

ASPECTS OF WASTE MANAGEMENT IN THE EUROPEAN UNION

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Abstract

People, through their economic activities, influence the environment. In urban areas, the population is growing. This phenomenon, in addition to the increases in the industry, leads to increased quantities of waste. In this way, besides socio-economic problems, environmental problems also appeared. Technologies that do not use raw materials in high percentages have negative effects on natural resources. Their exhaustion is also a consequence of the reduced use of raw materials. The article presents an analysis of the waste treated in the member countries of the European Union. A method of reducing the impact of waste on the environment is given by the application of technologies that reduce the quantities of waste generated. Some wastes are hazardous to human health. Their harmful effect is also affecting the environment. The composition of solid urban waste is influenced by the technologies used to produce the products, as well as the energy sources used. For this reason, it is beneficial for the environment to apply waste management systems in order to reuse and recycle them. Considering the predominantly urban distribution of the population of the European Union, the article presents the situation of municipal waste both generated and treated. An important contribution to sustainable development has a more efficient waste management. The circular economy can be considered as a solution to prevent the increase of the quantities of waste.

Keywords

waste, municipal waste, circular economy, waste management, European Union.

JEL Classification

Q53, Q50

Introduction

Solid waste landfills are one of the sources of methane emissions. Thus, the larger these deposits are, the higher the methane emissions (Jeong et al., 2019). Rapid urban expansion has caused waste management to change. The existence of sewerage and sewerage systems

represents important facilities of urban areas (Saxena et al., 2019). It is desired, as through the production processes, to result in reduced quantities of unusable waste. An economy in which all resources would be recycled can be considered a perfect economy (Jianu et al., 2019). Some wastes contain in addition to very toxic substances and certain valuable raw materials (Rădulescu et al., 2018). Therefore, waste management also involves knowing the factors that affect their collection. Motivation for an unpolluted environment is a key element in improving waste recycling (Otto et al., 2018). The efficiency of collection is also influenced by the climatic conditions in which the landfills are located. These can alter greenhouse gas emissions (Lee et al., 2017).

Sustainable development implies the existence of a waste management strategy. The strategy of the waste management can be influenced by the management of the waste collection infrastructure. These deficiencies lead to high emissions, as well as unsustainable practices in terms of waste management (Fuldauer et al., 2019).

Literature review

The interest in the sustainability of waste management strategies has led to the tendency to identify alternative waste management strategies (Dima et al., 2020). Communities can intervene on the issue of waste, through collaboration between stakeholders from various industrial and business sectors (Ng et al., 2019).

Linear type consumption is not sustainable. It involves further interventions to correct environmental, financial and social impacts (Angheluta et al., 2019). The circular economy allows the use of efficient practices with low costs (Negescu Oancea, et al., 2019). This means that the waste is turned back into raw material, which corresponds to the replacement of natural raw materials (Russo et al., 2019).

Food waste, as well as increasing the frequency with which food is wasted, leads to an increase in the relative amount of food waste in households. Thus, one of the interesting topics for research is given by the food waste (Burlacu et al., 2018). It is found that some of the food becomes food waste, not being a source of food. However, a large area of agricultural land is used to produce the raw materials needed for these foods (Burlacu et al., 2019). In addition, energy and water are consumed for the processing of the raw material, preparation, packaging and storage of these foods (Bodislav et al., 2019). All of these processes involve greenhouse gas emissions (van Herpen et al., 2019). One of the measures used in developing countries is the composting of food waste. But in addition to food waste, food waste also contains other associated materials (Ioniță et al., 2009). The presence of heavy metals in these associated materials increases the toxicity. At the same time, given the high severity, the cost of treatments increases when heavy metals are found in waste (Chu et al., 2019). Even if large quantities of food waste result in the food production process, they can be re-evaluated (Litra and Burlacu, 2014). Identifying sustainable solutions for waste management, as well as reducing the amount of waste, is the basis of the circular economy strategies in any industrial sector (Garcia-Garcia et al., 2019).

Another example of waste that will need attention in the coming years is waste from photovoltaic panels. It is considered that the amount of this waste will increase greatly due to the life cycle of the panels. The efficiency with which the photovoltaic panels are recycled is low. However, it is necessary to recover high quality materials. Increased efficiency in recycling could be achieved through heat treatments, but these lead to atmospheric pollutant emissions. For this reason, the photovoltaic panels to be built should consider improving the efficiency of the resources (Ardente et al., 2019). Improper management of plastic waste leads to plastic contamination. The aquatic environment, but also the terrestrial environment, through human activities, are contaminated with microplastic material. Soil quality, through agricultural land, but also water quality, through rivers and seas, can be influenced by high concentrations of microplastic materials (Corradini et al., 2019). Radioactive waste is another

major point of interest. Many countries, which have developed nuclear industries, have chosen to manage long-term radioactive waste through their geological disposal process (Scheidegger et al., 2019).

Methodology of research

The article presents an analysis of the waste treated in the member countries of the European Union, for the period 2004-2016. Considering the predominantly urban distribution of the population of the European Union, the article presents the comparative situation of municipal waste both generated and treated, for 2009, respectively 2018. The analysis was performed for both the total quantities and the quantities per capita.

Results and discussions

The high quantities of waste that people produce has increased the importance that must be given to the treatment of these wastes. Thus, the Table 1 presents the comparative situation of the treated waste in the member countries of the European Union. The comparison was made for 2004 and 2016 respectively. Also, for 2016, the weight distribution for hazardous waste and non-hazardous waste treatment is shown. It is noted that at European level, the total waste treatment increased in 2016, compared to 2004, with +197.460.000 tonnes. Also, the values increased in: Finland (+58.440.001 tonnes), Netherlands (+54.053.386 tonnes), Sweden (+49.839.963 tonnes), Greece (+44.575.661 tonnes), Germany (+37.202.862 tonnes). The decrease in the amount of total waste treatment was registered in: Bulgaria (-78.206.588 tonnes), Romania (-34.815.816 tonnes), Spain (-29.504.762 tonnes), Portugal (-14.276.095 tonnes). However, in 2018, the countries where the total waste treatment quantities were high are: Germany (383.204.029 tonnes). France (304.814.284 tonnes), Romania (175.698.723 tons), Poland (163.002.317 tons).

Table no. 1 Comparative situation of waste treated, European Union

Countries	2004	2016		
	Total waste treatment (tonnes)	Total waste treatment (tonnes)	Share hazardous waste treatment (%)	Share non-hazardous waste treatment (%)
European Union (28 countries)	2.114.190.000	2.311.650.000	3,32	96,68
Belgium	32.985.766	43.506.358	5,63	94,37
Bulgaria	195.064.838	116.858.250	11,28	88,72
Czechia	22.521.031	22.913.480	2,31	97,69
Denmark	12.892.738	19.062.523	9,89	90,11
Germany	346.001.167	383.204.029	5,61	94,39
Estonia	15.410.921	19.872.869	48,26	51,74
Ireland	18.227.850	11.767.578	0,67	99,33
Greece	25.499.043	70.074.704	0,60	99,40
Spain	136.220.011	106.715.249	1,99	98,01
France	283.391.472	304.814.284	2,35	97,65
Croatia	4.756.565	3.684.489	2,06	97,94
Italy	102.352.518	136.041.718	2,68	97,32
Cyprus	1.182.660	1.953.732	7,24	92,76
Latvia	988.139	1.836.259	1,12	98,88
Lithuania	4.579.718	4.810.390	1,27	98,73
Luxembourg	10.217.449	11.321.117	0,41	99,59
Hungary	9.826.086	13.960.246	2,45	97,55
Malta	3.097.939	1.472.647	0,03	99,97
Netherlands	85.826.150	139.879.536	3,79	96,21
Austria	51.627.556	60.028.645	0,75	99,25

Countries	2004	2016		
	Total waste treatment (tonnes)	Total waste treatment (tonnes)	Share hazardous waste treatment (%)	Share non-hazardous waste treatment (%)
Poland	128.581.819	163.002.317	0,85	99,15
Portugal	23.945.324	9.669.229	5,08	94,92
Romania	210.514.539	175.698.723	0,20	99,80
Slovenia	4.990.764	4.810.258	1,60	98,40
Slovakia	12.104.130	7.923.648	2,16	97,84
Finland	67.015.648	125.455.649	1,60	98,40
Sweden	87.181.191	137.021.154	0,97	99,03

Source: own processing according to data published by Eurostat, 2020

In 2016, the countries with the highest share of hazardous waste treatment were: Estonia (48,26%), Bulgaria (11,28%), Denmark (9,89%), Cyprus (7,24%), Belgium (5,63%). The share of non-hazardous waste treatment had high values for: Malta (99,97%), Romania (99,80%), Luxembourg (99,59%), Greece (99,40%), Ireland (99,33%).

As in Finland, compared to 2004, the amount of total waste treatment increased significantly (+58.440.001 tonnes), the Figure 1 shows the evolution of this indicator (tonnes).

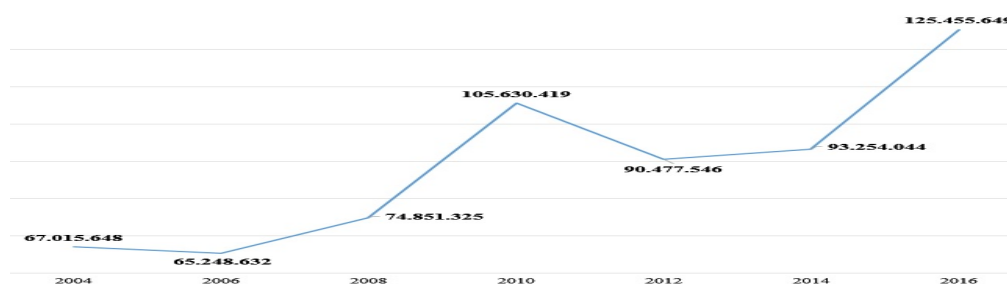


Fig. no. 1 Evolution of the total quantity of waste treatment, 2004-2016, Finland

Source: own processing according to data published by Eurostat, 2020

It is observed that the periods of decrease of values were: 2004-2006, 2010-2012. For the other periods the trend was increasing (2006-2010, 2012-2016).

Within the total quantity of waste generated and treated, municipal waste represents a separate segment. Thus, the Table 2 presents the comparative situation of municipal waste generated and treatment in the member countries of the European Union (thousand tonnes).

Table no. 2 Comparative situation of municipal waste generated and treatment

Countries	Municipal waste generated		Municipal waste treatment		Countries	Municipal waste generated		Municipal waste treatment	
	2009	2018	2009	2018		2009	2018	2009	2018
European Union (28 countries)	257,042	250,474	249,482	246,668	Latvia	753	785	753	676
Belgium	5,042	4,698	4,779	4,698	Lithuania	1,206	1,301	1,196	1,167
Bulgaria	4,449	2,973	4,309	2,922	Luxembourg	338	371	338	371
Czechia	3,310	3,732	2,894	3,732	Hungary	4,312	3,729	4,284	3,746
Denmark	4,206	4,436	4,206	4,436	Malta	268	310	268	285
Germany	48,466	51,013	48,466	51,013	Netherlands	9,738	8,806	9,738	8,806
Estonia	452	535	383	505	Austria	4,921	5,119	4,788	5,041
Ireland	2,953	2,768 (2017)	2,825	2,724 (2017)	Poland	12,053	12,485	10,054	12,485

Countries	Municipal waste generated		Municipal waste treatment		Countries	Municipal waste generated		Municipal waste treatment	
	2009	2018	2009	2018		2009	2018	2009	2018
Greece	5,154	5,415 (2017)	5,154	5,415 (2017)	Portugal	5,496	5,222	5,496	4,986
Spain	25,108	22,222	25,108	22,222	Romania	7,768	5,296	6,246	5,134
France	34,426	35,272	34,426	35,272	Slovenia	1,069	1,009	851	795
Croatia	1,743	1,768	1,732	1,619	Slovakia	1,654	2,254	1,583	2,253
Italy	32,107	30,165	29,840	27,488	Finland	2,562	3,041	2,562	3,041
Cyprus	589	547 (2017)	589	505 (2017)	Sweden	4,390	4,416	4,390	4,416

Source: own processing according to data published by Eurostat, 2020

Regarding municipal waste generated, it is noted that, in 2018, the highest quantities were generated by Germany (51,013 thousand tonnes), France (35,272 thousand tonnes), Italy (30,165 thousand tonnes), Spain (22,222 thousand tonnes). Also, the lowest quantities generated were recorded in: Malta (310 thousand tonnes), Luxembourg (371 thousand tonnes), Estonia (535 thousand tonnes), Latvia (785 thousand tonnes), Slovenia (1,009 thousand tonnes).

In 2018, the countries where the amount of municipal waste treatment was high are: Germany (51,013 thousand tonnes), France (35,272 thousand tonnes), Italy (27,488 thousand tonnes), Spain (22,222 thousand tonnes).

For 2018, there is a negative difference between municipal waste generated and municipal waste treatment in: Italy (-2,677 thousand tonnes), Portugal (-236 thousand tonnes), Slovenia (-214 thousand tonnes), Romania (-162 thousand tonnes), Croatia (-149 thousand tons), Lithuania (-134 thousand tons), Latvia (-109 thousand tons). Also, of the countries with the highest values of waste generated in 2018, there were significant decreases compared to 2009: Spain (-2,886 thousand tonnes), Italy (-1,942 thousand tonnes). For the same period, Germany had an increase of + 2,547 thousand tonnes. Based on this information, the Figure 2 shows the evolution of the quantities of municipal waste generated for Germany and Spain, for the period 2009-2018 (thousand tonnes).



Fig. no. 2 Evolution of the quantities of municipal waste generated, Germany and Spain, 2009-2018 (thousand tonnes)

Source: own processing according to data published by Eurostat, 2020

It can be seen that the quantity of municipal waste generated for Germany had a relatively increasing trend for the period 2009-2016, and for the period 2016-2018 the trend was decreasing. For Spain, the quantity of municipal waste generated decreased in 2009-2014, and in 2014-2018 the trend was increasing.

The amount of municipal waste generated and treatment depends on a number of factors. As the number of urban population is one of the main factors, the Table 3 presents the

comparative situation of municipal waste generated and treatment, in the member countries of the European Union (kilograms per capita).

Table no. 3 Comparative situation of municipal waste generated and treatment, 2009-2018 (kilograms per capita)

Countries	Municipal waste generated		Municipal waste treatment		Countries	Municipal waste generated		Municipal waste treatment	
	2009	2018	2009	2018		2009	2018	2009	2018
European Union (28 countries)	511	488	496	481	Latvia	352	407	352	351
Belgium	467	411	443	411	Lithuania	381	464	378	417
Bulgaria	598	423	579	416	Luxembourg	679	610	679	610
Czechia	317	351	277	351	Hungary	430	381	427	383
Denmark	762	766	762	766	Malta	649	640	649	587
Germany	592	615	592	615	Netherlands	589	511	589	511
Estonia	339	405	287	382	Austria	590	579	574	570
Ireland	651	576 (2017)	623	567 (2017)	Poland	316	329	264	329
Greece	464	504 (2017)	464	504 (2017)	Portugal	520	508	520	485
Spain	542	475	542	475	Romania	381	272	307	264
France	534	527	534	527	Slovenia	524	486	417	383
Croatia	405	432	402	396	Slovakia	307	414	294	414
Italy	543	499	505	455	Finland	480	551	480	551
Cyprus	729	637 (2017)	729	587 (2017)	Sweden	472	434	472	434

Source: own processing according to data published by Eurostat, 2020

It is noted that in 2018, municipal waste generated in kilograms per capita had the highest values in Denmark (766 kilograms per capita), Malta (640 kilograms per capita), Germany (615 kilograms per capita), Luxembourg (610 kilograms per capita), Austria (579 kilograms per capita). The countries with the lowest municipal waste generated in kilograms per capita were: Romania (272 kilograms per capita), Poland (329 kilograms per capita), Czechia (351 kilograms per capita), Hungary (381 kilograms per capita), Estonia (405 kilograms per capita).

In terms of waste treatment in kilograms per capita, in 2018, the countries with the highest values were: Denmark (766 kilograms per capita), Germany (615 kilograms per capita), Luxembourg (610 kilograms per capita), Malta (587 kilograms per capita), Austria (570 kilograms per capita). Low values were recorded in: Romania (264 kilograms per capita), Poland (329 kilograms per capita), Czechia (351 kilograms per capita), Latvia (351 kilograms per capita), Estonia (405 kilograms per capita).

Conclusions

The technologies by which the products are manufactured influence globally global warming and environmental pollution. Municipal waste consists mostly of waste generated by households, but also includes waste generated by small institutions and businesses.

From the analysis presented, it was found that in the member countries of the European Union the total waste treatment increased from 2.114.190.000 tonnes (in 2004) to 2.311.650.000 tonnes (in 2016). Regarding municipal waste generated, it is noted that, in 2018, the highest quantities were generated by the countries with the largest population (Germany, France, Italy, Spain). The highest quantities of municipal waste treatment were recorded in these countries. Municipal waste generated in kilograms per capita were higher in: Denmark, Malta,

Germany, Luxembourg, Austria. Also in these countries were the highest values for municipal waste treatment in kilograms per capita.

Climate change and human activities can destabilize the critical processes of the planetary system. Preventing the increase of the quantities of waste can also be achieved through the circular economy. The increase of industrial activities, due to the increasing demands, leads to an increased consumption of resources. These aspects negatively affect the planetary resources, but also the quality of human life. A circular economy is based on sustainable flows of materials and energy. Thus, waste can be included in reuse programs to create additional value. The efforts of producers and consumers can lead to the activation of a circular economy (Velenturf and Jopson, 2019).

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