

WASTE MANAGEMENT OF EU COUNTRIES RELATED TO CIRCULAR ECONOMY ISSUES

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Abstract: In a situation where the coronavirus pandemic has caused a number of socio-political-economic challenges around the world. It has been changing the values of all entities from the largest to the smallest since its outbreak. Nowadays, we need to create the conditions for a sustainable coexistence of man and nature more than ever, incorporating waste management further within the circular economy. In this scientific paper, we focus on measuring indicators of circular economy set up by the EU to analyze the development, compare the V4 countries, and find new solutions. Only continuous monitoring can contribute to the transition of the existing linear market economy system to its greater efficiency and sustainability throughout the value chain.

Keywords: sustainable development, circular economy, European union, V4 countries

1 Introduction and Problem Formulation

Already in 1989, Norwegian philosopher A. Naess said that there was a general need to find ethical solutions for economic problems. Practical answers do not exist only from an economic perspective. So far, economic development, especially in developed countries, has led to significant environmental changes. The life of future generations is in danger and there is a legitimate question: why is high consumption the basic norm of conscious people? (Measured as a positive result in economic growth) (A. Naess, 1989).

In the last few decades, the concept of sustainable development has been creating an integral part of governmental and corporational governance. Despite its unprecedented importance of responsible behavior for the well-being of future generations, sustainability has a significant role in bridging the gap between policy, theory, and practice (L. M. A. Bettencourta, J. Kaurc, 2011).

According to R. W. Kates (2011), Sustainable Science has a rather interdisciplinary character which can only be succeeded by implementing its principles in order to avoid tremendous environmental and developmental threats. To tackle global challenges, which predictably are on the rise, the integration of this knowledge among policymakers, researchers, and funders is key in bringing science and society to life. Only critical reflection at all levels through common integration calls can provide the necessary intuitional framework (W. Mauser et al., 2013).

The rapid outbreak of COVID-19 is changing the whole world. It affects the socio-political-economic environment of countries all over the world. The values and consequent behaviors are changing, moving on from the international, governmental, institutional, and business levels to the individual one. There are voices from respected representatives of the professional public warning that nothing will be the same again as before. Therefore, there are legitimate questions as to how the current situation will help or harm sustainable development; the extent of which is difficult to estimate. Despite uncertainties, reports from the end of March 2020 prove the positive impact of the lockdown on, among other things, the clearing of seawater and the return of fish in Venice. Furthermore, the Earth Overshoot Day (the date when people have used up the planet's annual resources) in 2020 lands on August 22 (Footprintnetwork.org., 2020), whereas in 2019 it was on July 29. Due to the pandemic, it is the first time since the start of its measuring when people have decreased their global footprint (Overshootday.org, 2020).

What is more, there are also questions about the compliance or non-compliance of individual member states with the sustainable development measures of the EU while they attempt to mitigate the economic impact of the crisis. The focus, however, should

not be on re-investing into previous economic systems, but on the creation of new ones that respect the sustainability principles as previously agreed upon in the EU agenda.

Business as usual has generated a significant level of growth, whereas, at the same time, it has caused a variety of challenges, as well. The "take-make-consume-dispose" model of the linear economy has taken for granted the abundance of resources and their availability. An economic growth based on the above-mentioned approach would result in a need for two planets in order to meet our demands. (R. C. Brears, 2018).

One of the side effects of overwhelming consumption and irresponsible behavior which destroys not only land but also the maritime environment is waste generation. The current linear model does not use sources efficiently nor does it deal with waste recovery in a sophisticated manner. Since 1970, material extraction tripled in 2017, and it continues to grow (Eurolex.europa.eu, 2019).

To transform a linear economic model to reach ambitious EU aims until 2050, we need to take proper actions and decisions within the next five years. The highest priority is to achieve climate-neutral and circular economy transformation, which is considered to be an opportunity for sustainable, green, and digital business challenges. Furthermore, the strategic part of the EU Green Deal is a new circular economy action plan. This plan represents a policy framework to reduce, reuse, and recycle materials as well as to stimulate the common circular design of products in order to minimize its harmful environmental impacts.

According to M. Fischer (in Incien, 2017) from the Ministry of Environment of the Slovak Republic, the following should be prioritized: a "change of attitude and thinking at all levels, consumer, academic or political. The transition to a circular economy cannot take place without the involvement of all stakeholders and without everyone being aware of their role in this process." Moreover, the present policy frameworks of individual economies so far have only been transforming the transition to the circular model in the domestic environment. However, it would be essential to be aware of their strong interaction with the international value chain, as well (OECD, 2018).

Nowadays, in the EU market, only 12 % of all materials are recycled. The circular economy is one of the priorities of the EU Green Deal. It is based on using the resources more efficiently while generating less waste. That is why waste management should be one of the main milestones of member states. In order to achieve it, we need to properly and continuously measure indicators of the circular economy set up by the EU and we need to analyze the development, make direct comparisons between the V4 countries, and find new solutions.

2 Methodology

When processing the present scientific paper, the following scientific methods were used: through taking a closer look at the literature, we searched for and obtained professional and scientific information related to the issue, and by applying abstraction, we selected the most relevant ones for our research. We collected information and data for the processing of relevant facts about sustainability and circular economy from the sources of the professional and scientific public, such as Brears R.C., Kaurc J., Naess A., Mauser W. as well as from the international and Slovak institutions such as the OECD, Eurostat, European Commission, the Institute of Circular Economy, and Global Footprint Network.

Through synthesis, we have developed a general view of the significance of the circular economy in the context of international trade. The method of analysis, induction, and

deduction developed parts of the paper in which we deal in more details with the importance and implementation of the circular economy principles through the analysis of its indicators. In the logical sequence of the acquired knowledge, we further compare the elements of circularity in the EU and formulate the conclusions of their possible further development. In this scientific article, we also use mathematical-statistical and graphical methods to specify and clarify the basic context and development trends of relevant indicators.

For a comprehensive insight into the issues addressed through the evaluation of selected indicators in the field of the circular economy, we evaluate the current situation in selected countries, with an emphasis on the Visegrad group.

3 Circular economy in the EU countries

The circular economy (CE) can be considered an effective business model in the fight against excessive waste generation and environmental pollution. Its main principle is the reuse of waste, respectively, the reuse of products no longer used in the value chain. CE is a comprehensive system where the implementation of its basic standards is possible at all levels of the value chain.

Whether the given countries have already implemented or are in the process of implementing CE into their national economy, we can measure and analyze it through 4 main areas of the economy, divided into 10 main indicators set by the European Union as follows (Ec.europa.eu., a. 2019):

PRODUCTION AND CONSUMPTION

1. EU self-sufficiency in the use of primary raw materials in production (to what extent is the EU independent from the rest of the world in some selected primary raw materials)
2. Green public procurement (share of total public procurement for a given period of time)
3. Waste generation (municipal waste production per person, total municipal waste production)
4. Food waste generation

WASTE MANAGEMENT

5. Municipal waste recycling rate
6. Recycling rate: total packaging waste, plastic packaging waste, wood waste, electrical and electronic waste, recycled bio-waste per person and recovery rate from construction and demolition waste

SECONDARY RAW MATERIALS

7. Circular material use rate (share of demand for secondary raw materials in total demand for raw materials)
8. Trade in recyclable raw materials

COMPETITIVENESS AND INNOVATION

9. Private investments, jobs and gross value added to CE sectors
10. Patents (related to waste management and recycling)

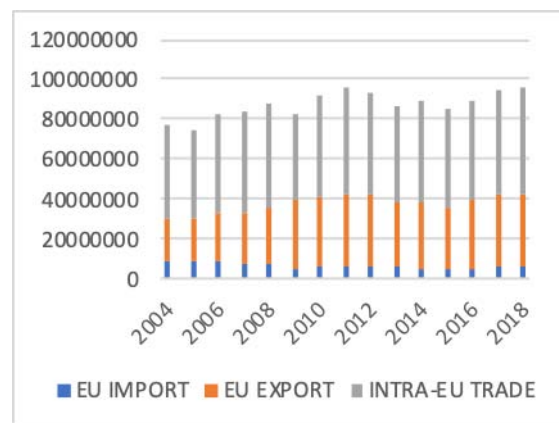
In order for the circular economy to be progressively introduced into the currently prevailing linear model, its continuous monitoring is essential. Therefore, we will subsequently focus on the analysis of the development of selected CE indicators in the EU and its closer quantification and comparison in the V4 countries.

3.1 Secondary raw materials

The first CE indicator examined is the EU's trade in secondary (recyclable) raw materials, resp. waste whose material composition consists mainly of wastes and their forms of paper, plastic, precious metals, iron and steel, and various other types of metals and scrap. Graph 1 shows the development of the EU

trade in recyclable secondary raw materials with non-member countries between 2004 and 2018.

Graph 1 EU trade in recyclable raw materials in the years 2004 - 2018 (in millions of tons)



Source: own processing according to Ec.europa.eu. (eurostat), online, 2018d

Since 2004, imports of recyclable waste from non-EU countries have shown a predominantly declining trend. In 2004, imports amounted to 9.1 million tons, while in 2018 it amounted to 5.9 million tons, a decrease of 35%. On the contrary, the export of recyclable raw materials in the given period increased by 69%, and its value in 2018 reached 36.8 million tons. The total value of exports in 2018 was EUR 14 billion. Intra trade in EU countries with recyclable raw materials has developed slightly cyclically since 2004; which, quantitatively speaking, far outnumbered EU trade with third countries. In 2018, trade between EU member states amounted to more than 58 million tons (Ec.europa.eu., b. 2018).

Among the most important export markets (outside the EU) in terms of the volume of exports of secondary raw materials in 2018 were (Ec.europa.eu., b. 2018):

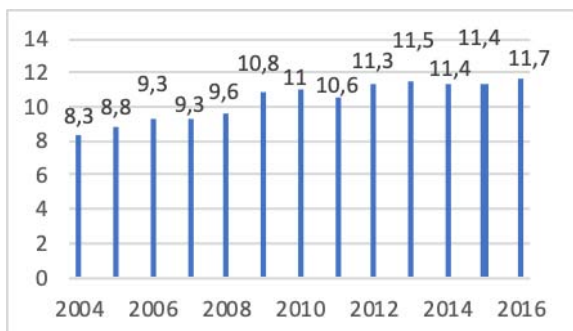
1. Turkey (12.8 million tons)
2. China (5.1 million tons)
3. India (4.6 million tons)
4. Indonesia (1.9 million tons)

Among the most important markets from which the EU imported recyclable waste in 2018 were (Ec.europa.eu b. 2018):

1. China (1.6 million tons)
2. Norway (1.1 million tons)
3. USA (0.8 million tons)
4. Russia (0.6 million tons)

An indicator that measures the share of recovered material (in other words, one that is returned to the economy) in the total material used is called CMU (Circular material use). It is calculated as the proportion of material returned to circulation in the total volume of materials used over a period of time. Increasing the CMU rate means that secondary materials replace primary raw materials and thus reduce the environmental burden (Ec.europa.eu., c. 2018). The evolution of the CMU rate between 2004 and 2016 in the EU is shown in Graph 2.

Graph 2 Circular material use development in the EU in the years 2004 - 2016 (in %)



Source: own processing according to Ec.europa.eu. (eurostat), online, 2018e

The rate of the CMU indicator has been on the rise in EU countries since 2004. A slight decrease was recorded in 2011, along with a slight stagnation in 2014 and 2015 (Ec.europa.eu., c. 2018). Table 1 shows the development of the CMU indicator of selected EU countries in the observed period, from 2014 to 2016.

Table 1 Circular material use in the selected EU countries in the years 2014 – 2016 (in %)

No.	country/year	2014	2015 *	2016
1.	Netherlands	26.6	25.9	29
2.	France	17.8	18.7	19.5
3.	Belgium	18.2	18.3	18.9
4.	United Kingdom	15.6	16.2	17.2
5.	Italy	16.8	16.6	17.1
6.	Estonia	11	11.2	11.8
	EU	11.4	11.4	11.7
7.	Germany	10.7	11.2	11.4
8.	Austria	9.1	10	10.6
9.	Poland	12.5	11.6	10.2
10.	Slovenia	8.4	8.5	8.5
13.	Czech Republic	6.9	6.9	7.6
16.	Hungary	5.4	5.8	6.4
19.	Slovak Republic	4.8	5	4.9

* = estimated data according to EUROSTAT

Source: own processing according to Ec.europa.eu. (eurostat), online, 2018e

The European average of the material use rate of the total amount of material used in 2016 was 11.7%. Countries above the EU average in 2014-2016 included: the Netherlands (29%), France (19.5%), Belgium (18.9%), the United Kingdom (17.2%), Italy (17.1%), and Estonia in 6th place (11.8%). The ten countries with the best CMU rates (but below the European average) were closed by Germany, Austria, Poland, and Slovenia. The Slovak Republic (4.9% in 2016) ranked 19th, which was the worst ranking within the CMU rate among the V4 countries - 9th place Poland, 13th place the Czech Republic, and 16th place Hungary.

3.2 Competitiveness and innovation

In EU countries, the link between the growth of competitiveness and the growth of environmental responsibility can be observed at the same time. One of the key indicators of progress is innovation. It is through successful patents in this direction that we can assess the technological advances that improve the process of transition from the current model of the economy to the circular one. Graph 3 shows the development of the number of EU patents related to recycling and processed secondary raw materials in the years 2000-2015.

Graph 3 Development of the number of patents related to the recycling and processing of secondary raw materials in the EU in the years 2000 – 2015

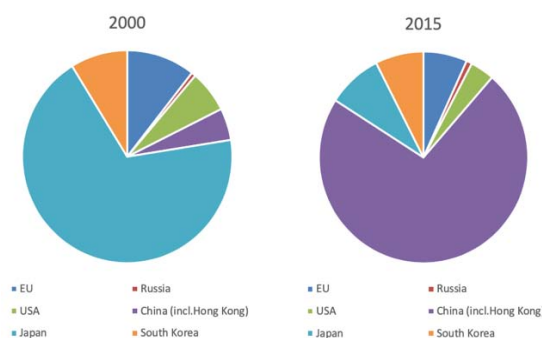


Source: own processing according to Ec.europa.eu. (eurostat), online, 2018f

As Graph 3 shows, the growth in the number of patents related to the recycling and processing of secondary raw materials from 2000 to 2015 has been very slow in EU countries. Among the countries with the highest number of patents in 2015 is Germany 89.87, Poland 67.4, and France 36.68. In the V4 countries, the Czech Republic ranked second after Poland 9.58, the Slovak Republic 6.2, and Hungary in the number of 1.33 patents per year.

Graph 4 shows the number of CE-related patents in EU countries compared to the number of CE-related patents in the US, Japan, Russia, China (including Hong Kong), and South Korea in 2000 and 2015.

Graph 4 Number of patents related to circular economy in EU, USA, Japan, Russia, China (Hong Kong included) and South Korea in the years 2000 – 2015 (in %)



Source: own processing according to Ec.europa.eu. (eurostat), online, 2018f

Graph 4 shows that Japan had the largest share (69%) in the number of patents filed in 2000 among the examined countries, representing more than 2000 patents in 2000. The European Union came in second with 11%, which was equivalent to approximately 310 patents. In third place, with a share of 9% (less than 259 patents), was South Korea. However, during the observed 15 years, a significant change in the share of patents among the monitored economies can be observed. In 2015, China (including Hong Kong) occupied the first position with a share of 73%, which amounted to approximately 3,810 patents. It was followed by Japan with an 8% share (444 patents) and South Korea (7%) with 391 patents per year.

According to the figures in Graph 4, it can be stated that the European Union, as one of the most developed regions in the world, is not making sufficient progress in the field of innovation related to the circular economy. The aforementioned halt in the import of waste from third countries, its return to the EU Member States, and the continued growth of waste calls for a much more strategic policy of the Member States in this area. It

is these innovations that can contribute to more efficient waste recovery and, at the same time, to the sustainable development of Europe.

The positives or negatives of development in the sectors dealing with recycling, repair, reuse of goods, renting and leasing are also determined by indicators such as: Employment in the relevant sectors and Gross investment in tangible goods. Table 2 shows the development of the employment rate in the sectors related to recycling, repairs, reuse of goods, renting and leasing, in the years 2008-2010 and 2015-2017 on total employment.

Table 2 Employment rate in the sectors of recycling, repair, reuse of goods, renting and leasing in total employment in the selected EU countries in the years 2008 – 2010 and 2015 – 2017 (in %)

country/year	2008	2009	2010	2015	2016	2017
Latvia	2.33	2.38	2.48	2.86	2.89	2.82
Lithuania	2.46	2.24	2.33	2.72	2.69	2.77
Croatia	:	:	2.1	2.21	2.19	2.21
Poland	2.17	2.01	2.07	2.21	2.21	2.2
Italy	2.17	2.1	2.11	2.05	2.05	2.06
Slovenia	1.83	1.78	1.88	2.17	2.09	2.06
Spain	1.6	1.61	1.67	2	2.04	2.04
cypress	1.56	1.5	1.5	1.91	1.99	1.99
Hungary	1.69	1.86	1.89	1.82	1.92	1.88
Portugal	1.73	1.76	1.75	1.81	1.82	1.84
Slovak Republic	1.16	1.07	2.13	1.78	1.76	1.78
Bulgaria	1.59	1.61	1.73	1.72	1.76	1.72
EU	:	:	:	1.7	1.73	1.69
France	:	:	1.66	1.54	1.52	1.64
Finland	1.44	1.49	1.58	1.74	1.65	1.58
Sweden	1.61	1.53	1.53	1.58	1.56	1.58
Romania	1.49	1.44	1.42	1.54	1.58	1.54
Greece	:	:	:	1.43	1.65	1.52
Austria	1.47	1.47	1.46	1.5	1.49	1.51
Germany	1.15	1.32	1.41	1.43	1.47	1.49
Netherlands	1.17	1.17	1.22	1.17	1.18	1.19
Belgium	:	1.13	1.13	1.16	1.11	1.1
Czech Republic	:	:	:	:	:	:
Denmark	1.52	1.24	1.24	1.38	1.36	:
Estonia	1.75	:	:	:	2.01	:
United Kingdom	1.45	1.51	:	1.59	:	:

: = data not obtained

Source: own processing according to Ec.europa.eu. (eurostat), online, 2018g

The average of EU countries in the share of people's employment in the sectors of recycling, repair, reuse of goods, renting and leasing in total employment in 2017 was approximately 1.7%. The country where the share of employment (in the above sectors) was the highest in 2017 is Latvia, with a share of 2.82%. Of the V4 countries, Poland achieved the best results in the same year, 2.2%, followed by Hungary 1.88% and Slovakia 1.78%. No data were recorded from the Czech Republic. A positive result was that the V4 countries (apart from the Czech Republic) exceeded the EU average. Countries that did not record values for the last monitored year 2017 are marked in a gray frame. EU countries not listed in Table 2 did not report any data in the observed indicator. These are: The Republic of Ireland, Luxembourg and Malta.

Subsequently, for comparison, Table 3 shows the percentage share of gross investment in tangible goods (including land) in total GDP - in the sectors of recycling, repair, reuse of goods, renting and leasing, between 2008-2010 and 2015-2017.

Table 3 Gross investment in tangible goods (including land) as % of GDP (in the sectors of recycling, repair, reuse of goods, renting and leasing) in the selected EU countries in the years 2008 – 2010 and 2015 – 2017 (in %)

country/year	2008	2009	2010	2015	2016	2017
Latvia	0.55	0.49	0.27	0.27	0.27	0.35
Lithuania	0.24	0.1	0.1	0.14	0.14	0.23
Romania	0.49	0.26	0.25	0.2	0.2	0.21
Slovak Republic	0.48	0.24	0.23	0.21	0.17	0.21
Bulgaria	:	:	0.29	0.18	0.18	0.17
Poland	0.19	0.16	0.17	0.18	0.17	0.16
Belgium	:	0.27	0.16	0.15	0.15	0.15
Hungary	0.1	0.12	0.11	0.13	0.17	0.14
Netherlands	:	0.15	0.14	0.12	0.12	0.13
EU	:	:	:	0.12	0.12	0.12
Croatia	:	:	0.19	0.15	0.11	0.12
cypress	0.14	0.13	0.08	0.06	0.06	0.12
Portugal	0.18	0.16	0.14	0.1	0.12	0.12
Germany	0.08	0.08	0.08	0.09	0.09	0.1
Spain	0.12	0.08	0.09	0.09	0.09	0.1
Austria	0.12	0.11	0.08	0.09	0.08	0.1
Sweden	0.19	0.14	0.11	0.13	0.14	0.1
Italy	0.18	0.21	0.2	0.1	0.13	0.09
Finland	0.11	0.09	0.09	0.09	0.1	0.08
Greece	:	:	:	0.04	0.04	0.05
Czech Republic	:	:	:	:	:	:
Denmark	0.14	0.09	0.08	0.09	0.09	:
Estonia	0.28	:	:	:	0.15	:
France	:	0.1	0.11	0.11	:	:
Slovenia	:	0.3	0.26	:	:	:
United Kingdom	:	:	:	0.15	:	:

: = data not obtained

Source: own processing according to Ec.europa.eu. (eurostat), online, 2018h

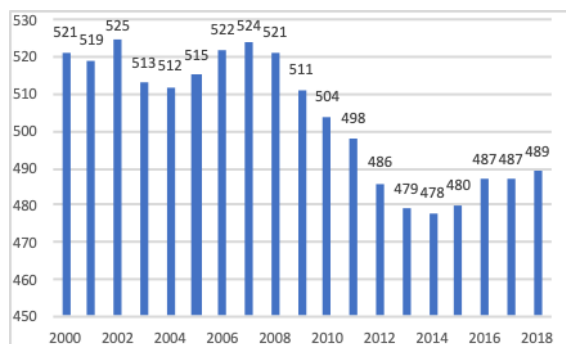
The data in Table 3 reveal that investments in CE-related sectors are very low. None of the monitored EU countries exceeded the half-percent mark in this indicator (with the exception of Latvia, in 2008). Of the V4 countries, the Slovak Republic with 0.21% was ranked first in 2017, followed by Poland 0.16%, and Hungary 0.14%. The Czech Republic again did not report any data in this area. The countries in the gray framework are those that did not record any data for the last monitored year 2017. Table 3 does not include those EU countries that do not report data for any reference period. They are again the Republic of Ireland, Luxembourg, and Malta.

3.3 Production and consumption

In the third group "Production and consumption", the total production of municipal waste will be elaborated. This type of waste includes that which is collected by municipal units and disposed of through the legislation of the state. A large part of the waste is made up of household waste, but we also include waste from public institutions and offices. Graph 5 shows the

development of waste production in EU countries in kilograms per person, in the years 2000 to 2018.

Graph 5 Generation of municipal waste in the EU in the years 2000 - 2018 (in kg/person)



Source: own processing according to Ec.europa.eu. (eurostat), online, 2018i

The average generation of municipal waste per capita in the EU has increased slightly over the last four years. In 2018, the total production of municipal waste per person was 489 kg. The smallest recorded value of the given indicator in 2014 was 478 kg / person. On the contrary, the highest level in the observed period was in 2002, amounting to 525 kg / person.

Among the EU countries, Romania (272 kg) reached the lowest value in the production of municipal waste per capita in 2018. In contrast, the country that produced the most municipal waste per capita in 2018 is Denmark (766 kg). An overview of the total generation of municipal waste per capita in all EU member states, in the years 2000, 2010, and from 2016 to 2018 is shown in Table 4.

Table 4 The municipal waste generation in EU countries in the years 2000, 2010, 2016 – 2018 (in kg/person)

country/year	2000	2010	2016	2017	2018
Romania	355	313	261	272	272
Poland	320	316	307	315	329
Czech Republic	335	318	339	344	351
Hungary	446	403	379	385	381
Estonia	453	305	376	390	405
Latvia	271	324	410	411	407
Belgium	471	456	419	411	411
Slovak Republic	254	319	348	378	414
Bulgaria	612	554	404	435	423
Croatia	262	379	403	416	432
Sweden	425	441	447	452	434
Lithuania	365	404	444	455	464
Spain	653	510	463	473	475
Slovenia	513	490	457	471	486
EU	521	504	487	487	489
Italy	509	547	497	488	499
Portugal	457	516	474	487	508
Netherlands	598	571	520	513	511
France	514	534	521	526	527
Finland	502	470	504	510	551
Austria	580	562	564	570	579
Luxemburg	654	679	609	615	610
Germany	642	602	633	627	615
Malta	533	601	593	631	640

Denmark	664	:	782	782	766
Ireland	599	624	581	576	:
Greece	412	532	498	504	:
cypress	628	689	640	637	:
United Kingdom	577	509	483	468	:

: = data not obtained

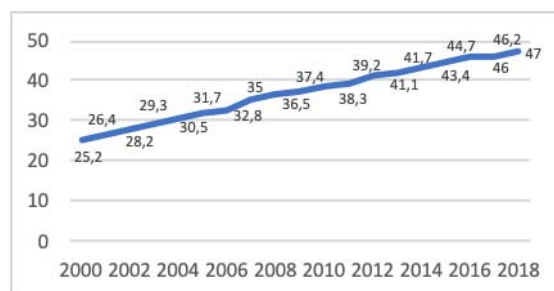
Source: own processing according to Ec.europa.eu. (eurostat), online, 2018i

Based on Table 4, it can be concluded that although the total production of municipal waste has increased slightly in recent years, it has decreased by 30 kg per person compared to 2000. Of the V4 countries, Poland (329 kg / person) was the best in 2018, followed closely by the Czech Republic (351 kg / person), Hungary (381 kg / person), and Slovakia (414 kg / person) last. On the positive side, all V4 countries are below the European average in total municipal waste production. On the other hand, as follows from the development from 2000 to 2018, Hungary clearly recorded the most positive results in reducing municipal waste generation; and the worst development was recorded in the Slovak Republic, which increased waste generation by 160 kilograms per person since 2000.

3.4 Waste management

More efficient waste management is also possible thanks to its recycling. Graph 6 shows the development of the municipal waste recycling rate in the EU in the years 2000-2018.

Graph 6 The municipal waste recycling rate in the EU in the years 2000 – 2018 (in %)



Source: own processing according to Ec.europa.eu. (eurostat), online, 2018j

The results of Graph 6 confirm that the average recycling rate of municipal waste in the observed period in the EU countries increased slightly. In 2000, its value was 25.1% compared to 2018 when it reached 47%. Table 5 shows the percentage of municipal waste recycling in EU countries, in the years 2000, 2010 and 2016-2018.

Table 5 The municipal waste recycling rate in the EU countries in the years 2000, 2010, 2016 – 2018 (in %)

country/year	2000	2010	2016	2017	2018
Germany	52,5	62,5	67,1	67,2	67,3
Slovenia	6	22,4	55,6	57,8	58,9
Austria	63,4	59,4	57,6	57,7	57,7
Netherlands	44,1	49,2	53,5	54,6	55,9
Belgium	49,7	54,8	53,5	53,9	54,6
Lithuania	0	4,9	48	48,1	52,5
Luxemburg	36,1	46,5	48,2	50,4	50,1
Italy	14,2	31	45,9	47,8	49,8
Denmark	37,1	:	46,7	46,9	47,9
EU	25,2	38,3	46	46,2	47
Sweden	38,5	47,8	48,4	46,8	45,8

France	24.5	36	41.9	43	44
Finland	33.6	32.8	42	40.5	42.3
Hungary	1.6	19.6	34.7	35	37.4
Slovak Republic	5.1	9.1	23	29.8	36.3
Bulgaria	15.5	24.5	31.8	34.6	36
Spain	18.4	29.2	33.9	33.1	36
Czech Republic	0.9	15.8	33.6	34.1	34.5
Poland	2.1	16.3	34.8	33.8	34.3
Portugal	10.5	18.7	30.9	28.4	28.9
Estonia	2.4	18.2	28.1	28.4	28
Croatia	:	4	21	23.6	25.3
Latvia	0	9.4	25.2	24.8	25.2
Romania	0	12.8	13.3	14	11.1
Malta	10.1	5.2	7	7.1	6.5
Ireland	11.9	35.7	40.7	40.4	:
Greece	8.8	17.1	17.2	18.9	:
cypruss	3	10.7	17.2	16.1	:
United Kingdom	11.1	40.2	44	43.8	:

: = data not obtained

Source: own processing according to Ec.europa.eu. (eurostat), online, 2018j

According to the data in Table 5, it is clear that the recycling rate of municipal waste was below the average (47%) in most European countries during the period under review. The Member State with the highest rate of municipal waste recycling in 2018 was Germany (67.3%). The positive results of two economies are significant: Slovenia, which ranked just behind Germany in 2018, with a municipal waste recycling rate of 58.9%, while in 2000 it had reached a level of only 6%. Similarly, Lithuania in 2000, with a municipal waste recycling rate of 0%, reached the sixth position in 2018, with a municipal waste recycling rate of 52.5%. Of the V4 countries, Hungary (37.4%) achieved the highest rate of municipal waste recycling in 2018, followed by the Slovak Republic (36.3%), the Czech Republic (34.5%), and Poland (34.3%). We can evaluate positively the development of all V4 countries, which have increased the rate of municipal waste recycling since 2000. Nevertheless, it is worth emphasizing that the recycling rate of all types of waste is constantly increasing. A successful example is Slovenia, which is currently one of the leaders in a separate collection. The goal of the country is to achieve the so-called concept of "zero-waste", which helps to build an economy based on circular models of the economy (Detersová, 2019).

4 Conclusion

In recent decades, we have seen significant societal changes related to enormous, but also destructive human activity. These are negative externalities of individuals and groups, which are immediately reflected in changes in existing systems and living conditions around us. As changes in nature can in some way affect the functioning of individuals, companies, and entire nations, the concept of sustainability is increasingly used in professional circles. It is this concept which takes into account the needs of future generations based on the idea of changing the current market system towards greater consumer awareness, but also towards more efficient use of resources by society.

An important understanding on the part of individual national economies and their international forms of cooperation is the fact that the consumerist way of life causes an enormous burden on the environment, the changes which, either directly or indirectly, affect the lives of its inhabitants. Economic growth based only on the quantitative growth of products and services is not

directly related to the growth of human well-being. This situation also creates a number of negative externalities that do not yet take into account possible future economic losses in the area of social quality of life, environmental protection, or future economic costs.

Sustainable development and its principles can be applied to the lives of individuals, communities, nations, and also to international institutions. The result is a lower (in terms of volume) and more efficient use of natural resources. It is the model of a circular economy that can be considered a concept based on the theory of sustainable development and can be applied in the fight against excessive waste generation. The circular economy represents the transition of the existing linear system of the market economy to higher efficiency and sustainability throughout the value chain. The concept of the circular economy represents a set of strategies – some of the original ones, such as reducing consumption, reuse, and recycling, along with several new ones, the preference to borrow items from owners, for instance. All this aims to restructure the global economy to reduce waste. The application of circular economy strategies does not focus on halting economic growth, instead, it aims to change our approach to the management of resources and to restore harmony with nature in the interest of continued, albeit high-quality growth. The transition to a circular economy can contribute to the creation of new job opportunities, but this should be preceded by a comprehensive change in existing business structures. However, the circular economy may also negatively affect some existing, less efficient sectors. From a long-term perspective, nevertheless, we are talking about the logical and necessary direction of the existing global business structures.

According to our analysis, it is found that even if the new action plan represents a new approach to a more sustainable future in Europe, there is a lack of development in terms of examined indicators in the past. Since 2004, the circular material use has been increasing fairly slowly, along with the number of patents in comparison to China. Moreover, the ranking of all V4 countries is behind the EU average. Employment rate and gross investment related to the circular economy are indicators in which V4 countries scored above the EU average, except for the Czech Republic with no obtained data. In addition, the generation of municipal waste per capita has declined since 2000. However, this indicator slightly increased to 489 kg/person in 2018. The positive results of V4 countries are that all of them reached better scores than the EU average. What is even more important is the development of the selected indicator. Since 2000, it only declined in Hungary (446 kg) to 381 kg in 2018; whereas in Slovakia, waste generation increased from 254 kg in 2000 to 414 kg in 2018. Furthermore, the recycling rate of municipal waste in Visegrad group was far behind the EU average. Effective waste management and higher recycling standards are needed in all V4 countries. There is a potential to implement principles of the circular economy within the V4 to create new business and job opportunities at the same time as to decline waste generation, make a more effective material/product life cycle, and shape a more sustainable EU market.

The situation that arose after the outbreak of the coronavirus pandemic presented us all with new challenges in this area, as well. In our view, in the current situation, even more than before, with sufficient human and financial capacity in science and research, we can become leaders in this rebirth. So how to get out of the vicious circle of the linear economy and return to the "nature-based economy"? Perhaps the coronavirus pandemic will pave the way for these solutions for humanity; in a way that we move from classical, long-established solutions towards new and different approaches. We can only hope that humanity will learn even more and that it will not be the other way around, and in the pursuit of economic recovery, measures aimed at sustainable development will not be abandoned.

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