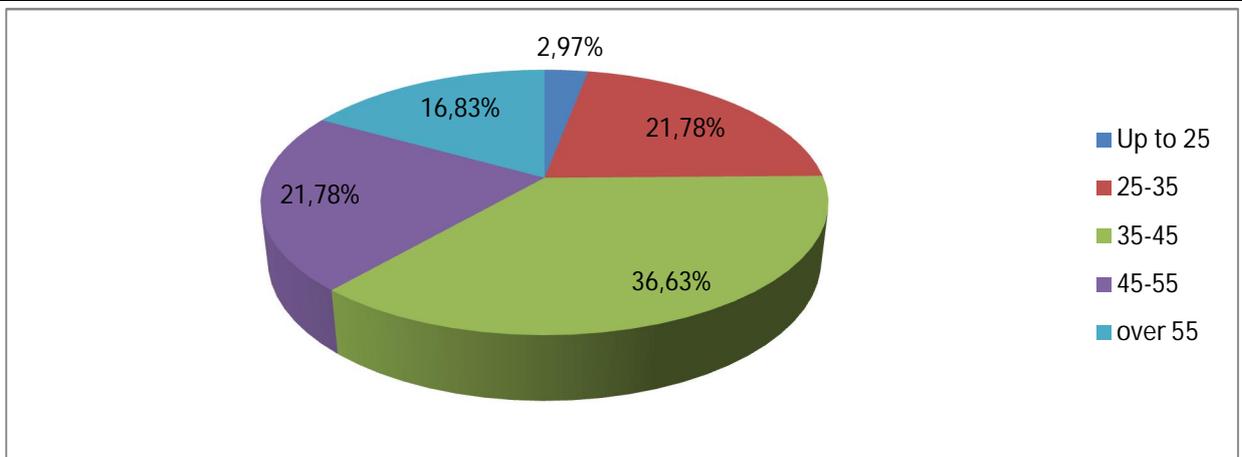
Question no. 21. Gender of respondents?



Question no. 22. Level of education of respondents?



Question no. 23. Age of respondents?





Conclusions of the research

Out of 101 respondents, almost 60% of them did not participate in project activities, and only 8 respondents were using the equipment purchased through the Project, so we consider the results to be representative (influence of project beneficiaries on the obtained results is not dominant).

The largest number of respondents, over 90% believe that waste is a big or very big problem in their municipality which represents an increase of approximately 10% compared to the survey conducted at the beginning of the Project implementation. This shows us that the Project has managed to improve the awareness of the population on waste issues.

Compared to the initial survey, a significant increase (by almost 30%) of those who know what compost is has been noted. Also, the increase (by approximately 25%) of those who now know that composting can be conducted in the household is also significant.

Of the total amount of waste generated in surveyed households / business facilities, according to respondents' opinion, approximately 54% of waste is made up of compostable waste (an increase of approximately 12% compared to the initial survey.) This data is now even closer to data from RPUO where it is stated that biodegradable and garden waste in relation to the total waste comprise: in Bor: 49%, in Kladovo 54% in Majdanpek 49% in Negotin 68% and it points to the great potential of composting and reuse of biodegradable waste.

A significant level of awareness is also shown in the data that almost 80% of the respondents consider that due to composting, the amount of generated and deposited waste decreases. The largest number of respondents (83%) thinks that composting helps protect the environment and natural resources. Similar to the previous question, the majority of respondents (92%) think that compost from households helps protect the environment and natural resources.

Out of the 101 interviewed respondents, 78% of them are familiar with the fact that their project has been implemented in their municipality, which indicates that the focus of the Project is on promoting and informing the local population. The fact that the information sources are diverse is also very positive.

It is a very positive fact that approximately 75% of respondents have changed something in their approach to waste management in the last 12 months, within as many as 30% of respondents say that they started composting. However, there is still room for improvement, as approximately 30% of the respondents do not know or cannot assess whether the project resulted in waste reduction, and 11% of respondents think that composting does not help to reduce the amount of waste. Also, approximately 45% of respondents believe that there will be only a few interested parties for composting in the future. .

It is encouraging to note that in most of the respondents who started composting, a good result was achieved and they are satisfied.

Respondents are now more aware of the seriousness with which composting has to be undertaken, so the number of those who are most suited to do it themselves is reduced, and the number of those who think that the best solution is that a specialized company collects biodegradable waste and then composts it is increased. Also, there is a significant increase (by approximately 12%) of those who say that they do not have time for composting, which tells us about increasing the awareness of the composting process.

Regarding key reasons for not composting biodegradable waste, compared to research conducted at the beginning of the project, there is a reduction in those who do not know how to compost (by approximately 20%), the number of those who do not have the appropriate place or do not have the appropriate vessels, or consider that they would not have any benefits or that compost has an unpleasant smell is approximate, while the number of those who say they do not have time is increased by approximately 12%.



Respondents are now more familiar with the cost of composting equipment, since composters can be purchased at a price of several thousand dinars on the market. Compared to the research conducted at the beginning of the project, there is a reduction in those who think that equipment costs more, and the increase in those who consider equipment costs less.

It is encouraging to note that approximately 68% of respondents would probably or certainly start composting if they got composting equipment. Compared to the research conducted at the beginning of the project, there is a reduction in those who are indecisive (from 60% to approximately 53%) and an increase in those who would certainly start (by approximately 12%) and a reduction of those who would certainly not start by approximately 5%.

Respondents are now more aware of the fact that biodegradable waste makes a significant share in municipal waste that is being taken over by the local utility company and deposited further on, so now the main reason for starting composting is the situation in which the municipal waste disposal service would be charged by quantity. Also, the percentage of those who would certainly begin composting with the free allocation of equipment (by approximately 12%) has also been increased.

Another data indicates that the population is familiar with the composting process. The largest number of respondents (approximately 47%) in case they do the composting would feel most suitable with the specialized company which collects biodegradable waste and then composts it, followed by approximately 28% of respondents who consider the best solution is the central plant in which the inhabitants would transport biodegradable waste themselves and finally, approximately 25% of those who find it most suitable for each household to have their composting vessels. Compared to the research carried out at the beginning of the project, there is a reduction of those who would feel most suitable to do it themselves (by approximately 8%), and the number of those (by approximately 7%) who think that the best solution is that a specialized company collects biodegradable waste and then composts it.

Recommendations

Composting and re-utilizing biodegradable waste would significantly reduce the amount of waste that is permanently disposed of at landfills, which would significantly extend their service life, but reduce the costs of waste collection and transportation.

RPUO is a proposed waste management system that includes a waste collection system in two vessels (a recyclable waste vessel and a vessel for other mixed waste) and that recyclable materials are collected in a recyclable waste vessel, and the waste vessel for other mixed waste will collect other waste that will be treated by biological stabilization. This will directly affect the reduction of the amount of biodegradable waste that will be disposed of at the landfill. In the biological stabilization plant, the waste collected in the vessel for other mixed waste will be stabilized in order to reduce the organic content of waste in order to meet the requirements of the EU Landfill Directive. The fraction formed by this treatment represents a stabilized waste that will be disposed of at the landfill.

In addition to this proposed system, it is also important to reduce the amount of other mixed waste at the place of formation, in order to reduce the costs of collecting and transporting waste. In addition, this way the compost that households could use for their own needs would also be produced.

Objectives of RPUO which should be contributed to:

- Waste reduction: Reduce the amount of waste per inhabitant which should be disposed of at the landfill, promotion of recycling, separation and reuse.
- Collection, separation, reuse / recycling: Developing and commencing the application of the waste separation system at the formation site, including appropriate technical solutions and economic



mechanisms for the participation of households in a new waste collection and sorting system. Introduction of separation of specific materials from waste (used PET packaging, plastic, paper, glass, metals). Development of non-hazardous and hazardous waste collection program from households, industrial waste management program, municipal waste recycling and reuse program, biodegradable waste management and packaging waste management program, etc.

- Impact on the environment and the social environment: Significantly improve the quality of life of the inhabitants of the region indirectly through the rehabilitation of the dumpsites and reducing the risk to human health. Prevent pollution of the environment, surface and underground waters and soil.
- Developing public awareness: Establishing and developing programs and systems of informing, educating and increasing the impact of public opinion.azvijanje javne svesti:

Recommendations for improving the composting system:

- Additionally strengthen the awareness of the population about the need to protect, preserve and improve the state of the environment, as well as about certain terms in the field of waste management (what is recycling, separation, composting and how each of these procedures is implemented in practice),
- Have an impact on the change in the behavior of the population within the waste management system, primarily in reducing the amount of waste generated in the household itself, the primary separation of recyclable waste, and on the separation and composting of biodegradable waste,
- Get the inhabitants thoroughly acquainted in with composting technology, conditions regarding the location, equipment, procedure, compostable waste, application of compost, etc. Given that this is a treatment that is neither complicated nor expensive, we consider that significant effects can be achieved with an acceptable financial cost (extension of the life span of the landfill, reduction of the costs of collecting and transporting waste, improvement of the characteristics of the land, etc.)
- Provide composting equipment that will be given to households for use in order to start with this type of treatment of biodegradable waste,
- Improve the system for composting and treating biodegradable waste that occurs on public areas and in public enterprises through capacity building within municipal public utility companies dealing with waste,
- Pay special attention to improving knowledge and technical capacities for composting in rural communities and agricultural holdings,
- Encourage public utility companies to introduce models to stimulate citizens and businesses to reduce the amount of waste within their households and firms and to do the waste selection,
- Improve the technical and organizational capacities of public utility companies to adequately improve the biodegradable waste management system, primarily through its collection by specialized firms, household processing or through some of the models that would respond to the conditions at the territory of the municipality or region in the best way,
- Improve educational programs in primary and secondary schools that contribute to improving knowledge about the role of citizens in waste management, models for reducing the amount of waste and environmental protection,
- Improve the technical equipment of public institutions and waste selection and composting companies, with special emphasis on educational institutions, pre-school institutions, institutions with biodegradable waste at their disposal (e.g. nursing homes, hospitals, etc.)



- Through extracurricular activities in elementary and secondary schools, develop workshops for making composters from available materials (wood, wire ...).

This publication was made with the help of EU funds through the Interreg IPA Cross-Border Cooperation Program Bulgaria-Serbia under the number CCI No. 2014TC1615CB007. The uniquely responsible person for the content of this publication is the Municipality of Kladovo and in no way it can be interpreted as the standpoint of the European Union or the Program Steering Body.
