

RECYCLING OF WASTE IN FAVOR OF ECONOMIC AND ENVIRONMENTAL PROTECTION

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ABSTRACT

At the European level, programs aimed at protecting the environment are subject to regulation. Not only is an increase in the overall amount of waste a result of the development of industrial activities, but it is also a consequence of an increase in the total number of people living in a particular region. This article takes a multi-pronged approach to analyzing the process of recycling waste products from municipal landfills. If the available raw materials are not used to their maximum capacity, this may result in the buildup of greater waste. This would ultimately lead to the depletion of the natural resources that the world has to offer. In addition to that, considerable attention is paid to the recycling of electronic trash as well as biowaste in this particular piece of writing. Both the construction of brand new buildings and the demolition of existing ones are necessary components of the expansion of an urban area. These activities inevitably result in the generation of waste. As a direct consequence of this, the present scenario with respect to the rate of waste recovery from construction and demolition projects is shown below.

KEYWORDS: *waste, waste recycling, European Union, environmental protection*

INTRODUCTION

Product manufacturing has been impacted by increased pollution and climate change. The way in which the products are used influences the management of the resulting waste. Municipal waste is waste generated by human households. Their management depends on each community. This is how environmental problems arise. Raw materials not used to the maximum can turn into waste. This process can lead to the rapid depletion of natural resources.

The harmfulness of waste is manifested both in terms of people's health and in terms of the environment. Thus, one of the main environmental problems is waste management.

The urban population is growing. This can have the effect of increasing municipal waste generated. A proper waste management is needed for a sustainable development of a community. The positive impact on the environment is all the greater as the amount of waste generated decreases.

Also, the existence of a waste collection infrastructure can represent an advantage in the desire to protect the environment.

1. LITERATURE REVIEW

Waste management is a significant global challenge, with economic, social and environmental implications. In the European Union, policies on recycling and reuse of resources are based on a solid legislative framework, aiming to reduce the negative impact of human activities on the environment and promote sustainable development (Angheluță et al., 2020). Efficient waste management strategies

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are essential to prevent their excessive accumulation and to ensure a more sustainable use of natural resources.

In the context of industrial and urban growth, the amount of waste generated is constantly expanding. Studies show that public policies play an essential role in implementing sustainable solutions in the field of environment and energy (Bodislav et al., 2020). An integrated approach to environmental policies involves not only regulating recycling processes but also promoting innovative waste recovery practices in order to preserve natural resources.

A particularly important aspect of recycling is the management of electronic waste, which contains valuable materials, but also substances hazardous to the environment. Previous studies emphasize that public policies on the recycling of electronic equipment must be supported by effective economic mechanisms and public awareness campaigns (Bodislav et al., 2019). At the same time, the management of organic or biodegradable waste is becoming a priority in modern ecological strategies, as it can be transformed into biogas or compost, thus contributing to the circular economy. In the process of accelerated urbanization, construction and demolition projects generate significant amounts of waste, which requires efficient materials recovery solutions. Recycling construction and demolition waste is essential for reducing pollution and reusing materials in new infrastructure projects (Bran et al., 2020). Therefore, the recovery rates of this waste must be constantly monitored to improve management strategies and reduce environmental impact.

In a broader context, the environmental risks associated with excessive waste generation are amplified by the phenomenon of globalization. Studies highlight that economic interdependence between states can influence the efficiency of recycling and waste management strategies at the international level (Profiroiu et al., 2020). In addition, the growth of urban populations exerts additional pressure on natural resources, requiring innovative solutions for sustainable urban development and reducing the ecological footprint (Profiroiu et al., 2020).

The analysis of econometric models for forecasting the production of natural resources, including recyclable materials, is essential for making effective decisions in the field of public policies. Studies show that econometric forecasts can contribute to the development of better-founded policies to optimize recycling processes and resource use (Rădulescu et al., 2020). Also, food safety issues in the context of globalization and population growth require more rigorous management of available resources, including through recycling and reuse of materials (Rădulescu et al., 2020).

2. FINDINGS

Recycling and reuse of waste allows to decrease the amount of waste that is generated. Effective waste monitoring and management contributes to the implementation of sustainable community development. Thus, the recycling rate of municipal waste is an important indicator of the interest that communities give to recycling processes. The comparative situation of the municipal waste recycling rate, for the period 2000-2020, is shown in table 1.

Table 1. The comparative situation of the municipal waste recycling rate, for the period 2000-2020 (%)

Countries	2000	2004	2008	2012	2016	2020
European Union	27,3	31,8	36,5	40,9	46,5	47,8
Belgium	49,7	53,5	52,7	53,4	53,5	52,0
Bulgaria	15,5	17,2	19,4	25,0	31,8	34,6
Czechia	0,9	5,5	10,4	23,2	33,6	45,4
Denmark	37,1	41,0	47,9	42,5	48,3	45,0
Germany	52,5	56,4	63,8	65,2	67,1	68,3
Estonia	2,4	24,8	20,2	19,1	28,1	28,9
Ireland	11,9	29,5	33,6	36,6	40,7	40,4
Greece	8,8	10,1	17,7	17,0	17,2	:

Countries	2000	2004	2008	2012	2016	2020
Spain	18,4	30,9	39,7	29,8	33,9	36,4
France	24,5	29,0	33,8	37,7	39,3	42,3
Croatia	:	:	2,8	14,7	21,0	29,5
Italy	14,2	17,6	23,8	38,4	45,9	51,4
Cyprus	3,0	3,2	7,5	12,5	16,1	16,4
Latvia	0,0	4,6	6,4	14,7	25,2	39,6
Lithuania	0,0	1,9	8,5	23,5	48,0	45,1
Luxembourg	36,1	41,5	46,0	47,4	49,2	52,8
Hungary	1,6	11,8	15,2	25,5	34,7	32,0
Malta	9,8	6,3	3,6	14,6	12,6	10,5
Netherlands	44,1	46,9	48,4	49,4	53,5	56,9
Austria	63,4	57,4	63,2	57,7	57,6	61,8
Poland	2,1	4,9	10,5	12,0	34,8	38,7
Portugal	10,5	13,5	17,3	26,1	30,9	26,5
Romania	0,0	1,1	0,9	14,8	13,4	13,7
Slovenia	6,0	20,4	18,9	41,9	55,6	59,3
Slovakia	5,1	6,2	7,4	13,4	23,0	42,2
Finland	33,6	33,6	34,3	33,3	42,0	41,6
Sweden	38,5	43,9	45,6	46,9	48,4	38,3

Source: made by the authors based on the data available on the EUROSTAT website

The data in the table shows the evolution of the recycling rate of municipal waste for the period 2000-2020. Thus, compared to 2000, in 2020 the recycling rate of municipal waste increased in: Czechia (+44.5%), Italy (+37.2%), Latvia (+39.6%), Lithuania (+45.1%), Hungary (+30.4%), Poland (+36.6%), Slovenia (+53.3%), Slovakia (+37.1%). The values of this indicator decreased in: Austria (-1.6%) and Sweden (-0.2%). Also, in 2020, the highest values were recorded in: Belgium (52%), Germany (68.3%), Italy (51.4%), Luxembourg (52.8%), Netherlands (56.9%), Austria (61.8%), Slovenia (59.3%). The lowest values were in: Cyprus (16.4%), Malta (10.5%), Romania (13.7%).

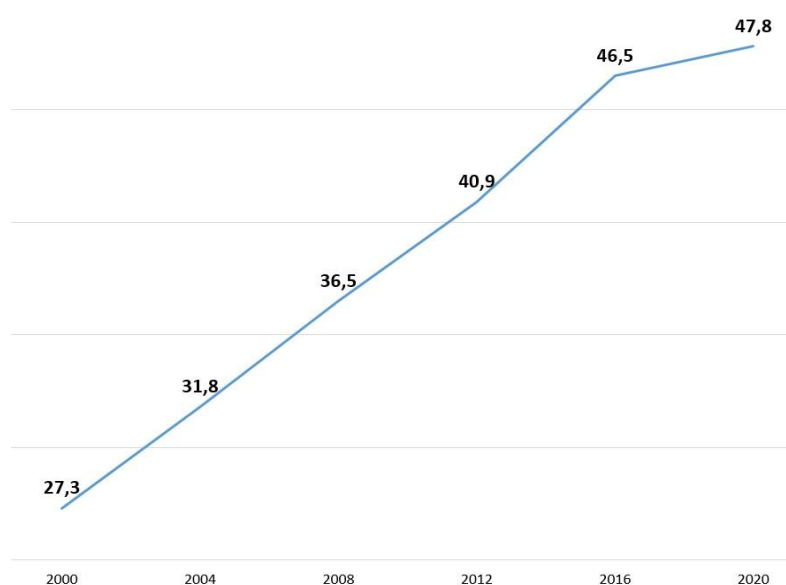


Figure 1. Evolution of the recycling rate of municipal waste, for the period 2000-2020 (%)

Source: made by the authors based on the data available on the EUROSTAT website

The evolution of the recycling rate of municipal waste indicates an increase from 27.3% (2000) to 47.8% (2020).

Table 2. The comparative situation of the amount of biological waste recycled, for the period 2000-2020 (kilograms per capita)

Countries	2000	2004	2008	2012	2016	2020
European Union	53	59	69	69	82	90
Belgium	106	116	98	93	85	155
Bulgaria	0	0	0	13	37	34
Czechia	1	2	5	8	23	70
Denmark	105	112	114	125	153	158
Germany	92	94	98	110	116	129
Estonia	1	6	21	14	10	10
Ireland	4	12	24	34	40	49
Greece	3	0	9	16	17	:
Spain	77	98	134	48	72	80
France	60	71	82	87	98	96
Croatia	:	:	3	6	7	21
Italy	22	34	53	73	94	116
Cyprus	0	0	0	8	19	6
Latvia	0	3	3	6	42	35
Lithuania	0	3	5	17	104	100
Luxembourg	93	123	138	128	167	186
Hungary	2	4	8	18	30	39
Malta	50	32	0	12	0	0
Netherlands	145	147	142	140	144	156
Austria	227	192	202	196	181	179
Poland	6	6	10	5	21	42
Portugal	33	29	36	66	79	70
Romania	0	0	0	29	18	18
Slovenia	7	8	8	21	69	70
Slovakia	7	8	12	15	26	59
Finland	38	36	44	60	65	80
Sweden	41	48	57	65	72	78

Source: made by the authors based on the data available on the EUROSTAT website

From the data presented, it can be seen that, at the European level, the amount of recycled biological waste increased by 37 kilograms per capita (kpc). The most important increases were registered in: Czechia (+69 kpc), Denmark (+53 kpc), Italy (+94 kpc), Lithuania (+100 kpc), Luxembourg (+93 kpc), Slovenia (+63 kpc), Slovakia (+52 kpc). Decreases were recorded in two countries: Malta (-50 kpc) and Austria (-48 kpc). However, the highest values for the year 2020 were in: Austria (179 kpc), Denmark (158 kpc), Luxembourg (186 kpc), Netherlands (156 kpc), Belgium (155 kpc). The lowest values of the amount of recycled biological waste were registered in: Estonia (10 kpc), Romania (18 kpc), Cyprus (6 kpc), Croatia (21 kpc). Also, Malta does not recycle biological waste. The evolution of the amount of biological waste recycled at the European level is presented in figure 2.

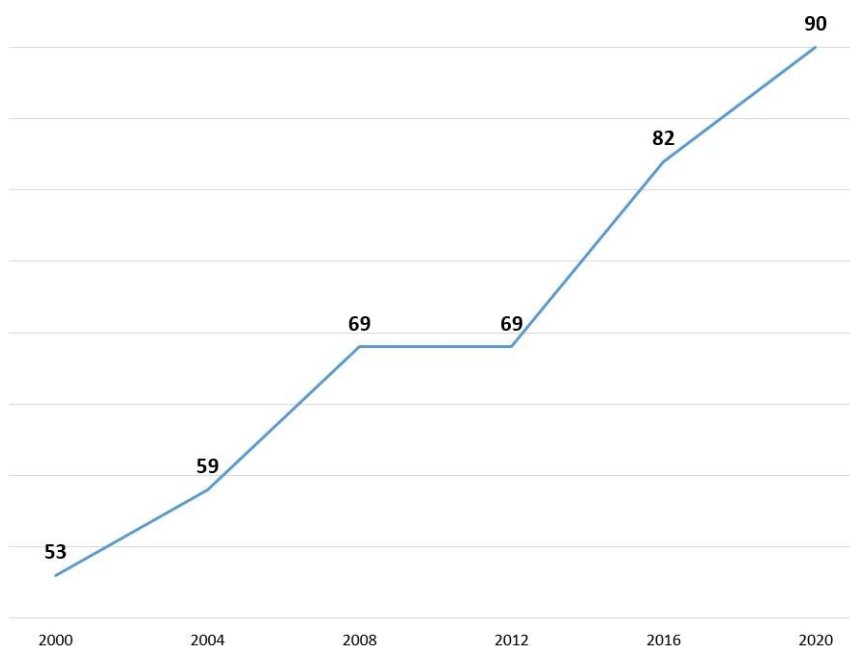


Figure 2. Evolution of the quantities of recycled biological waste, for the period 2000-2020 (kilograms per capita)

Source: made by the authors based on the data available on the EUROSTAT website

It is observed that the values increased from 53 kpc (in the year 2000) to 90 kpc (in the year 2020). Another important indicator of waste recycling is the recycling rate of e-waste. The comparative situation for the period 2010-2018 is presented in the following table (%).

Table 3. Comparative situation of recycling rate of e-waste, for the period 2010-2018 (%)

Countries	2010	2012	2014	2016	2018
European Union	27,9	30	32,8	39,5	38,9
Belgium	30,4	32	29,6	38,3	39,3
Bulgaria	40,8	62,4	68,3	105,2	66,7
Czechia	22,7	27,1	29,3	54	43,6
Denmark	41	46,5	42,3	41,4	67,5
Germany	37,8	34,8	36,9	39	36,9
Estonia	30,3	35,9	35,7	51,8	53,7
Ireland	30,9	36,1	43,1	49,5	53,5
Greece	19,4	18,6	29	34,2	35,8
Spain	14,7	19	26,2	37,4	43
France	21,8	22,6	26,3	37,1	34,2
Croatia	:	:	35,7	89,2	83,4
Italy	27,8	27,7	27,3	:	:
Cyprus	11,5	12,2	17	27,1	:
Latvia	14,5	26,5	26,4	23,2	43,3
Lithuania	16,6	41,1	64,6	38,9	36,4
Luxembourg	33	27,6	35,4	45,6	44,1
Hungary	26	30,8	47,7	53,4	50,5
Malta	13,1	9,9	11,5	15,9	:
Netherlands	27,8	33,2	38,1	40,4	41
Austria	35,7	38,2	39,1	41	46
Poland	17,7	30,4	27,4	38,9	39,1
Portugal	22,8	24,9	38,2	45,8	:

Countries	2010	2012	2014	2016	2018
Romania	12	14,5	21,3	25	:
Slovenia	22	26,9	27,5	39,3	33,6
Slovakia	34,9	42,6	44,1	50,3	45,8
Finland	28,7	32,8	42,4	42,1	49,2
Sweden	55,3	62,6	52,7	55,4	45,4

Source: made by the authors based on the data available on the EUROSTAT website

From the data presented by EUROSTAT, at the level of the European Union the recycling rate of e-waste increased by 11%. In two countries the shares decreased: Germany (-0.9%) and Sweden (-9.9%). In the other countries the values increased. The recycling rate of e-waste increased by over 25% in: Bulgaria (+25.9%), Denmark (+26.5%), Spain (+28.3%), Croatia (+47.7%), Cyprus (+38.7%), Latvia (+28.8%). In 2020, shares of over 50% were in: Bulgaria (66.7%), Denmark (67.5%), Estonia (53.7%), Ireland (53.5%), Croatia (83.4%), Hungary (50.5%).

Construction and demolition activities also generate waste. Thus, the following table presents the comparative situation of the recovery rate of construction and demolition waste, for the period 2010-2018.

Table 4. Comparative situation of recovery rate of construction and demolition waste, for the period 2010-2018 (%)

Countries	2010	2012	2014	2016	2018
European Union	:	:	87	87	88
Belgium	17	18	32	95	97
Bulgaria	62	12	96	90	24
Czechia	91	91	90	92	:
Denmark	:	91	92	90	97
Germany	95	94	:	:	93
Estonia	96	96	98	97	95
Ireland	97	100	100	96	100
Greece	0	0	0	88	97
Spain	65	84	70	79	75
France	66	66	71	71	73
Croatia	2	51	69	76	78
Italy	97	97	97	98	98
Cyprus	0	60	38	57	64
Latvia	:	:	92	98	97
Lithuania	73	88	92	97	99
Luxembourg	98	99	98	100	98
Hungary	61	75	86	99	99
Malta	16	100	100	100	100
Netherlands	100	100	100	100	100
Austria	92	92	94	88	90
Poland	93	92	96	91	84
Portugal	58	84	95	97	93
Romania	47	67	65	85	74
Slovenia	94	92	98	98	98
Slovakia	:	:	54	54	51
Finland	5	12	83	87	74
Sweden	78	81	55	61	90

Source: made by the authors based on the data available on the EUROSTAT website

From the data presented by EUROSTAT, it can be seen that, in 2018, interest in the recovery of construction and demolition waste was high (in 17 countries the values were 90% and above 90%). Thus, in three countries the weights were 100% (Ireland, Malta, Netherlands). However, compared to 2010, in 2018 the values decreased for: Bulgaria (-38%), Germany (-3%), Estonia (-1%), Austria (-20%), Poland (-9%), Slovakia (-3%).

CONCLUSIONS

Hazardous waste affects people's health. The existence of recycling measures, respectively of waste reuse, can contribute to the existence of an environment conducive to life. The increase in the consumption of goods and resources without being associated with effective waste management leads to an increase in the amount of waste. The analysis carried out reveals in most cases an increase in interest in aspects related to waste recycling. Thus, the recycling rate of e-waste has increased in most countries. Also, the recovery of construction and demolition waste is an indicator that is given special attention. The way people perceive environmental issues influences the degree to which certain balances or imbalances can occur.

REFERENCES

- Angheluță, S.P., Petrescu, I.E., Niculescu, M.A., & Velicu, E.R. (2020). *Aspects of Waste Management in the European Union*. In: R. Pamfilie, V. Dinu, L. Tăchiciu, D. Pleșea, C. Vasiliu (Eds.), *6th BASIQ International Conference on New Trends in Sustainable Business and Consumption*. Messina, Italy, 4-6 June 2020. Bucharest: ASE, pp. 244-251.
- Bodislav, D.A., Rădulescu, C.V., Bran, F., & Burlacu, S. (2020). *Public policy in the areas of environment and energy*. In: R. Pamfilie, V. Dinu, L. Tăchiciu, D. Pleșea, C. Vasiliu (Eds.), *6th BASIQ International Conference on New Trends in Sustainable Business and Consumption*. Messina, Italy, 4-6 June 2020. Bucharest: ASE, pp. 228-235.
- Bodislav, A.D., Rădulescu, C.V., Moise, D., & Burlacu, S. (2019). Environmental Policy in the Romanian Public Sector. *Journal of Emerging Trends in Marketing and Management*, 1(1), 312-317.
- Bran, F., Rădulescu, C.V., Bodislav, D.A., & Burlacu, S. (2020). Environmental risks in the context of globalization, *Journal of Economic Convergence in European Union*, 350, 228-235.
- Profiroiu, C.M., Bodislav, D.A., Burlacu, S., & Rădulescu, C.V. (2020). Challenges of Sustainable Urban Development in the Context of Population Growth. *European Journal of Sustainable Development*, 9(3), 51-51.
- Rădulescu, C. V., Bran, F., Burlacu, S., Dobrea, C. R., & Diaconu, S. (2020, October). Challenges regarding food resources in the context of globalization and population growth. In *Proceedings of the International Conference on Economics and Social Sciences* (pp. 1041-1052).
- Rădulescu, C. V., Bodislav, D. A., Burlacu, S., Bran, F., & Karimova, L. (2020). Econometric model for forecasting oil production in OECD member states. In *E3S Web of Conferences* (Vol. 159, p. 02005). EDP Sciences
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