

Control of Recyclable Wastes and Zero Waste Project Applications: Example of Necmettin Erbakan University

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Abstract

Billions of people around the world consume unconsciously every day. The resulting wastes are again left to nature by being irresponsible. Due to the rapid depletion of natural resources, humanity has entered new searches. The most important of these, waste management and recycling, dates back to B.C. Each purchased product is made available to us in a package. Well-evaluated wastes benefit the country's economy. The issue of evaluation of all wastes, especially recyclable wastes initiated with the Zero Waste Project, was initiated in our country in 2017 and was finalized in 2019 with a regulation.

In this study, the current situation of our university in terms of environmental awareness and protection of natural resources has been evaluated and it has been tried to reveal what studies have been done and what needs to be done. All activities carried out from the establishment of the Zero Waste Unit to the collection of wastes in separate classes are indicated in stages. In addition, a survey study was conducted on 306 people, in which students, academicians and administrative staff participated. According to the results of the survey, it was seen that the participants were conscious about waste management. Then, the contribution to the economy and the environment is calculated over the amount of collected waste, and the extent to which the country's economy can be contributed is emphasized with numerical values. As a result, the current level of awareness on waste management in universities was determined and information was given on how to improve it.

1. Introduction

Living beings tries to live together and continue their lives in a healthy and happy environment since their formation. Their most important needs is food and shelter. As time and technology progress, our needs are shaped and undergo many changes. During this time, fire the most important invention in human history was discovered and the greatest damage that can be given to nature has begun to be given. Fire which began to become uncontrollable caused many forests to burn. In the time until it was determined what would burn and what would put out the fire, the

burning forests led to the deterioration of the first ecological order.

In the industrial age, the extraction of resources and the production of goods expanded to meet the ever growing consumer culture. Many consumption indexed products such as fabrics, white goods and electronic products that were once called luxury, are now becoming commonplace [1]. In proportion to these, environmental problems have emerged and environmental pollution issues have begun to enter our lives.

New strategies should be developed on waste management by considering the sociological and economic effects of the society. In this regard, states

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should develop solutions to this situation through contracts and regulations in the international environment.

When looking at the processes carried out within the framework of waste management, which has an effective place among environmental protection policies, it is located the minimization of domestic, medical, hazardous and non-hazardous waste, separate collection at the source, intermediate storage, transportation, recovery, recycling and disposal of waste. [2].

In the light of all these developments, the importance which is given to recycling has increased considerably, especially in recent years. Recycling is no longer viewed as just a waste collection business, but societies approach it as an initiative to raise environmental awareness and protect natural resources. [3].

In recent years, the importance of evaluating wastes with various projects around the world, even the efforts to create no waste have started. In our country, studies on waste management have gained momentum. The “Zero Waste Project” which was initiated under the auspices of the Presidency and with the support of the Ministry of Environment and Urbanization, is the best example of this. With the Project initiated at the Ministry’s service building on september 25, 2017, seperate collection, transportation and evaluation of waste at the source was initiated in all areas including public institutions, shopping malls, schools, universities, dormitories, airports, bus stations, hospitals, estates and residences. Compared to the past, recycling projects, which were left only to the volunteers of the citizens are encouraged by the state this time and they are tried to be developed through non governmental organizations, authorized organizations affiliated to the ministry, municipalities and television channels.

The Industrial Revolution started with James Watt’s invention of the first steam engine in 1765, developed with the use of electricity as an input in iron production in 1870, and accelerated in 1940 with the Fordist Production System. The Flexible Production System and Information Society phase, which came to the fore in the 1980’s, continues today [4]. This situation has brought to the production and the use of resources used in production to an unavoidable point.

The rapid increase in the world population from the past to the present and the increase in the

amount of consumption and the amount of waste generated at the same rate have led to the formation of different waste management practices and different reuse areas and sectors. Due to the rapid depletion of natural resources and the effect of damage to the environment, manufacturers have searched for different raw materials and it has been seen that many materials can be reused.

The products that we did not use as garbage for years were evaluated haphazardly and caused serious damage to the environment.

Recycling is the recycling of materials such as glass, paper, aluminum, plastic, battery, motor oil, accumulator, concrete, organic, electronic, medical, hazardous and non-hazardous wastes left after being used by people, after physical and chemical processes, and converted into raw materials and recycled. is included in the energy production process [5].

Recycling can reduce the negative effects of solid wastes on the environment, human health and the country's economy, as well as protect groundwater from pollution by eliminating pollution and destruction of natural resources. In addition, the raw materials and by-products required by the industry can be obtained from recycled products without consuming natural resources again [6].

Akçay and Dal’s research aimed that determine the opinions of science teachers about sustainable development and zero waste. The sample group of the study consists of 102 science teachers working in Ağrı city center and central villages. “Opinion Form on Sustainable Development and Zero Waste” was used as data collection tool in the study. As a result of the research, it was determined that science teachers have general knowledge about the concepts related to sustainable development and zero waste, but their knowledge on some subjects is insufficient. Most of the teachers stated that sustainability means continuity and continuity, as well as investing in the future, protection of natural resources and their transfer to the future, continuous development and economic continuity [7].

Increasing concern about solid waste problems and a holistic approach to their management Pietzsch et al. (2017) developed a literature review about the subject “Zero Waste”. To that end, a systematic literature review was executed, through which 102 published articles were analyzed with the aim to, initially, comprehend the concept of Zero

Waste, and, then, map its benefits, challenges, and critical success factors [8].

In this study, our aim is to explain the level of the Zero Waste approach in the university and the municipality we are affiliated with, how our students have this awareness and how they should evaluate their waste and how we can contribute to our country's economy by offering solutions.

2. Material and Method

In this section, the researches, findings and comments related to the research problem are discussed. Figure 1 shows the graphic taken from the Higher Education Institution page, where there are 129 state universities, 74 foundation universities and 4 foundation university vocational schools affiliated to the Higher Education Institution in the 2019-2020 academic year in our country.

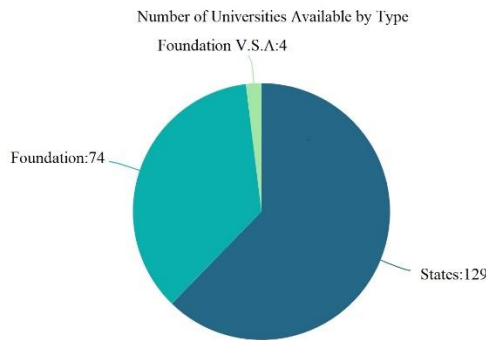


Figure 1. Number of universities in our country [9]

In Figure 2, the graph taken from the Higher Education Institution page shows that 3.002.964 people enrolled in the associate degree departments, 4.538.926 people in the undergraduate departments, 297.001 people in the graduate departments and 101.242 people in the doctorate departments of these universities in 2019-2020.

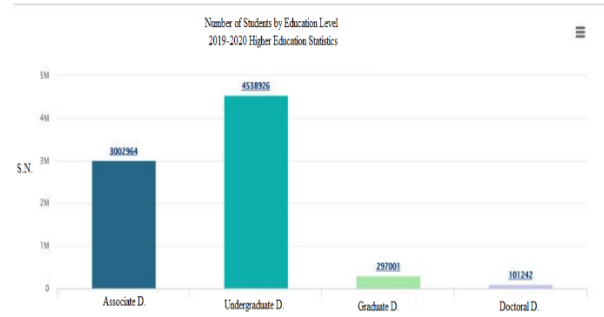


Figure 2. Total number of students [9]

There are 7.940.133 students in higher education in total across the country. Considering that each individual produces 1,17 kg/ person.day waste in a day, the amount of waste to be generated is approximately 9,289 tons. These wastes include all waste groups. If it is considered that 20% of the total waste amount is packaging waste and it is assumed that these wastes can be collected separately at the rate of 100%, 1,857 tons of packaging waste will be generated per day. When these wastes are supported with waste management and Zero Waste projects in universities, they will make a great contribution to the country's economy and natural resources.

2.1. Working Area

University campuses can be considered “small cities” due to their size and the number of people living in the area on a daily basis and many higher education institutions can generate significant environmental and social activities through both direct and indirect activities [10]. Universities and schools are the best places to launch awareness campaigns to raise global awareness of environmental issues, because they are essential sources of knowledge and culture [11]. Necmettin Erbakan University which was established by being published in the Official Gazette dated 21 July 2010 and numbered 27.648, located within the borders of Meram district of Konya that is the province with the largest surface area in Turkey, has been included in our study area. There are a total of 36.334 students, including 20 faculties, 8 vocational schools, 31 research centers, 4 institutes, 8 coordinators, 27.020 undergraduate, 2.900 associate degree, 6.085 graduate and 329 pedagogical formation students throughout our university. In addition, there are 1.909 teaching staff and 1.149 administrative staff [12].

As a result of the decision taken by the university administration on 21.02.2020, faculty unit supervisors started to work within the scope of Zero Waste Management.

At the beginning of the university, recyclable wastes and organic wastes will be started and then all waste groups determined in the Waste Management Regulation will be tried to be separated.

Considering that it is a Faculty of Medicine affiliated to our university, it will be delivered to a company that has an agreement with Konya Metropolitan Municipality in order to manage the hazardous and medical wastes. In this article, only the amount of recyclable waste has been tried to be emphasized. The amounts of chemical and hazardous waste groups formed in the laboratories have not been calculated by us. Faculties have taken the necessary precautions for the chemical and hazardous wastes generated in the laboratories and they dispose of these wastes in accordance with the regulations.

For the waste codes under 20 code headings in the annexes of the Waste Management Regulation, the group starting with we 15, that is, packaging waste, is taken as basis. 15 01 01 Paper – Cardboard Packaging, 15 01 02 Plastic Packaging, 15 01 04 Metallic Packaging, 15 01 07 Glass Packaging classes are the waste codes that we will include in the calculation. We expect that paper and cardboard waste will come out of the classrooms and canteen. It is aimed to mix Plastic, Metal and Glass wastes in all waste bins left in the corridors, canteen and common areas, and then to separate them and deliver them to the municipality.

3. Results and Discussion

The Zero Waste approach is based on the 4R rule which forms the basis of awareness. Concepts such as Reduction, Reuse, Recycle, Respect are the words that make up the rule. The 4R Rule is a great way to protect our environment. That will help us for a livable world. That can be a guide for humanity to think while consuming and creating waste and what they should do to reduce the damage they cause to environment. It plays a role in changing lifestyles and teaches what they can do for future generations.



Figure 3. 4R Rule steps[13]

If we expand these terms a little more; Reduction; includes all the ways required for waste reduction. Wastes must be prevented. For global development, instead of spending our energy on the management of wastes, we can spend it on the management of wastes that do not occur or that occur less. In order to reduce waste generation, that is, non-recyclable disposable wastes, it was requested to apply a discount when the students come to buy their drinks with their own glasses by meeting with the school canteen managements.

It enables us to use durable and long lasting goods and to prefer materials that do not contain toxic substances. This concept will lead us to move away from disposable materials, produce waste-free or minimal waste, and protect natural resources.

Reuse; It means that a product that has completed the first use stage is used without changing its physical conditions, instead of being included in the waste class. We can classify the wastes that we can not reduce and that we have to produce. For instance, PET bottles will remain as waste after the product we use in them. Instead of this, it can be stored by putting food that we can consume in winter. In addition, in rural areas, tomato paste boxes or oil cans are also used by planting flowers in them.

The biggest obstacle to reuse is the ego of humanity. The concept of being new should be set aside and the understanding of reuse should be adopted.

Recycling; According to the definition in the Waste Management Regulation, is an "Any recovery process in which wastes are processed into products, materials or substances for their original use or other purposes, including the reprocessing of organic materials, excluding energy recovery and use as fuel or reprocessing of waste for filling".

In this step, after the wastes to be recycled are collected separately, new products can be obtained by breaking down and melting. While new products are

obtained by saving energy from wastes such as paper, glass, metal and plastic, more compost can be produced from organic wastes.

Respect; It is actually the most important item. Man has to respect himself. Based on this, we have to know that we are not the only ones living in the world and that we have to respect other living things as well. Henderson Island, which is located in the Pacific Ocean and is inhabited by no one, is heavily polluted by wastes which are stuck to sea creatures. No people live on this island. By indirect means, the reverse current in the oceans has been polluted by pollutants carried by attaching to the creatures that live and migrate on that island.

In other words, humanity did not show the same respect to nature that it did not feel for itself and has succeeded in polluting an island it has never lived on.

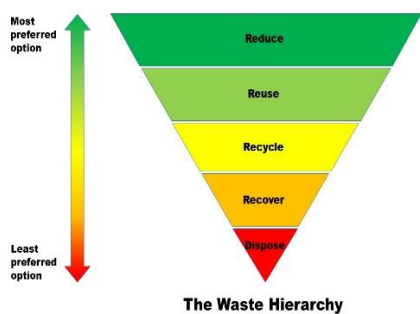


Figure 4. Zero Waste hierarchy

In accordance with the zero waste hierarchy, our primary goal is that the product we purchase should be durable, repairable and recyclable. So the important point is to consider before buying whether we really need it. Banning single-use plastic waste in canteens, cafeterias, social facilities, etc. on the campus, as well as preventing the use of plastic bags in markets and shopping centers will also help us reduce waste generation. Reusing the wastes we produce in the most appropriate form, instead of directly eliminating them, will again contribute greatly to waste management. If we have produced the waste but cannot reuse it, recycling is one of the best solutions. For this purpose, together with the commission established at the university, indoor boxes placed in faculties and social areas and outdoor piggy banks, where we will finally store the waste, were placed.

For this; In cooperation with the commission established at the university, the indoor boxes shown in Figure 7, which were placed in faculties and social

areas, and the outdoor piggy banks, shown in Figure 6, where we will finally store the waste, were placed. A total of 1200 indoor boxes and 11 outdoor boxes were placed in our faculties. These boxes and piggy banks were provided by Konya Provincial Directorate of Environment and Urbanization, Konya Metropolitan Municipality and Meram Municipality. In addition, a mobile waste collection center with 4 compartments was provided to our Rectorate building through the Meram Municipality agreement company.

A meeting was held with the Ministry of Youth and Sports regarding the provision of a compost machine for organic wastes that will originate from the cafeteria and be generated as a result of student consumption. A compost machine was requested to the most suitable point for the cafeteria section through the Ministry. Due to the cost of the machine, no results have been obtained yet. After the supply of collection materials, face-to-face training were given to 350-400 cleaning personnel and administrative personnel working in 9 faculties and the Rectorate. In addition, Environmental Awareness and Zero Waste training was given to approximately 80 participants within the scope of Necmettin Erbakan University Faculty of Nursing.



Figure 5. Waste temporary storage unit



Figure 6. Indoor boxes



Figure 7. Mobile waste collection center

Due to the pandemic period, an online survey was conducted with the participation of 213 students, 5 academicians, 13 administrative staff and 76 private sector employees. Participants were asked 18 questions. They were asked to mark the options

"Strongly Disagree - Disagree - No Idea - Agree - Strongly Agree" among the 1-5 options for their answers to the questions. The surveys were initiated by sending the web page created using the Survey Google Docs system to the participants. After the expected 15-day period, data were taken from the system as the answers are written in Table 1. It has been seen in the answers given by the participants of this survey that our students are aware of waste management and environmental awareness, but it is seen that the necessary materials are not provided to put them into practice and that environmental awareness education is not done much.

Table 1. Survey question and answer percentages

SURVEY QUESTIONS				
1. I follow the environmental problems of our country.				
5,20 %	5,90%	23,50 %	42,20 %	26,80%
2. I know that waste is classified.				
2,30 %	1,60%	6,20%	22,50 %	69,00%
3. I have information about the Zero Waste Project launched in our country.				
6,50 %	7,80%	2,90%	28,80 %	37,60%
4. I know what recyclable waste is.				
2,30 %	1,30%	7,90%	29,90 %	59,20%
5. Organic waste (food waste, etc.) and I accumulate recyclable waste (paper, glass, plastic, metal) separately.				
10,20 %	17,40 %	16,70 %	22,60 %	34,10%
6. I know at what stages the waste that I throw into the recycling bins goes through.				
5,60 %	14,40 %	30,20 %	22,60 %	28,90%
7. I know that I contributed to the national economy when I supported the Zero Waste Project.				
6,90 %	3,60%	9,80%	22,50 %	58,20%
8. I find the importance given to recycling sufficient in our country.				
28,60 %	33,20 %	26%	10,20 %	6,30%
9. I use the Zero Waste Bins located in the university corridors to contribute to recycling and the economy.				

3,70 %	6,30%	12,70 %	26%	53,30%
10. If an event (Interview-Symposium) on Zero Waste management is held at the university, I will participate.				
9,90 %	13,90 %	23,10 %	23,40 %	31%
11. I participate in environmental activities of Non-Governmental Organizations.				
13,50 %	22,80 %	34,70 %	17,50 %	15,80%
12. I would like to take part in an Environmental and Zero Waste Community to be established at the university.				
7,30 %	10,60 %	26,10 %	20,10 %	36,60%
13. I know that plastics have been lost in nature for many years.				
2,30 %	0%	1,30%	10,20 %	86,50%
14. I know that household waste is used in the production of electricity.				
6,30 %	6,90%	20,10 %	16,80 %	51,30%
15. I use lamps and electrical appliances when necessary.				
3,90 %	1,30%	11,10 %	25,20 %	60%
16. I throw the waste batteries in the waste battery box instead of throwing them in the trash.				
7,20 %	6,90%	7,20%	24,30 %	54,80%
17. I use cloth bags or nets instead of plastic bags in grocery stores.				
7,20 %	11,80 %	19%	23%	40,30%
18. I read it electronically instead of printing it out to avoid wasting paper.				
10,50 %	17,00 %	21%	18%	34,10%

4. Conclusion and Suggestions

After the lack of equipment and trainings, with the project we started in May 2020, the wastes started to be weighed and collected through a company which is contracted with the Municipality. The total amount of waste measured weekly with the help of a hand scale until April 2021 is presented in Table 2.

Table 2. Amount of waste collected

WASTE CODE	WASTE NAME	AMOUNT
15 01 01	Paper and Cardboard Packaging	33,408 kg
15 01 02	Plastic Packaging	22,272 kg
15 01 04	Metallic Packaging	7,424 kg
15 01 07	Glass Packaging	11,136 kg

According to the amount of waste collected, it belongs to the Ministry of Environment and Urbanization <https://sifiratik.gov.tr/sifir-atik/atik-sayaci> the contributions we have made to nature have been determined by the transactions made through the online system.

Our contribution to nature and economy with the 33,408 kg of paper and cardboard waste we collect;

- With the paper we collected, 567 trees were kept in nature.
- We saved 83 m3 of land in the landfills.



Figure 9. Our earnings from our paper - cardboard waste

Our contribution to nature and economy with the 22,272 kg plastic waste we collect;

- We saved 363 barrels of raw material oil.
- 913 kg of greenhouse gas emissions were prevented.

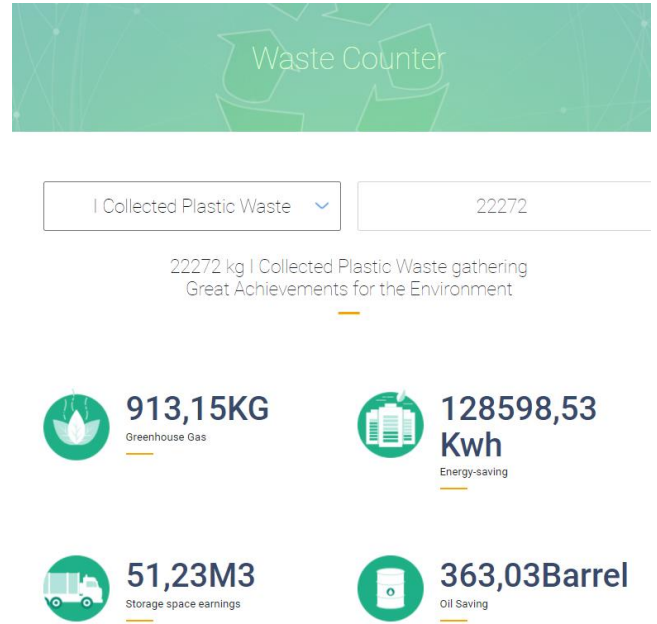


Figure 10. Our earnings from our plastic waste

Our contribution to nature and economy from the 7,424 kg of metal waste we collect;

- We saved 9 kg of raw materials used from nature.
- We prevented 705 kg of greenhouse gas emissions.



Figure 11. Our earnings from our metal waste

Our contribution to nature and economy from the 11,136 kg of glass waste we collect;

- We saved 13 kg of raw materials.
- We prevented 334 kg of greenhouse gas emissions.



Figure 12. Our earnings from our glass waste

Considering that we do not produce main materials such as cellulose and terephthalate within the borders of our country, but import them from abroad, promoting the recycling of paper and plastic bottles will enable us to use previously produced wastes instead of imported raw materials. In this way, the current account deficit in our country due to imports will be tried to be closed to some extent. In order to prevent waste with the Zero Waste Project, food waste will be prevented by the portion arrangement to be made in the cafeterias. In addition to all the activities carried out for the development of the Zero Waste Project at universities, different suggestions can be presented.

- Environmental awareness trainings can continue continuously for all staff, academicians and students throughout the university.
- Information brochures about zero waste projects initiated at the university can be prepared for first year students who have just started university.
- Various activities can be supported by establishing a student community with volunteer students.
- Educational studies on zero waste should be carried out in established student groups and all faculties.
- Environmental awareness and zero waste training should be given to everyone, from the rector to the cleaning staff.
- Projects such as conferences, waste-free living panels, waste-free camps should be developed.
- Working areas such as non-governmental organizations, associations and foundations should be expanded.
- The responsibilities of each individual should be clearly stated.

Contributions of the authors

All authors contributed equally to the study.

Conflict of Interest Statement

There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

The study is complied with research and publication ethics

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