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Chapter 7

A comparative study among the participant countries and their regions

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7.1 Introduction

Circular economy (CE) is a principle, which introduced into economic practice, generates profit, new jobs, conservation of natural resources, environmental protection. On the other hand, the transition from the linear to the circular economy requires political determination, consistency and last but not least, investments.

The countries of the European Union are in different phases regarding the transition to CE and in the following pages a comparison will be made from this point of view between Romania, Italy, Greece and Spain. This study will analyse the indicators defined by the European Commission for monitoring the implementation of the Circular Economy.

7.2 Territorial areas of Romania, Italy, Greece and Spain

The economic branches related to the rural area, the agricultural-food industries can easily switch to the circular economy considering the specifics of the raw material. The successful application of the circular economy in this area and the contribution to the growth of the gross domestic product depends, to a large extent, on the geography of the territory, the agricultural area, the labour force available in the rural environment.

The studies from the precedent chapters and other documents used [1, 2, 3], allow to draw the first conclusions concerning the possibilities and the benefits

of implementation of circular economy. The table 7.1 summarises the specifics of the four countries from these points of view.

The largest country in terms of area is Spain, but the largest population is in Italy.

Table 7.1 General comparison

	Romania	Italy	Greece	Spain
Surface [km^2]	238,397	301,337	132,049	505,944
Population [million inh.]	20.1	60.7	10. 8	47.13
Rural area	90% of the territory	87.1%	97.2%	85% of the territory
Population living in rural area	46.27%	63.3%	28.5%	19.4%
Agricultural area	61.37% of the total area	42.7% of the total area	49.3% of total area	47.2% of total area

Considering the percentage of rural territory from the total surface of the country, Greece is on the first place, followed by Romania. However, Italy stands out with a higher percentage of inhabitants living in the countryside. In Spain, the majority of the population prefers urban centres, only 19.4% living in rural areas. In Italy, out of the 60.7 mil of inhabitants, 60% prefer to live in small rural villages, having different activities not all connected with agriculture and food production.

The surface area available for agriculture has important percentages in all countries, the largest share being in Romania, representing 60% of the total surface area of the country. In the case of the other countries, it is between 42.7% and 49%. These values underline the importance of applying the circular economy in the agro-food field for all partners in the project. It is necessary to modernise agriculture and all related economic branches through a superior exploitation of natural resources (and we include here the lands used for agricultural yards) and the reduction to zero of storable waste.

In all countries, an increase in the number of companies working in the agricultural and food sector can be observed. In Romania, in the last years the number of trading companies working in this area has grown by around 12%, in 2018 reaching the figure of 30,451. In Italy, according to ISTAT (2017), the food and beverage sector involved over 50,000 Italian enterprises. Greece, taking into consideration the specific of its territory, the fragmentation of the area (including the islands), has an important number of companies distributed all over the country. In 2017, 548,493 enterprises were active. Agriculture and food industry are very important branches of the Spanish economy with a turnover of close to 96,000 million Euros CES, 2018). As in the case of Greece, there are many artisanal products, canning, traditional manufacturing processes.

7.3 Comparative study concerning circular economy indicators

A general picture regarding the implementation of the circular economy in the four countries is given by the monitoring indicators defined in Chapter 3. Those indicators for which there are data for all countries will be analysed. The comparison will be done following the areas of interest defined by the European Commission.

The study will underline the results obtained by each country and the future perspective for a real transition towards a circular type economy.

The data provided by Eurostat were used for the analysis, the most recent being from 2019. Since the exit of the United Kingdom from the European Union took place in January 2020, the values at the EU-28 level have been considered as reference values.

Production and consumption

In the case of this area, *Self-sufficiency of raw materials* and *Green public procurement* will not be discussed without having the data for all countries; we will go to the municipal waste generation.

Generation of municipal waste per capita

Municipal waste generation per capita is an important indicator in terms of municipal waste management and is correlated with waste management indicators. The best results (Fig. 7.1) are found in Romania, which generates the lowest amount of waste per capita over the whole period considered. The figures are slightly upward for all countries. This indicates an increase in consumption and therefore a rise in the living standards in all countries considered, including the EU average values. The next lowest waste generation is in Spain, followed by Italy and Greece. The latter, according to the official data, generated the highest amount of waste per capita of the four countries, exceeding the European averages.

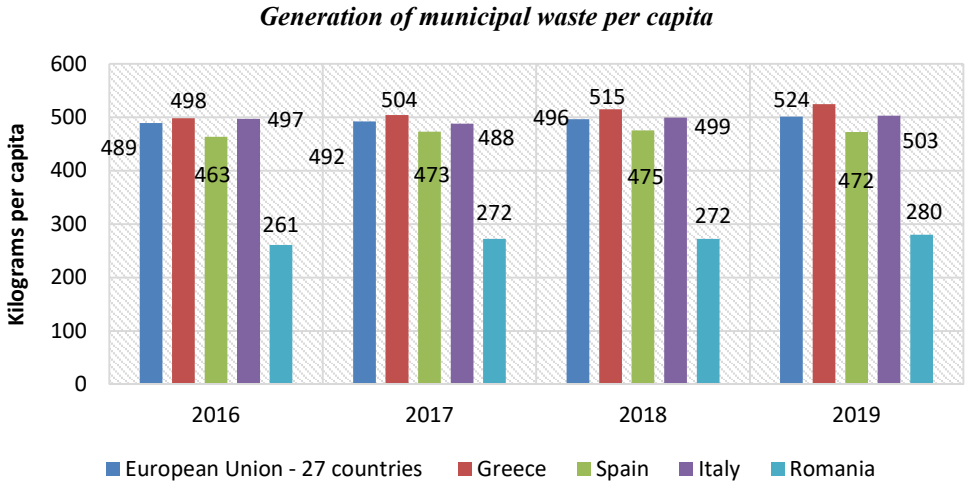


Figure 7.2

Generation of waste excluding major mineral wastes per GDP

The graphical representation of this indicator is presented in Figure 7.2 and looks different from the previous figure due to the ratio to gross domestic product. For this reason, Romania, which has a small GDP, shows values well above those of Spain, Italy, or Greece.

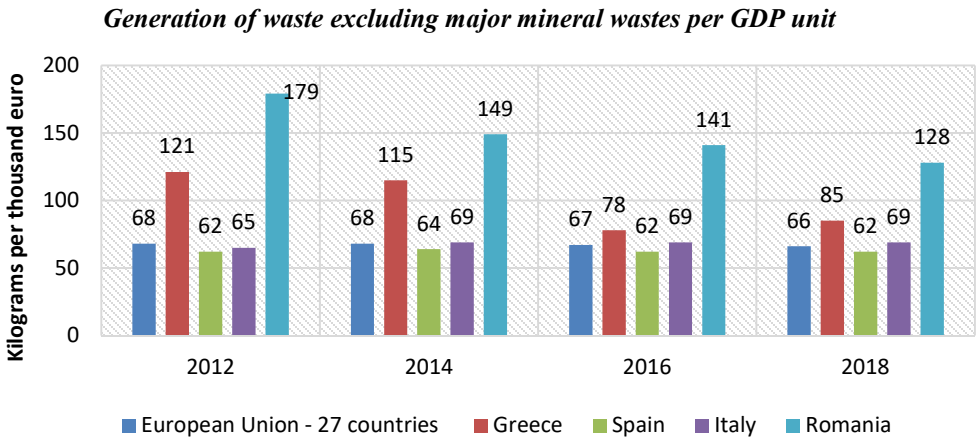


Figure 7.2

In the case of Greece, there is a significant decrease in the value of the indicator between 2012 and 2019. Correlating the descending values of this indicator with those represented in Fig. 7.1 (which show an increase in the amount of waste generated), it can be concluded that the gross domestic product has increased significantly. This is not the case for Spain or Italy, which maintain roughly constant values throughout the period.

Generation of waste excluding major mineral wastes per domestic material consumption

The best results for this indicator are obtained by Romania, which proves a good efficiency in the use of raw materials entering the economy, maintaining its tendency (shown in Figure 7.1) to generate a small amount of waste. There is

a significant decrease in the indicator in 2016 and 2018 compared to 2014.

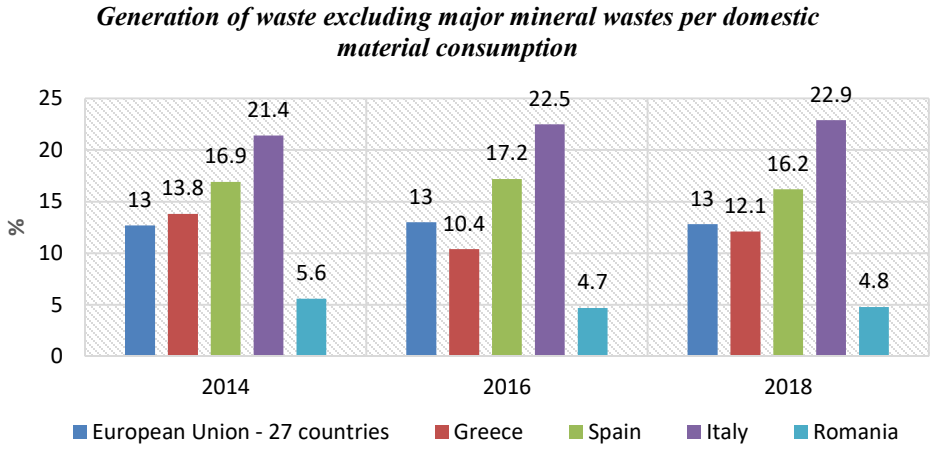


Figure 7.3

The next position is occupied by Greece which is also below the European average and similarly marks a decrease in 2016 compared to 2014. The highest value of the indicators is shown by Italy, which shows an increase in the ratio of waste generated to raw material consumption in the three years for which Eurostat has carried out the assessment.

Waste management

This focus area is particularly important for the circular economy, as it includes the selection and reuse of waste and its transformation into new products which are introduced into the economic cycle. The circular economy has defined a series of indicators that monitor the amount of municipal waste recycled and also the percentage of recovery of different categories of waste.

Recycling rate of municipal waste

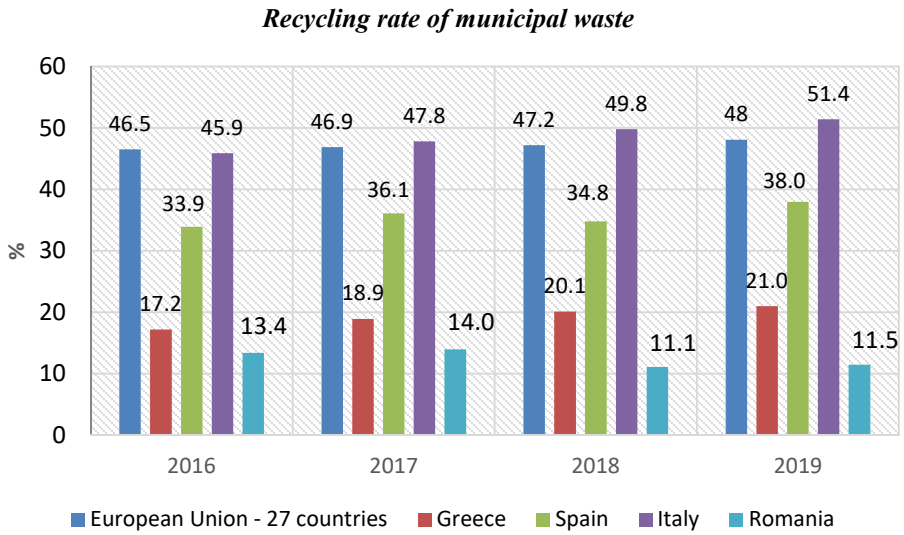


Figure 7.4

As it can be seen, the European average for the period considered is around 46.8%, with about half of the municipal waste being recycled. According to this indicator, Italy ranks first, recovering more than 50% of municipal waste, followed by Spain, Greece, and Romania, which are below the European average. There is a significant gap between the four countries, indicating the need for measures across the waste management chain, from selective collection to the development of waste recycling systems and equipment.

The situation looks a little different when we go deeper into this analysis and look at recycled packaging waste and then its types.

Recycling rate of all packaging waste

Packaging waste collection is legislated at the European level by the Packaging Waste Directive. The document was drafted in 1994, updated in 2018, and sets procedures and targets for recovery. The values obtained by the four countries

participating in this analysis for this indicator, which considers all types of packaging together, are shown in Figure 7.5.
Spain performs best, followed closely by Italy, with both countries showing remarkable consistency.

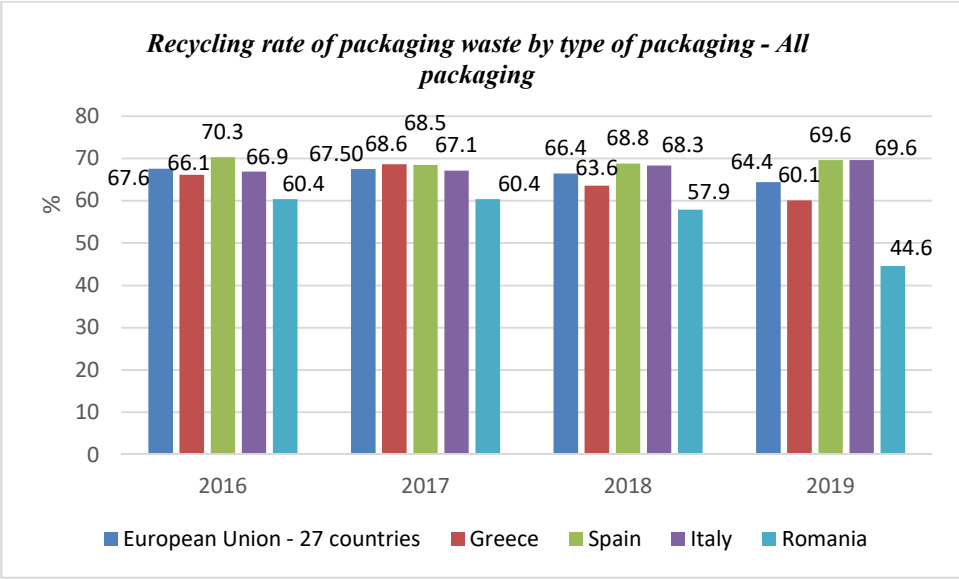


Figure7.5

Greece, also similar to the values of Italy and Spain in 2016 and 2017, registers a slight decrease in 2018 and 2019. Romania records the lowest values for this indicator and even a significant decline in 2019, when it manages to recycle less than half of the packaging introduced into the economic circuit. This indicates unwanted disruptions in the packaging recovery process. However, overall and with the exception of 2019, all four countries have outperformed the European average in packaging recycling and have values close to it.

Recycling rate of plastic packaging waste

The countries in this analysis report different figures for the recycling of certain types of packaging, depending on the legislation adopted and the logistics developed at the national level.

Plastic packaging, the most damaging in terms of environmental impact, is insufficiently recycled at the European level, below 50%. In the whole range,

Spain and Italy are considered to exceed this figure. In 2016, the largest amount of plastic packaging waste at the European level is recycled in Romania. The country maintains its position above the European average in the period 2017-2018, only to see an inexplicable drop in the amount of recycled waste in 2019. Between 2016 and 2019, there is a decrease of about 15% in recycled plastic packaging in Romania.

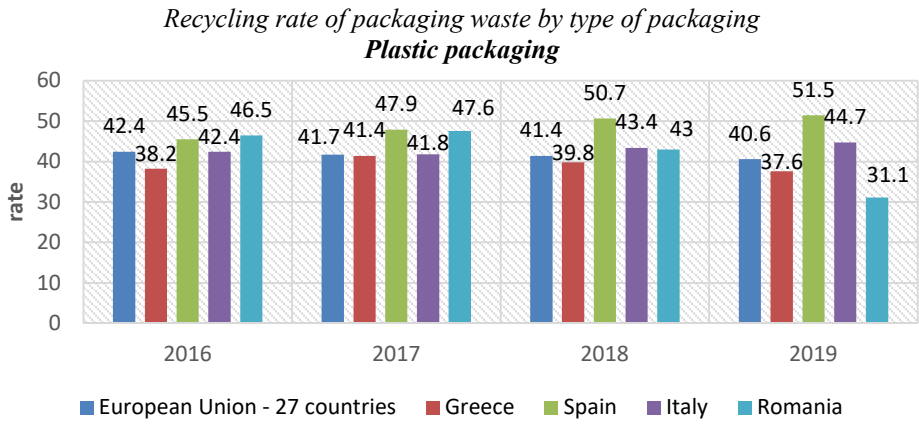


Figure 7.6

Greece is below the European average in all the years considered, and the logistics in Greece need improvement. In addition, the shortcomings in the plastic packaging collection and recycling chain in Romania need to be corrected.

Recycling rate of paper and cardboard packaging waste

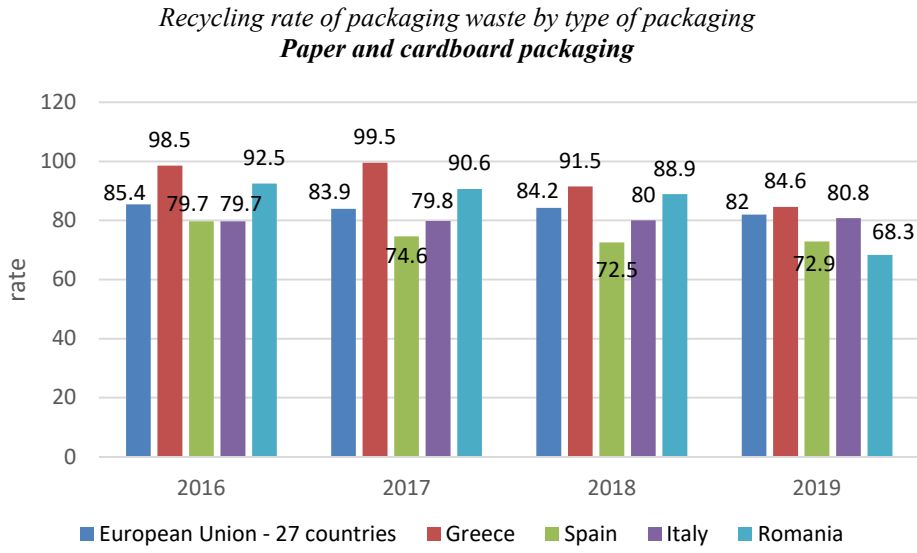


Figure 7.7

Paper and cardboard packaging waste is one of the most recyclable wastes and can be 100% recovered.

The European Union recycles on average more than 82% of this type of packaging. Greece is in the top position, reaching almost 100% in 2017 with the recovery and reuse of paper and cardboard from packaging. Italy and Spain, in this order, achieve lower values than the European average. Romania registers the same variation observed for plastic packaging: very good values in the period 2016-2018, which places it in second place after Greece and then a sharp decrease in 2019.

Recycling rate of wooden packaging waste

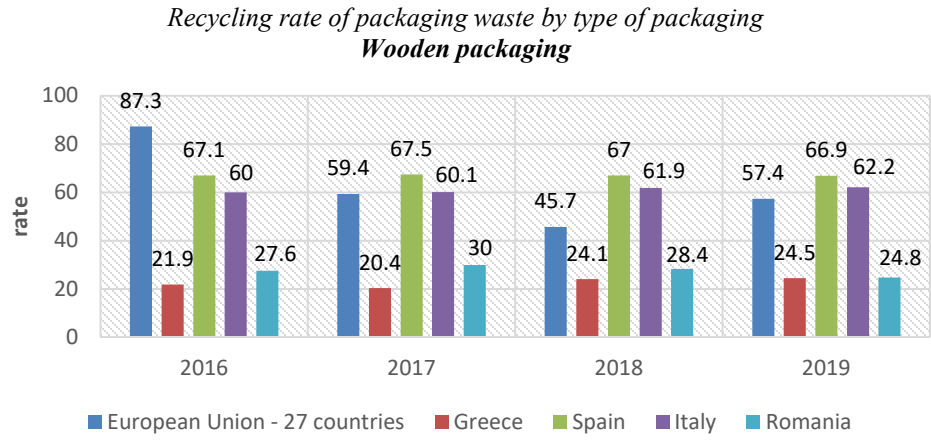


Figure 7.8

As far as wooden packaging is concerned, the European strategy recommends as a first measure, repairing, reusing and then recycling such packaging.

The results for this indicator (Fig. 7.8) rank Spain first, followed by Italy at a small distance. There are fluctuations in the value of the indicator both at the EU level and among the countries participating in the study. The lowest values, significantly below the European average, are recorded by Greece and Romania.

Recycling rate of metallic packaging waste

Metals are valuable packaging especially when it comes to the packaging used for beverage cans. Their recycling and generally the disposal of all metals used for individual packaging or to facilitate the transportation of products are very important given the limited resources of the subsoil.

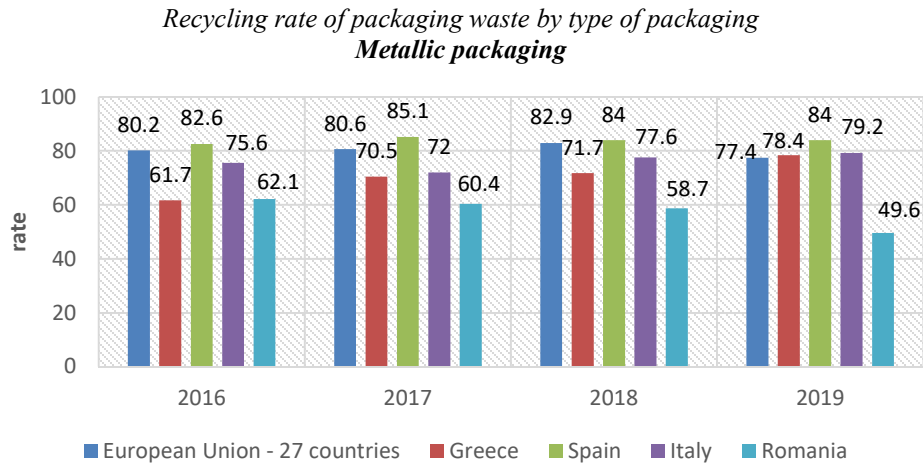


Figure 7.9

The recovery rate of metal packaging waste at the EU 27 level is above 80% between 2016 and 2019 and there is a decrease below this value in 2019. The same reduction in recycling is noted in 2019 as for the previous indicators. As 2019 is the year of the outbreak of the Covid-19 epidemic, waste selection and recycling might have decreased in importance compared to the public health issues. Spain ranks above the EU average throughout the range considered.

Consistency and stability in the chain of selection and recycling of scrap metal also shows Italy (with values close to the EU 27) and Greece, the latter having a nice upward evolution, including in the year of the epidemic outbreak.

The analysis of how countries overcame the economic crisis triggered by the pandemic, an exceptional situation, will be made with the data of the next years and Romania, with a more fragile and new implementation of circular economy principles, is steadily dropping for this indicator.

Recycling rate of glass packaging waste

It should be mentioned that glass packaging can be recycled 100% and for an infinite number of times, with each tonne of recycled glass saving more than a tonne of raw materials used to create a new container. There is also a growing consumer interest in beverages in glass packaging. Under these circumstances, the recycling of this packaging is very much needed.

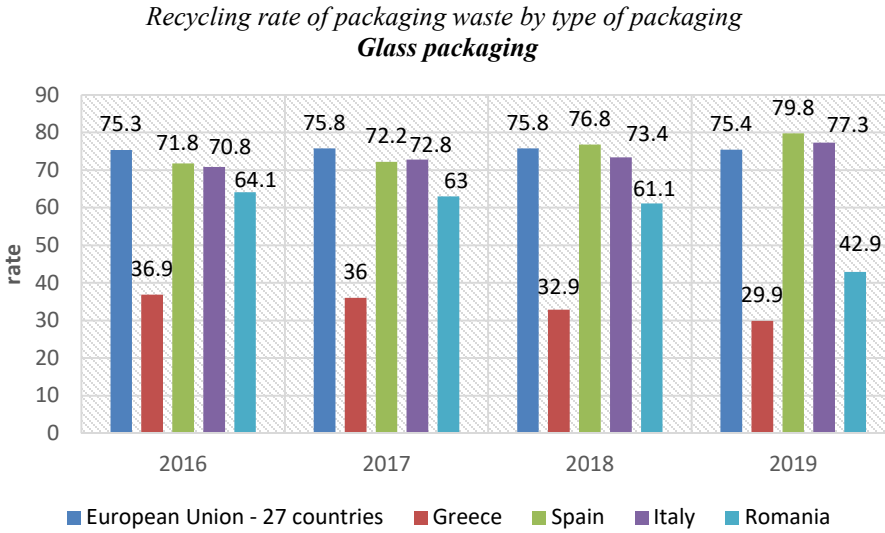


Figure 7.10

Spain and Italy are in the top positions, with a recycling record in 2019 higher than the EU. Recycling of glass packaging waste is declining in Greece and Romania between 2016 and 2019. An analysis of this situation needs to be carried out in both countries, and legislation and processing systems need to be strengthened.

Recycling of biowaste

The indicator expresses the amount of municipal biowaste recycled per capita.

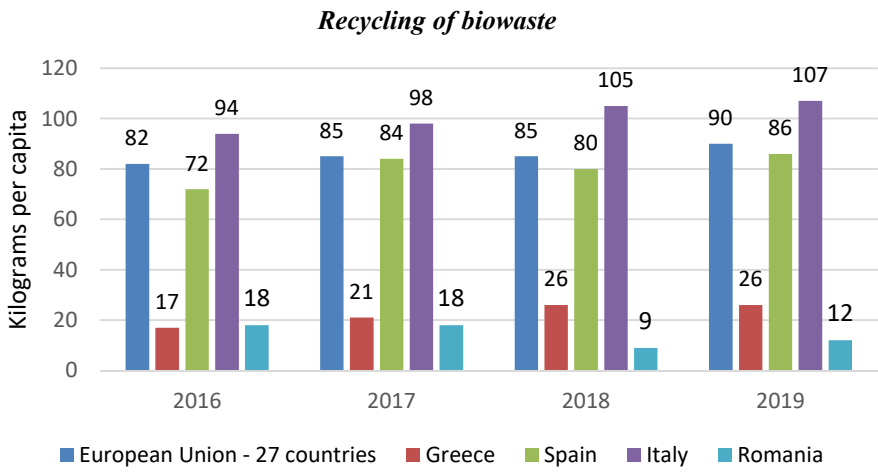


Figure 7.11

In terms of municipal waste recycling, Italy ranks first with values above the European average, followed by Spain, which is below the EU-27 values with variations between 2 and 13%. Romania and Greece report very low values for municipal bio-waste recycling, although the latter has an increasing recycling rate.

Recovery rate of construction and demolition waste

The calculation of the European averages for this indicator has been carried out since 2014. Moreover, some countries did not present national values until later this year.

However, the results published by Eurostat show a good recycling rate of around 90%, as this waste can be used for other construction works, especially roads.

Compared to municipal waste, the collection and sorting of construction and demolition waste is easier, as it is produced in a specific place and time.

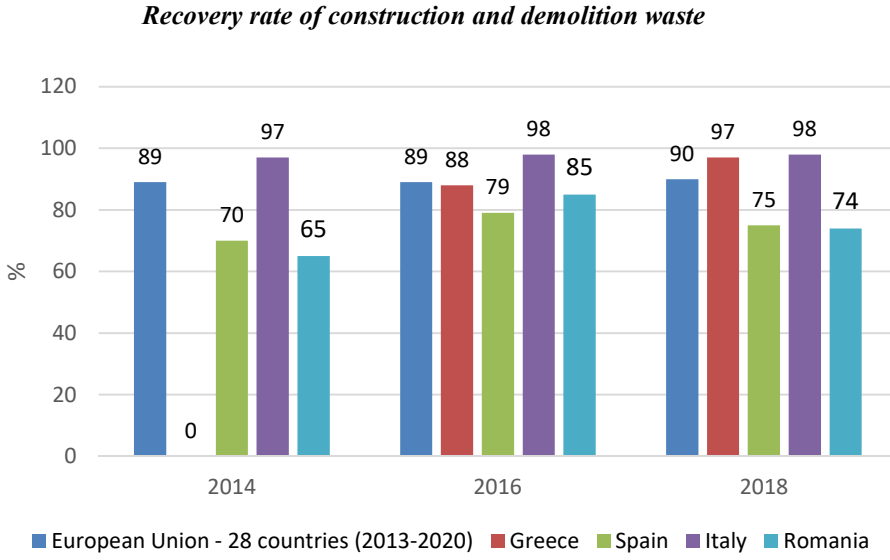


Figure 7.12

Italy and Greece reach values above the European average; Spain and Romania manage to reuse more than 74% of the waste from construction and demolition.

Secondary Raw Materials

In this group, there are two main indicators through which progress towards the circular economy is monitored:

- "End-of-life recycling input rates" - calculated for certain materials that are in short supply at the EU level and which need to be recovered from the end-of-life products.
- "Circular material use rate" - calculated as the ratio of secondary raw materials to total raw materials used, as the sum of new and secondary raw materials introduced into the economy. The results for this indicator are shown in Figure 7.13.

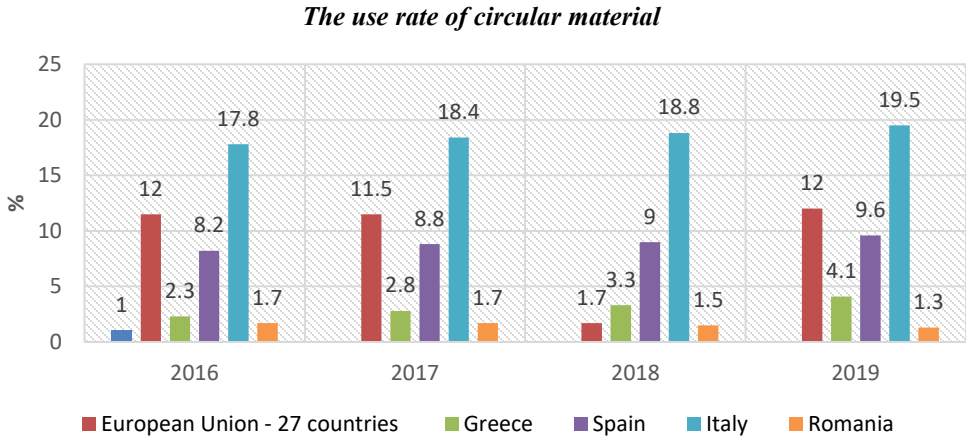


Figure 7.13

Trade in recyclable raw materials (tonne).

"Trade of recyclable raw materials between the EU Member States and with the rest of the world" is a complementary indicator of the "Secondary raw materials" domain that measures the trade of waste inside and outside the European Union. Obviously this indicator is closely linked to the capacity of each country to collect and recover its waste.

The waste categories whose trade is monitored are established by means of a List of CN-codes used for the calculation of Trade in recyclable raw materials. The main types of recyclable waste are: precious metals, aluminium, copper, nickel, ferrous metals, plastics, paper and cardboard [14]. This list is constantly updated according to the EU priorities.

The indicator can be expressed in tonnes, as in figure 7.14, or in monetary units, i.e. euro.

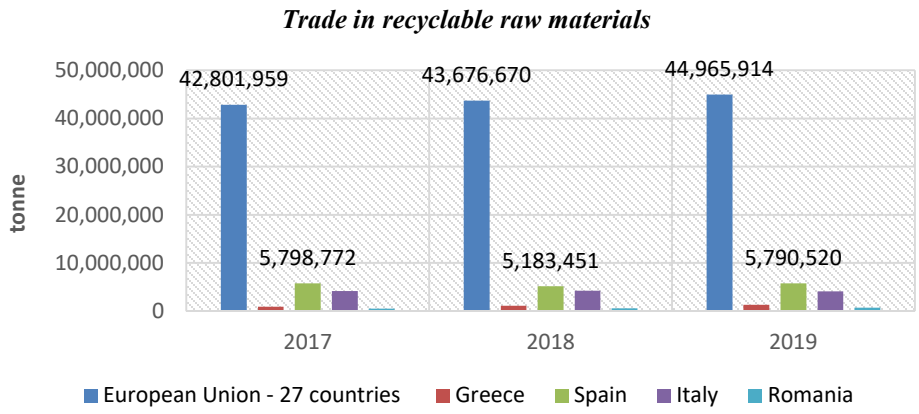


Figure 7.14

This shows that there is a huge difference between the indicator values at the European level and the individual values of the four countries.

Competitiveness and Innovation

Waste valorisation requires the development of new products and technologies, creativity and innovation. The development of this branch of the economy related to the processing and recovery of waste leads to new specialisations and new jobs.

The European Commission has introduced some indicators for the Competitiveness and Innovation area that take into account the above mentioned.

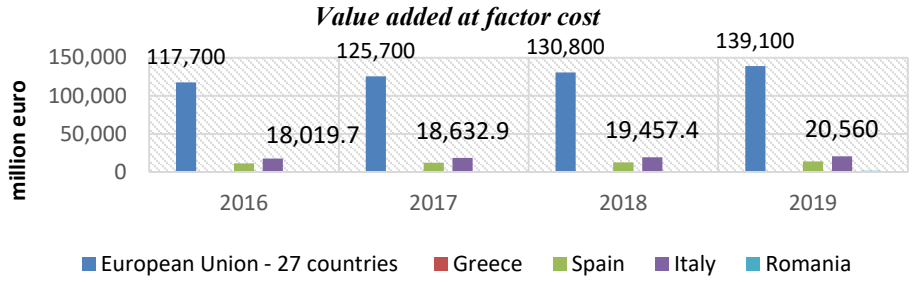


Figure 7.15

Value added at factor cost

This indicator is expressed in million euros and shown in Figure 7.15. If expressed in absolute value, it makes the contribution of the countries under analysis almost irrelevant compared to the EU average.

Value added at factor cost—percentage of Gross Domestic Product

When the added value generated by the waste valorisation is related to the Gross Domestic Product, the effort of each EU-27 member becomes significant.

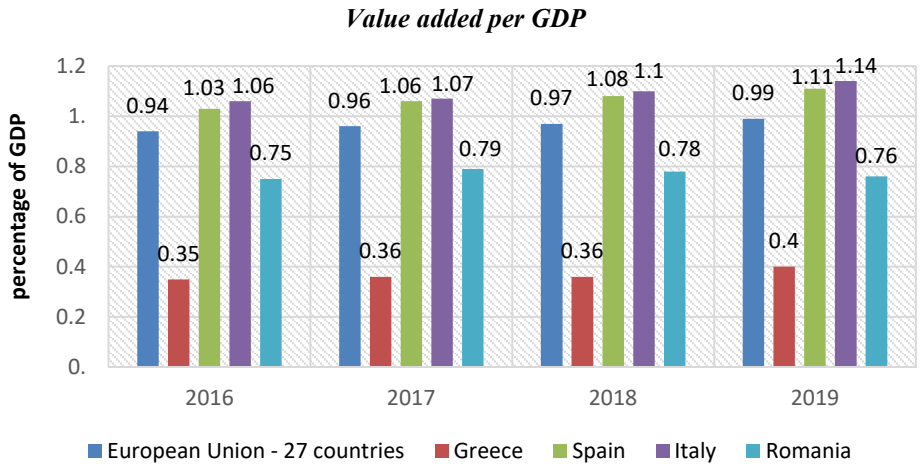


Figure 7.16

The results measured by this indicator are related to the efforts to recycle and reintroduce into the economy the materials resulting from morally and physically exhausted products.

Not surprisingly, Italy and Spain are in the top positions. In the Greek economy the indicator is on an upward trend, with values still lower than the top two. At the Romanian level, high values of the ratio are noticed, roughly constant in the 2016-2019 period, but mostly also due to the low GDP of the country.

Gross investment in tangible goods—percentage of gross domestic product

The indicator refers to those investments, made during a calendar year, which are directly related to waste recycling. This category includes a wide range of purchases; equipment, installations, technologies, land, etc.

The value of these costs in relation to GDP can provide a view on the efforts of countries to develop in line with the circular economy.

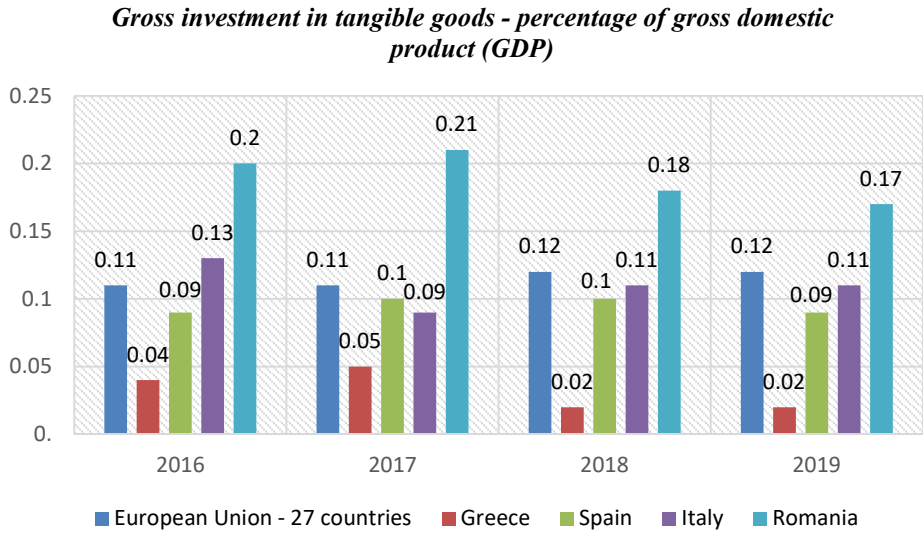


Figure 7.17

On this indicator, Romania ranks first, well above the European average, which demonstrates the country's effort, in relation to its gross domestic product, to develop the circular economy. The next best performers are Italy, which fluctuates around the European average, and then Spain. Greece accounts for the lowest investment in relation to GDP.

Persons employed—percentage of total employment

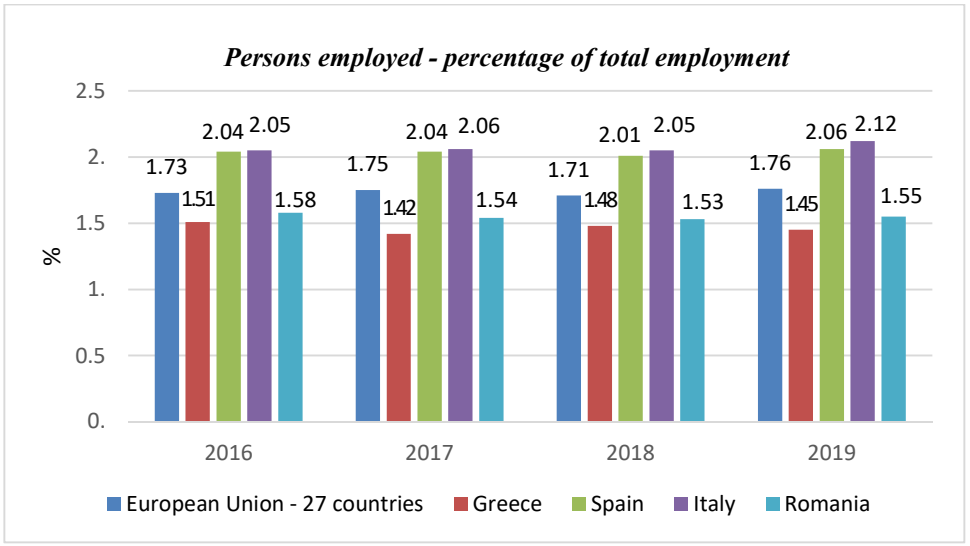


Figure 7.18

The development of waste recycling, waste processing technologies and equipment, the extraction of valuable materials from waste products, leads implicitly to the creation of new jobs. The ratio of the number of people employed in these jobs adjacent to the circular economy to the total number of jobs is an important indicator of the speed of transition from the linear to the circular economy.

New industries are developing rapidly in Italy and Spain, followed by Romania and Greece.

Patents related to recycling and secondary raw material (per million inhabitants).

As mentioned earlier, recycling waste involves new technologies, new equipment, and actually making new products. It requires inventiveness, and patents obtained.

Patents related to recycling and secondary raw materials

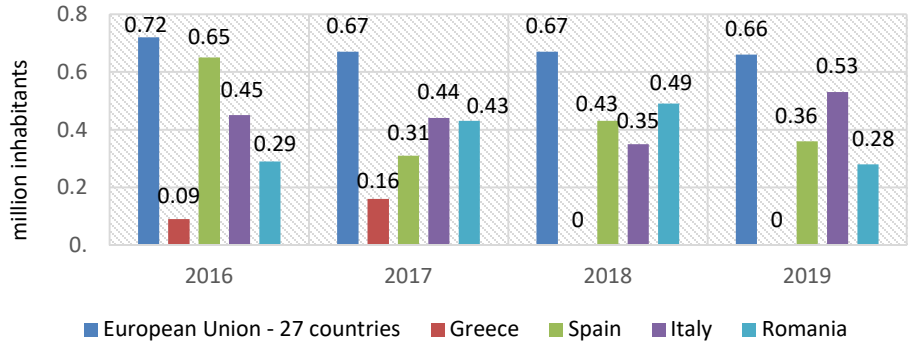


Figure 7.19

At the EU-27 level, the number of patents varies between 0.72 and 0.66 per million inhabitants and in terms of the four countries analysed, the leading position is occupied alternately by Spain, Italy and Romania. Obviously creativity cannot be conditioned by imposed limits, so we can observe a variation in the number of patents in the area of recycling and secondary raw materials, not always on an upward trend. According to the official data, in 2015 there were 350.03 patents per million inhabitants in the EU-27 and in 2019 the figure fell to 295.32 patents (27). At the global level, the best result was recorded in China and Hong Kong, with 3,975 patents per million inhabitants.

Conclusions

The comparative analysis of the status of the implementation of the circular economy in the four countries participating in the project has highlighted the following:

- All four countries have adopted strategies, national plans to transition to a circular economy;

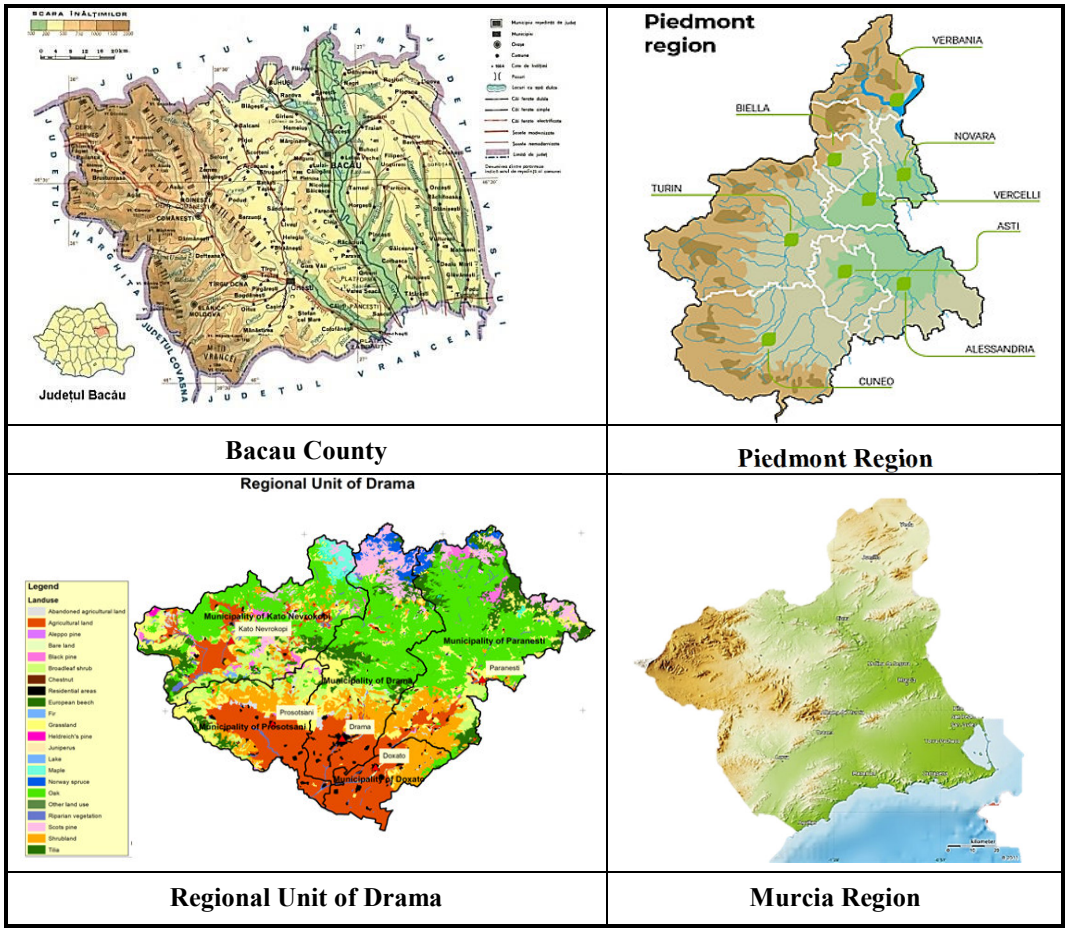
- All countries are making efforts to recover resources through reuse, repair and recycling of waste and by-products.
- Integrated waste management, changing people's waste habits is essential and requires information campaigns, projects -such as this one- and a lot of government involvement.
- The transition from a linear to a circular economy requires time, consistency, political determination and financial effort;
- The most advanced country on this path is Italy followed by Spain;
- Greece and Romania are progressing towards implementing the circular economy and a larger budget allocation, greater involvement of local and regional authorities would ensure faster progress.

7.4 Implementation of circular economy in the rural area of participant regions, realisations and perspectives

The four regions involved in this analysis are Bacau County, Piedmont Region, Unit of Drama from the Eastern Macedonia and Thrace Region and Murcia Region. As it can be observed in the figure 7.20, there are some similarities from point of view of landforms.

The characteristics of the territory have a great importance in the development of agricultural activities and in the entire processing chain of these primary products. The general information of the regions from this point of view can be seen in the table 7.2

Considering the presentations made in the previous chapters, all four regions are interesting, have remarkable aspects in terms of geography, history, economy, and natural resources, and can be valuable sources of inspiration. The exchanges of information, experience, and hopefully, raw materials, and technologies, can contribute to faster development of the circular economy or to its implementation where appropriate.



Bacau County	Piedmont Region
Regional Unit of Drama	**Murcia Region**

Figure 7.20 The four regions

In the regions analysed, the agri-food sector is present in different proportions, depending on the types of economic activities in the area. In the following paragraphs, a summary of the activities in these regions will be given, with a special focus on agriculture and the food industry, areas where this study advocates the transition to the circular economy.

According to the Food and Agriculture Organization (FAO), there are losses of about 14% between the harvesting of raw materials and when the final product reaches the consumer's table [7] "These wastes and losses include significant amounts of resources and energy. It is estimated that worldwide 25% of the

water used in agriculture is wasted through these losses and generates 8% of greenhouse gases."

Table 7.2 General comparison of the regions

	Bacau County	Piedmont Region	Regional Unit of Drama	Murcia Region
Surface [km2]	6621	25,403	3466	11,313.9
Population[inh.]	743,574	4,356,406	98287	1,493,898
Mountains	34%	43.3%	70%	27%
Depressions and hills	28%	30.3%	17.5%	38%
Plains and plateaus	38%	26.4%	12.5%	35%
Climate	Temperate continental	Central continental with Mediterranean influences *	Mediterranean – central European*	Semi-arid Mediterranean
Temperature	av. summer temp. 12°C ÷ 20°C; av. winter temp. (-4) ÷ (-7) °C	20 ÷ 25°C summer 6°C winter	range of temp. 38°C and -5.8°C average temp. 14 ÷ 16°C	hot summer, mild winter average temp. 14 °C to 18 °C
Precipitation	400 ÷ 1400 mm per year (67.91**)	109.65 mm per year**	10.4 ÷ 67.4mm (48.27 mm per year**)	300 ÷ 500 mm per year. (23.94mm**)
Rural area km2	92% of the total area	73.2% of the total area	97.5% of the total area	95.88% of the total area
Rural population	52.6% from total population	48.4% from total population	50.44% from total population	4.12% from total population
Agricultural area	48.4% of the territory	40% of the territory	30% available from which 19% cultivated	35.9% of the territory arable farming

*https://www.worlddata.info/europe/italy/climate-piedmont.php#:~:text=Piedmont%20is%20one%20of%20the,also%20happening%20during%20a%20year.**https://tcktcktck.org/spain/murcia

Bacau County

Economic activities

The gross domestic product of Bacau County in the share of the national gross domestic product is around 2% of Romania's gross domestic product in 2019 [11, 15]. It is not a large contribution, but *the agricultural area* of the county represents 48.4% of the total surface of the county being divided as follows:

- 58% arable area;
- 26.9% pastures;
- 12.32% meadows;
- 1.85 % vineyards and wine nurseries;
- 0.93% fruit orchards and nurseries.

The majority of agriculture crops include cereal grains, wheat and rye, barley, corn grains, sunflower, sugar beet, potatoes. According to the last data available of National Institute of Statistic, in the last years (2015-2018) the value of the production of the agriculture branch has increased, which is considered a positive thing for the development of this economic activity.

It has to be underlined that there are modern companies in the area of agriculture which have already applied in their activity the principle of circular economy and one of examples is Group Serban S.A. The company uses new technologies for its agricultural crops and re-uses all the secondary products waste which result on the entire production chain, from seeding to distribution.

- *The animal husbandry* represent also an activity of the people from the rural area in a wide variety, starting with cows, pigs, sheep, chicken, etc.

- *The industrial activities,* in 2019*,* contributed with 17.4% (https://bacau.insse.ro/wp-content/uploads/2019/04/Anuar_2019_site.pdf) to the added value targeted at the county level. The main branches are:

- *Food and beverage industry:* meat and salami from chicken, pork, beef, food and beverage, bread and bakery products, milk and dairy products, etc.
- *Aircraft* - component manufacturing, assembly, repairs;
- *Manufacturing from metal and plastics;*
- *Production and supply of electric and thermal energy*, gas, hot water, waste management, etc.;
- *Chemical products.*

Trade and services contributes with 23.6% (as above) to the targeted added value of the Bacau County

- *Construction* participation in added value of the county is 12.6%.

- *Other economic activities*:
  - oil industry;
  - salt extraction;
  - professional, scientific and technical activities.

Work force

According to the statistical data of 2020 [15], Bacau County has 743,574 inhabitants of which 391,159 live in the rural area which represents 52.6% of the population.

In the last decade a decline of work force because of the emigration problem, was observed within and outside the county. Simultaneously with the decrease in the number of inhabitants, the number of active people in the county also decreased. The distribution of work force is as follows:

- 11.3% of the people work in industry;

- 3.3% in agriculture;

- 10.6% in constructions;

- 35.2% in trade sector;

- 39.6 % in services and other sectors.

Although the population decreased in the county, the number of companies grew up in the last decade and also the number of the available jobs. This determined the increases of the GDP with around 29% from 2013 to 2017 (https://bacau.insse.ro/wp-content/uploads/2020/03/Anuar2020.pdf).
- The unemployment rate registered on 31.05.2020 in Bacău County was 4.8%.

There are over 112500 active companies in Bacău County, whose cumulative turnover reaches approximately 10 billion lei. Although the county is seen by

many as being in economic decline, the turnover of Bacău represents over half of the cumulated turnover of the entire region of Moldova.

Realisations

The position of the county concerning the implementation of circular economy indicators is the same as that of the country. However, some achievements can be listed.

- Adoption of the strategy for the transition to the circular economy in Romania;
- Management of municipal waste which includes selective collection and recovery;
- Presence of modern agro-food companies which started the introduction of circular economy in their activity;
- Small solar, photovoltaic panels and wind energy sources exploitations
- Higher education institution with programme dedicated to sustainable rural development and circular economy;
- Public information activities for citizens and companies about the circular economy and its benefits for the environment and economic profitability.
- In the county there are hydro-electric plants and some initiatives for exploitation of renewable energy

Perspectives

- The implementation of the circular economy in the economic area of Bacau County will be boosted by the adoption at the Romanian level of the strategy in the domain.
- In the area of agriculture, the soil quality (unpolluted, fertile soil, rich in micro and macro elements) and the recent new farms opened by young entrepreneurs represent good conditions for adopting the circular economy principles.
- The competition among companies, some of which already using secondary products, is also a favourable factor.
- The rivers of Bacau County allow the construction of micro-hydropower plants.

- The wind potential of the western part of the county Bacau County is significant, the wind speed being between 8-10 m/s.
- The solar potential is more intense in the central and southern part, being around 1650 kW / m^2.
- The biomass of the region can be exploited, the value of resources is 132.0 thousand cubic meters corresponding to 7411 Tj.

Piedmont Region

Economic activities

Among the four analysed regions, Piedmont Region has one of the most balanced geographical landforms between mountains, hills and plain with 38.3% of the territory covered by forests. This also influences the diversity of the economic life. The small administrative unities within the region adapted their activity to the geo-morphological characteristics of the territory.

From an economic point of view, it was observed a slow and steady decline of the Piedmont Region in the last years. The recovery is slower than the Italian average and the drive for innovation seems to be slightly lower than the Italian north-west.

In 2015, Piedmont produced 8% of the national GDP. Analysing the data of 2018, the Piedmont's economy has recorded a moderate recovery, producing in the region about 135 billion euro, which corresponds to 7.7% of the country's economy.

- *The agricultural sector* occupies about 40% of the territory and its contribution to the Gross Added Value is around 2% (3.5% of the GAV [5]) of the total of the region. A decline has been observed in recent years regarding both the cultivated area and the number of farms. The agricultural crops include fodder and cereals, mainly maize and rice. The agrifood sector of the Piedmont contributes with about 10% to the national turnover.

- *Fruit crops and vineyards* are especially in the area of Cuneo and include: apples, pears, kiwis, cherries and peppers

- *Food and beverage industry* developed based on local production but also on imports. There are big companies acting in this area such as Ferrero, Lavazza and Martini.

- *Services* contribution to the Region's total wealth is about 70%.

- *Industry,* and are included here all industry branches as food production, automotive, mechatronics, etc., contributes represent 24% of the added value of the region. There are 4% over the country value, so, Piedmont Region is well industrialised.

- *Construction*s - participation of the revenues of the region is around 4%.

Work force

The official data shows an unemployment rate of 8.2% in 2019 with a decreasing trend in recent years.

Employment rate in 2018 is 65.9% from the total number of 4,356,406 inhabitants from which:
- 2% are working in agriculture;
- 21% are hired in industry;
- 12% in services
- a large amount are self-employee;
- 97% of the agricultural farms are mainly family managed; there is no big corporate predominance on cultivation.
- the employment trend is increasing and is in line with the national average.
- according to the data for 2018, there is an increased demand for the most qualified employees, especially graduates.

Realisations

- Italy is on the first position in Europe in the transition to circular economy [1]
- the Piedmont region, according to the position of Italy, has the best circular economy implementation among the four regions. It has a good waste management system being on the first position concerning the recycling of municipal waste.

- the region has big food companies which capitalises the by-products and food wastes;
- in the region, there are innovative companies which collect secondary products and waste to transform them in other products and valuable components, as Agrindustria, partner in the project;
- nowadays 39.4% of the total energy consumption is produced from renewable sources (9,716.90 GWh);
- the hydroelectric power provides the greatest contribution of electricity (6,021.70 GWh)
- the region benefits from specialists in circular economy and systemic design from the Polytechnic University of Torino.

Perspectives

- the full implementation of CE in large companies such as Lavazza, Ferrero, etc. but also in the smaller ones.
- introducing the circular economy in all agricultural processes
- the existence of universities and research institutes with advanced results in the field of circular economy will determine the development of new processes and innovative products
- the possibility to have specialised work force in the area because of the higher educational system with important achievement in the circular economy;
- an integrate and harmonious development of the region on the bases of systemic design studies performed by specialist in
- new activities and new companies will generate new jobs.

Regional Unit of Drama

Economic activities

The geography of the region, with 70% mountains, impose the type economic activities and their importance, the mains being [12]:
- *exploitation of productive forests* - the regional Unit of Drama is a green area, the total surface covered by forest being 55% of the entire territory. The

productive forests, existing at different altitude, represent 49.97% of the total Regional Unit.
- *animal husbandry* - 21% of the region area, formed by grasslands and shrub lands is used for this activity
- *agriculture* - the agricultural crops represent 19% of the unit surface and include: cereals, cotton, tomatoes, tobacco, vineyards, fruits and vegetables.
- *food industry*: dairy products, bakery, pastry and confectionery products, cured meat products
- *marble exploitation* - about 80% of the total marble exports at national level are originated from the 80 active quarries of the Regional Unit of Drama.
- *food and beverage production*
- *other activities* transportation, storage, communication, social activities, wholesale and retail trade, catering services and financial services.
- *exploitation of renewable energy* – solar through photovoltaic stations, wind energy , water energy (52 Small Hydroelectric Stations), biomass station. Total energy produced from renewable sources is 1811.89 MW.

Work force

Comparing with the other regions, in Drama Unit is a higher unemployment rate, around 22.8 in 2018 and 21.8% in 2019.

The working population is distributed as follows:
- 18% of total population works in agriculture
- 55% are employed in area services;
-10% manufacturing; 13% industry; 4% constructions.

In Unit of Drama there many situations of self-employment, there are small firma with a minimum of personnel, from the own family.

Regional Unit of Drama as other regions is facing population decline.

Realisations

Greece, at the country level, has low values for circular economy indicators which also applies to the Drama Region.

Important actions in the Regional Unit of Drama on the line of circular economy:

- valorisation of wood waste into pellets and briquettes;
- production of energy from renewable sources;
- companies which implement circular economy –Alfawood;
- intelligent organic glass-made greenhouses;
- waste management infrastructure projects under implementation;
- exploitation of renewable energy – solar through photovoltaic stations, wind energy , water energy (52 Small Hydroelectric Stations), biomass station. Total energy produced from renewable sources is 1811.89 MW.

Perspectives

Implementation of CE is Regional Unit of Drama can be improved thanks to:

- an important percentage of the population lives in rural areas.
- the high level of unemployment of about 22% indicates the existence of the available labour force which can be can be involved in new processes for valorisation of waste and secondary products.
- agriculture and food industry, even if they have a small share in the economy of the region, they enable the implementation of the circular economy;
- there is 2% unused land in agriculture and it can be introduced into the circuit.
- the exploitation of natural resources, of renewable sources, already having a precedent, it can be amplified.
- new activities and an increase in the number of jobs can stop the decline of the population and the revitalisation of the area.
- the Regional Unit of Drama can be an example for the implementation of the circular economy taking into account the achievements so far.

Murcia region

Economic activities

The main activities in the area [9]:
- *services* - The contribution of this sector to the GVA (gross value added) is around 69.3%,
- *agriculture* - 6.1% is the contribution of this activity in Murcia Region. The agricultural crops represent 35.9% of the land of the region. The main cultures are: oat, barley, lettuce, citrus fruits, peaches, almonds, apricots, olives, and grape. There are also *grape vineyards* on a surface of 290 km^2 and wine producer.
- *industry* – 18.7% represent the participation of this sector to the GDP of the region; Murcia has some foreign companies choosing it as a location for factories, such as Henry Milward & Sons (which manufactures surgical and knitting needles) and American firms such as General Electric and Paramount Park Studios.
- *construction* - 5.9% contribution to the GVA, with 13.3% of the total number of companies.
- *professional, scientific and technical* activities – are the main area of the 10.5% of the active companies.
- *tourism* - 11.4% of the regional GDP.
- *renewable energy* implementation also is an important economic activity and a source of well-being.

Work force

There are following aspects:
- unbalanced distribution of the population; concentration of population in big and medium urban centres
- population decline, the migratory balance was negative; the number of people who left was greater than those who entered ;
- the region's population has an ageing index;
- unemployment rates in the Region of Murcia are slightly higher than the national one; in 2018, the unemployment rate was 15.83%
- the population working in agriculture represents 8.89%, three times higher than the corresponding rates at the national level;
- 23.64% are employed in the industry;
- in construction 12.57%.

Realisations

The first achievement was the decision of the Governing Council of the Region of Murcia to begin the process of drawing up the Region's Circular Economy Strategy (ESECIRM) in September 2017, a strategy which has been active since 1 January 2019.

The second one was the adoption of the Circular Economy Strategy of the Region of Murcia (ESECIRM) in 2019 with clear targets.

In Spain and in the Region of Murcia there are circular economy indicators at a high level and others which have to be improved. Spain has a good situation in the recycling of packaging waste, especially of plastic, glass and metallic waste. In the case of the other indicators, they can be enhanced.

Agriculture, ranching, and fishing contributed 5.99% of Region of Murcia's Gross Value Added.

The Region of Murcia also has:

- small but competitive agro-food sector, more dynamic than the national average;
- several successful experiences in the agro-food and construction sectors concerning the re-use of waste;
- exploitation systems of renewable energy sources.

Perspectives

- the existing good experience in performance agriculture and wine production which can introduce the recycling of secondary raw materials and waste;
- in the Region of Murcia, the proportion of agriculture, both in terms of assets and employed persons, is three times higher than the corresponding rates at the national level; this dynamics ensures good perspective for the circularity of this economic branch;

- there are already RES installed so, it is easy to increase their exploitation;
- workforce available considering the unemployment rate.
- a strong professional, scientific and technical group of companies which can help for a fast professionalization in CE.

Conclusions

Moving towards a circular economy, regions are clearly following the country's trend, in line with the national policy.

There are differences between regions in terms of the size of the territory, the area available for agriculture, the interest in developing the food industry, and the level of industrialisation in general.

A major influence on the success and extent of agricultural activities is the quality of the soil and the climate of the area concerned. In this respect, the Murcia Region is the most disadvantaged region, which, however, has successfully implemented family businesses on the available land.

The contribution of agriculture to the domestic product of the regions is between 2-5% but it should not be overlooked that it represents a fundamental economic branch for the survival and health of the population.

The agriculture and the food industry must benefit from monitoring the value chain and fully exploit by-products and waste, becoming a fully circular economic branch.

Regional authorities need to be more consistently involved in promoting the circular economy and consistently follow the transition to it.

The analysis of the four regions highlighted the differences between them but also their commonalities. The exchange of good practices could contribute to a faster implementation of the circular economy in these areas with all its benefits.

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