

Characteristics of Waste Generation in the European Union

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Abstract

It is desired that the impact of resource use on the environment be kept to a minimum. Thus, resource efficiency enables sustainable economic growth. This can reduce greenhouse gas emissions as well as the amount of waste generated. Given that climate change is contributing to environmental degradation, the interest in efficient waste management is high. Environmental protection measures can reduce the effects of global warming. Many of the technologies have negative influences on the environment. Thus, the application of new technologies can lead to a reduction in the amount of waste resulting from the production process. The article presents a comparative analysis of the distribution of waste generation in the member countries of the European Union. One measure that can lead to the efficient use of resources is the prevention of waste generation. In this way, the impact of waste on the environment decreases. From the analysis presented, it is observed that certain sectors of activity generate a higher amount of waste. At the same time, compared to 2010, in 2018, in most member countries of the European Union, the quantities of waste generated per capita increased. This can be an alarm signal for the call to action. Extending the life of a product and reusing it, through repair, can influence the change of production models. Measures to recycle and reuse materials are considered to be of greater importance.

Keywords

Generation of waste, waste management, European Union.

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Introduction

The environment is affected by an intensive use of resources. Consumption habits can also lead to more efficient use of resources. We can consider that reducing the use of non-renewable raw materials is one of the measures that can be applied for this purpose. We must keep in mind that the natural environment provides a good part of the food, as well as a part of the means necessary for the economic activities. However, the economic potential has not been fully directed towards the recovery of pollution-affected ecosystems. The way we treat the environment has a direct influence on people's way of life. Increased attention should be paid to how resources are used. Their intensive use can influence the way they are approached and waste management. It is also considered that for a better management the whole production cycle of a product should be rethought. The conservation of natural resources can be achieved through interventions in each stage of making a product. The quality of the environment can be improved through sustainable materials management measures. Reducing greenhouse gas emissions can also be achieved by applying resource efficiency measures (European Parliament, 2018). It is

considered that the improvement of natural capital and its protection can be achieved by applying a management that increases the efficiency of resource use (Zorpas, 2020).

Literature review

Globally, the population is on an increasing trend. The trend is also for the population to benefit from high levels of well-being and consumption. Thus, resource-intensive use will lead to changes in the way people use resources. The sustainable use of resources and their efficient use can lead to a decrease in the amount of waste produced. It is desired to increase the value of products and services by decreasing the amount of raw materials used. Such an approach can lead to an increase in the use of renewable energies. The decline of natural resources causes a decrease in the quality of life of people. Overexploitation of natural ecosystems accelerates the process of environmental degradation and contributes to the decrease of resources needed for future generations (Bran, et al., 2012). One of the priorities of the European Union is to reduce the amount of waste generated and recover it (Magazzino, et al., 2021). The impact of food waste is both economic and social and environmental. Thus, it is considered that in order to combat food waste, it is important to know the quantities of food that are wasted throughout their production chain (Caldeira, et al., 2021). Measures are also needed to avoid food waste, as well as to reduce this waste. In this way, the economic burden can be reduced, but also the environmental one (Jeswani, et al., 2021).

Lately, more importance has been given to plastic waste management. Increasing microplastic material concentrations negatively influence water and soil quality (Corradini, et al., 2019). Responsible, controlled individual behavior can lead to a decrease in the amount of waste generated, especially in terms of plastic waste (Kedzierski, et al., 2020). It is believed that the green economy can help promote a reduction in waste generation, encouraging sustainability. Thus, valuable substances are recovered from waste, which are then reused (Al-Ghouti, et al., 2021). In some cases, due to the life cycle of the products, waste production is inevitable. Recovery of high quality components from these products can be a measure that leads to improved recycling efficiency (Ardente, et al., 2019). Through the circular economy, for any field of activity, a sustainable waste management contributes to the identification of solutions that lead to the reduction of the amount of waste (Garcia-Garcia, et al., 2019). Waste generation influences both people's health and the state of the environment. Thus, it is desirable for waste management to consider reducing these effects and lead to a reduction in resource consumption (European Parliament, 2018).

Methodology of research

According to European legislation, economic activities are classified statistically by means of a nomenclature (NACE) (EC, 1990). Based on this classification, according to the existing data on the EUROSTAT website, information from the last 10 years was chosen for the analysis. The article presents a comparative analysis of the distribution of waste generation in the member countries of the European Union, for the period 2010-2018. Depending on the main economic activities, the article presents the comparative situation of the waste generated for 2010 and 2018, respectively. The analysis took into account the quantities of waste generated per capita.

Results and discussions

The processes in which materials are used lead to the generation of waste. Thus, most processes through which products are made have an impact on human health and the quality of the environment (Lagerkvist and Dahlén, 2012). In order to achieve a finished product, waste is produced in any sector of activity. Thus, for 2010, the situation of the distribution of waste generation by NACE activities is presented in the following table.

Table no. 1. Distribution of waste generation by NACE activities, 2010 (Kilograms per capita)

| Countries | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------|-----|-------|------|------|------|-------|------|------|------|-------|
| European Union | 47 | 1469 | 565 | 184 | 329 | 1715 | 222 | 50 | 437 | 5017 |
| Belgium | 21 | 156 | 1315 | 111 | 1328 | 1547 | 468 | 147 | 538 | 5630 |
| Bulgaria | 84 | 20311 | 447 | 1086 | 80 | 11 | 126 | 13 | 477 | 22635 |
| Czechia | 11 | 11 | 401 | 147 | 319 | 893 | 103 | 65 | 318 | 2268 |
| Denmark | 34 | 4 | 280 | 171 | 578 | 566 | 37 | 614 | 640 | 2923 |
| Germany | 3 | 300 | 599 | 111 | 426 | 2336 | 224 | 3 | 444 | 4446 |
| Estonia | 83 | 4846 | 2791 | 4908 | 209 | 328 | 144 | 639 | 323 | 14270 |
| Ireland | 22 | 481 | 715 | 73 | 746 | 353 | 31 | 1542 | 379 | 4344 |
| Greece | 0 | 4028 | 444 | 992 | 87 | 188 | 127 | 0 | 467 | 6333 |
| Spain | 125 | 681 | 354 | 50 | 206 | 815 | 217 | 7 | 498 | 2953 |
| France | 21 | 16 | 333 | 15 | 230 | 4022 | 387 | 0 | 452 | 5478 |
| Croatia | 3 | 7 | 148 | 25 | 519 | 2 | 5 | 27 | 0 | 735 |
| Italy | 5 | 12 | 606 | 45 | 352 | 1001 | 79 | 28 | 548 | 2676 |
| Cyprus | 156 | 460 | 159 | 4 | 33 | 556 | 205 | 1 | 1288 | 2861 |
| Latvia | 32 | 0 | 179 | 12 | 58 | 10 | 6 | 86 | 331 | 714 |
| Lithuania | 147 | 2 | 855 | 12 | 86 | 115 | 22 | 154 | 407 | 1801 |
| Luxembourg | 5 | 36 | 1711 | 4 | 408 | 17490 | 423 | 25 | 493 | 20597 |
| Hungary | 49 | 9 | 313 | 272 | 132 | 407 | 160 | 45 | 286 | 1674 |
| Malta | 7 | 136 | 22 | 0 | 32 | 2384 | 322 | 0 | 361 | 3264 |
| Netherlands | 282 | 11 | 848 | 77 | 470 | 4698 | 356 | 2 | 547 | 7291 |
| Austria | 66 | 32 | 354 | 54 | 486 | 2502 | 1492 | 57 | 553 | 5596 |
| Poland | 16 | 1618 | 752 | 533 | 358 | 547 | 86 | 27 | 234 | 4171 |
| Portugal | 7 | 25 | 259 | 28 | 175 | 122 | 93 | 65 | 515 | 1290 |
| Romania | 30 | 8762 | 380 | 291 | 52 | 36 | 142 | 1 | 255 | 9949 |
| Slovenia | 69 | 6 | 739 | 678 | 48 | 737 | 291 | 0 | 355 | 2922 |
| Slovakia | 97 | 31 | 495 | 163 | 136 | 331 | 127 | 41 | 319 | 1741 |
| Finland | 517 | 10227 | 2836 | 269 | 419 | 4595 | 1 | 276 | 313 | 19454 |
| Sweden | 33 | 9493 | 834 | 158 | 315 | 1000 | 195 | 86 | 431 | 12545 |

Source: own processing according to data published by Eurostat (2021)

Legend:

- | | |
|---|--|
| 1 – Agriculture, forestry and fishing | 6 – Construction |
| 2 – Mining and quarrying | 7 – Services (except wholesale of waste and scrap) |
| 3 – Manufacturing | 8 – Wholesale of waste and scrap |
| 4 – Electricity, gas, steam and air conditioning supply | 9 – Households |
| 5 – Water supply; sewerage, waste management and remediation activities | 10 – All NACE activities plus households |

For 2010, for all NACE activities plus households, generation of waste in kilograms per capita has high values for: Bulgaria (22635), Luxembourg (20597), Finland (19454), Estonia (14270), Sweden (12545). The economic activity for which the generation of waste in kilograms per capita is the highest is mining and quarrying. The countries with the highest quantities of this kind generated per capita are: Bulgaria (20311) and Finland (10227). The construction sector also generates large amounts of waste in Luxembourg (17490). Another activity with high values is electricity, gas, steam and air conditioning supply. Bulgaria (1086) and Estonia (4908) are the countries with the highest amounts of waste for this economic activity. For manufacturing, the highest values per capita are recorded in: Finland (2836), Estonia (2791), Luxembourg (1711), Belgium (1315). In Austria, services (except wholesale of waste and scrap) generate the highest amount in the field (1492). Also water supply; sewerage, waste management and remediation activities generate in Belgium 1328 kilograms per capita. For wholesale of waste and scrap, high quantities are generated in: Ireland (1542), Estonia (639), Denmark (614), Finland (276), Lithuania (154), Belgium (147). The agriculture, forestry and fishing sectors also contribute to waste generation. The countries with the highest values for this sector are: Finland (517), Netherlands (282), Cyprus (156), Lithuania (147),

Spain (125). For households, high values are recorded in: Cyprus (1288), Denmark (640), Austria (553), Italy (548), Netherlands (547), Belgium (538), Portugal (515).

For the European Union, in 2010, the distribution of the average quantities generated by the main economic activities is given in the figure no. 1.

It is observed that the highest average amount of waste generated is for the construction sector (1715), followed by mining and quarrying (1469) and manufacturing (565). The lowest quantities are generated by agriculture, forestry and fishing (47) and wholesale of waste and scrap (50).

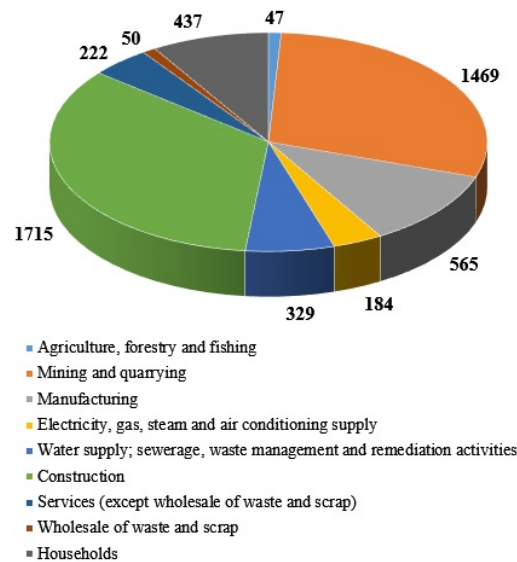


Figure no. 1. Distribution of average quantities generated by the main economic activities, 2010

Source: own processing according to data published by Eurostat (2021)

For 2018, the situation of the generation of waste by NACE activities distribution is presented in the following table.

Table no. 2. Distribution of waste generation by NACE activities, 2018 (Kilograms per capita)

| Countries | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------|-----|-------|------|------|------|------|-----|-----|-----|-------|
| European Union | 45 | 1391 | 552 | 175 | 514 | 1870 | 216 | 25 | 425 | 5212 |
| Belgium | 39 | 3 | 1475 | 69 | 1382 | 1983 | 424 | 115 | 428 | 5917 |
| Bulgaria | 44 | 15213 | 362 | 1848 | 387 | 27 | 108 | 33 | 448 | 18470 |
| Czechia | 13 | 8 | 479 | 48 | 468 | 1091 | 115 | 54 | 350 | 2626 |
| Denmark | 65 | 2 | 176 | 191 | 277 | 2071 | 317 | 0 | 604 | 3702 |
| Germany | 12 | 107 | 682 | 114 | 580 | 2717 | 211 | 19 | 450 | 4891 |
| Estonia | 105 | 5166 | 3305 | 5666 | 570 | 1659 | 627 | 27 | 415 | 17539 |
| Ireland | 61 | 407 | 708 | 31 | 307 | 391 | 641 | 0 | 327 | 2874 |
| Greece | 45 | 2395 | 499 | 322 | 256 | 213 | 79 | 9 | 429 | 4248 |
| Spain | 134 | 504 | 293 | 70 | 518 | 814 | 120 | 8 | 485 | 2945 |
| France | 20 | 21 | 335 | 22 | 391 | 3587 | 291 | 1 | 444 | 5113 |
| Croatia | 135 | 163 | 120 | 18 | 171 | 308 | 113 | 11 | 316 | 1355 |
| Italy | 6 | 22 | 470 | 38 | 698 | 1007 | 84 | 32 | 499 | 2855 |

| Countries | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------------|-----|-------|------|-----|-----|-------|------|-----|-----|-------|
| Cyprus | 23 | 175 | 430 | 2 | 120 | 1211 | 241 | 0 | 444 | 2646 |
| Latvia | 69 | 1 | 199 | 23 | 115 | 161 | 52 | 1 | 300 | 920 |
| Lithuania | 105 | 41 | 941 | 53 | 419 | 221 | 194 | 47 | 505 | 2527 |
| Luxembourg | 14 | 7 | 1022 | 12 | 571 | 12041 | 846 | 2 | 313 | 14828 |
| Hungary | 46 | 18 | 268 | 211 | 216 | 624 | 128 | 87 | 281 | 1879 |
| Malta | 25 | 83 | 54 | 1 | 251 | 4075 | 301 | 0 | 382 | 5173 |
| Netherlands | 272 | 4 | 813 | 89 | 497 | 5900 | 345 | 7 | 502 | 8429 |
| Austria | 16 | 6 | 646 | 57 | 276 | 5529 | 373 | 25 | 499 | 7428 |
| Poland | 11 | 1694 | 785 | 495 | 643 | 446 | 254 | 40 | 243 | 4612 |
| Portugal | 6 | 3 | 294 | 17 | 343 | 136 | 135 | 106 | 507 | 1546 |
| Romania | 30 | 9172 | 413 | 350 | 106 | 33 | 116 | 1 | 215 | 10435 |
| Slovenia | 30 | 7 | 801 | 466 | 139 | 323 | 1883 | 5 | 310 | 3964 |
| Slovakia | 97 | 50 | 627 | 179 | 280 | 99 | 468 | 63 | 414 | 2277 |
| Finland | 0 | 17418 | 1554 | 227 | 620 | 2849 | 168 | 36 | 369 | 23243 |
| Sweden | 95 | 10177 | 508 | 187 | 732 | 1217 | 209 | 59 | 429 | 13628 |

Source: own processing according to data published by Eurostat (2021)

Legend:

- | | |
|---|--|
| 1 – Agriculture, forestry and fishing | 6 – Construction |
| 2 – Mining and quarrying | 7 – Services (except wholesale of waste and scrap) |
| 3 – Manufacturing | 8 – Wholesale of waste and scrap |
| 4 – Electricity, gas, steam and air conditioning supply | 9 – Households |
| 5 – Water supply; sewerage, waste management and remediation activities | 10 – All NACE activities plus households |

For 2018, for all NACE activities plus households, generation of waste in kilograms per capita has high values for: Finland (23243), Bulgaria (18470), Estonia (17539), Luxembourg (14828), Sweden (13628), Romania (10435). The economic activity for which the generation of waste in kilograms per capita is the highest is mining and quarrying. The countries with the highest quantities of this kind generated per capita are: Finland (17148), Bulgaria (15213) and Sweden (10177). The construction sector also generates large amounts of waste in Luxembourg (12041). Another activity with high values is electricity, gas, steam and air conditioning supply. Bulgaria (1848) and Estonia (5666) are the countries with the highest amounts of waste for this economic activity. For manufacturing, the highest per capita values are recorded in: Estonia (3305), Finland (1554), Belgium (1475), Luxembourg (1022). In Slovenia, services (except wholesale of waste and scrap) generate the highest amount in the field (1883). Also water supply; sewerage, waste management and remediation activities generate in Belgium 1382 kilograms per capita. For wholesale of waste and scrap, large quantities are generated in: Belgium (115) and Portugal (106). The agriculture, forestry and fishing sectors also contribute to waste generation. The countries with the highest values for this sector are: Netherlands (272), Croatia (135), Spain (134), Lithuania (105), Estonia (105). For households, high values are recorded in: Denmark (640), Portugal (507), Lithuania (505), Netherlands (502).

Compared to 2010, in 2018, the amount of waste generated per capita increased in: Finland (+3789), Estonia (+3269), Malta (+1909), Austria (+1832), Netherlands (+1138), Sweden (+1083), Slovenia (+1042). For

the same period, the amount of waste generated per capita decreased in: Luxembourg (-5769), Bulgaria (-4165), Greece (-2085), Ireland (-1470), France (-365), Cyprus (-215).

For the European Union, in 2018, the distribution of the average quantities generated by the main economic activities is given in the following figure:

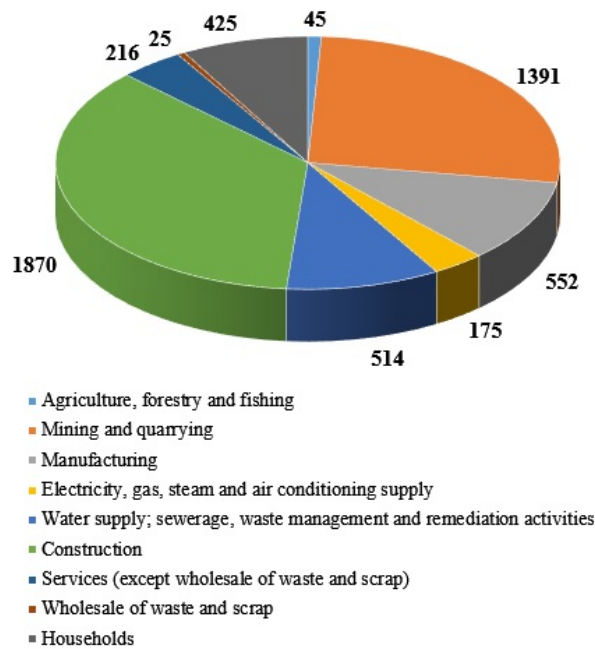


Figure no. 2. Distribution of average quantities generated by the main economic activities, 2018

Source: own processing according to data published by Eurostat (2021)

It is observed that the highest average amount of waste generated is for the construction sector (1870), followed by mining and quarrying (1391) and manufacturing (552). The lowest quantities are generated by wholesale of waste and scrap (25) and agriculture, forestry and fishing (45).

The search for solutions for waste disposal has become more and more present. The decrease of natural resources, as well as the increase of the interest for the ecological issue, were among the aspects that were the basis of this approach (Noor, et al., 2020).

Conclusions

From the analysis presented, it is observed that certain sectors of activity generate a higher amount of waste. Thus, the highest amounts of waste generated per capita are recorded for the mining and quarrying sector, followed by the construction sector. The situation is similar for both years (2010 and 2018). Other sectors of activity in which large quantities of waste generated per capita are registered are: manufacturing, water supply; sewerage, waste management and remediation activities. It is also found that households also register high values. Compared to 2010, in 2018, in most member countries of the European Union, the amounts of waste generated per capita increased.

Regardless of the type of waste generated, it is important that waste management be conducted in such a way that the benefits enjoyed by the current generation and future generations enjoy (Wisnubroto et al., 2021).

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