Chapter 3

Implementation of circular economy in rural area of Romania and Bacau County, realisations and perspectives

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3.1 CIRCULAR ECONOMY IN ROMANIA

3.1.1 Structure of the territory and rural area presentation

3.1.1.1 General presentation

Romania is located in the south-east part of the Central Europe, in the north of the Balkan Peninsula, on the lower Danube.

Figure 3.1 Romania's position in Europe [1]

Romania has border with five countries, the sixth neighbour being the Black Sea. To the NE and E it is bounded to the Republic of Moldova (681.3 km), to the N and E to Ukraine (649.4 km), to the SE to the Black Sea (193.5 km), to the S to Bulgaria (631.3 km), to the SW to Serbia (546.4 km) and to the W to Hungary (448.0 km).

Figure 3.2 Romania Neighbours [2]

The total length of Romania's borders is 3,149.9 km. Two thirds of these (2,064.4 km) are water border, determined by the Danube, Prut, Tisa rivers and the Black Sea, one third (1,085.5 km) is land border. Romanian territorial waters stretch up to 12 nautical miles off the Black Sea [2].

The capital of the country is Bucharest, a city with around 2.151.665 inhabitants [4], a very important industrial, commercial and cultural centre of Romania. The country has 263 cities from which 8 with more than 300,000 inhabitants such as: Iaşi, Constanţa, Braşov, Craiova, etc.

The surface of Romania is 238.397 km^2 (according to the National Institute of Statistics, 2019) being on 13th place on Europe and on the 80th on the world from this point of view. The population living in this area reaches 20121641 inhabitants, according to 2011 census and is formed of 88.9% Romanians, 6.1% Hungarians, 3.3% Romani, 0.2% Ukrainians and 0.2% Germans.

From an administrative point of view Romania is organized into counties, cities and villages. Romania has 41 counties and Bucharest, the capital city, which has a similar status to that of the county. For a better implementation of the development strategy of the country they were created eight regional development agencies (fig. 3.3) which include a number of counties, grouped according to the historical regions of Romania. They correspond to the NUTS II-level divisions in the European Union member states. Each development region includes four to seven counties.

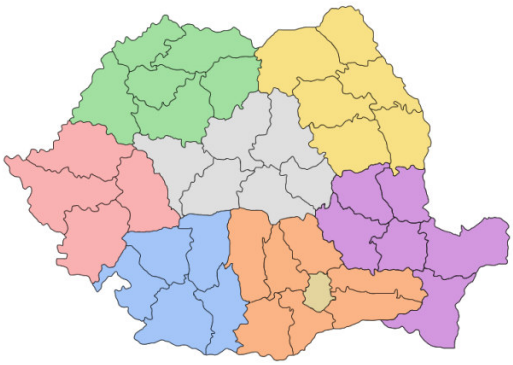


Figure 3.3 Development region of Romania [6]

3.1.1.2 Geography of Romania

Romania has on its territory all types of the landforms: mountains, hills and plains. Considering the entire surface of the country, 28% is occupied by mountains, 42% by hills and plateaus and 30% by plains.

Figure 3.4 Geographic map of Romania [5]

The main parts of the Carpathian Mountains, approximately two-thirds, are on the Romanian territory. They are medium altitude mountains with a significant number of depressions and about 1,500 km long, representing the longest mountain range in Europe. The Carpathians begin in the Vienna Basin and end in the Timoc Valley, 910 km being located on the Romanian territory. The maximum altitude is 2,544 m, in the Fagaras Mountains, part of the Southern Carpathians.

The hills and plateaus, situated around the Carpathian Mountains, represent the largest geographical relief form of the Romanian territory. There are heights between 200 - 800 meters and represent the area with the highest development of human settlements. Below, in the extension of the hills and plateaus, there are plains with an altitude lower than 200 m. The most important plain surfaces are in the south of the country (The Romanian Plain) and in west (The Western Plain).

Romania's hydrographic network includes: rivers and streams, lakes, groundwater, marine waters. The majority of rivers spring from the Carpathians and are collected, almost entirely, by the Danube. The main rivers are the following: Mures, Olt, Prut, Siret and especially the Danube, which is the second river of Europe in length and flow, after the Volga. It is an important river road passing through 10 countries. Before meeting the Black Sea, the Danube has created the Danube Delta, a biosphere reservation, which has been a UNESCO World Heritage Site since 1991.

Romania has around 3,500 lakes, located on all relief levels with various origins, sizes and shapes. They are usually small representing only 1.1% of country's surface.

Although it has a dense hydrographic network, Romania is a poor country in water resources. There are only 1,894 m^3/inhabitant /year comparing to the European average of 4,800 m3/inhabitant/ year [12].

3.1.1.3 Rural area

3.1.1.3.1 Population

There are many criteria at the level of European Union concerning the definition of the rural area, taking into consideration: the population size, the

density of the inhabitants per square kilometre, the administrative system, etc., but the most simple and commonly used definition is to consider the totality of the spaces outside the cities as rural area. Accepting this point of view, the rural area of Romania represents about 90% of the total country surface and the similar situation is in other countries, too.

An important part of the Romanian population lives in rural areas. In the last four years the percentage of the rural population has varied between 46.2% and 46.4%, being above the average of 23.6% in the EU Member States. This represents an important workforce which can be used for the modernisation and development of new economic activities.

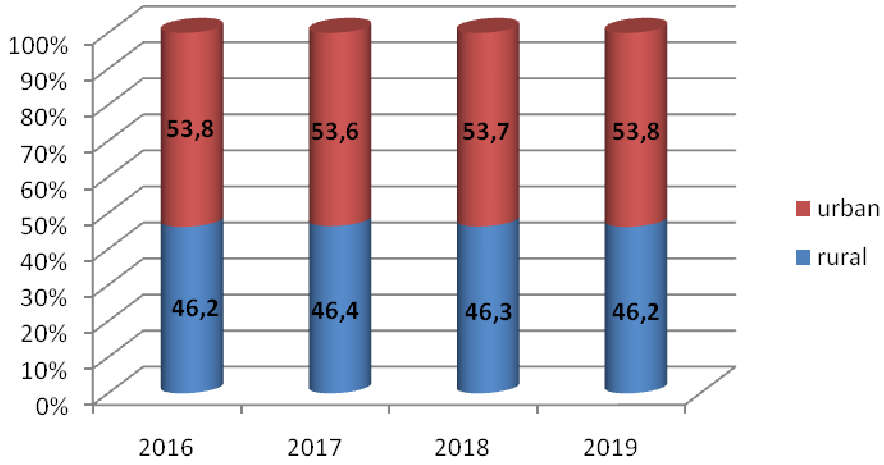


Figure 3.5 Resident populations by living areas
Note: In the graph, the percentages are expressed in US English

The migration phenomenon has an important effect on the Romanian population and according to data of the National Institute of Statistics (NIS) the number of residents in Romania has been steadily declining, being also permanently lower than the number of people officially domiciled in Romania.

Table 3.1 Resident population by living area [3]

	2016	2017	2018	2019
Total population	19760585	19643949	19530631	19414458
By environment:				

urban	10636418	10531819	10503470	10455362
rural	9124167	9112130	9027161	8959096
By gender per total country				
masculine	9649733	9602080	9553249	9500450
feminine	10110852	10041869	9977382	9914008
By gender in rural area				
masculine	4571117	4575187	4539809	4516381
feminine	4553050	4536943	4487352	4442715

In 2019 the official data of the NIS indicated 19,414,458 residents, a smaller number that at the last 2011 census which counted 20,121,641 inhabitants. The structure by gender of the residential population from the rural area is quite balanced between women and men, the proportion of the last one varying from 50.1% to 50.4% in recent years (Fig. 3.6).

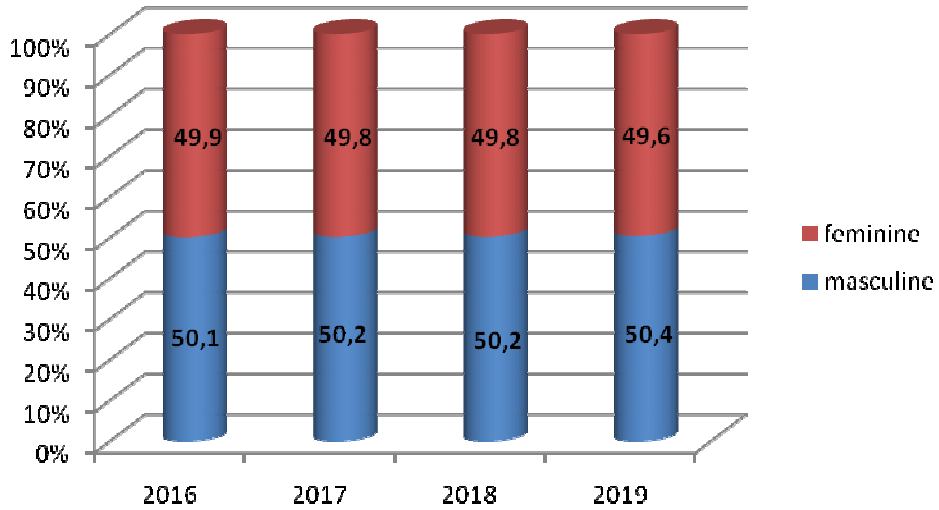


Figure 3.6 Distribution of population from rural area by gender

Note: In the graph, the percentages are expressed in US English

Considering the fact that at the level of the entire country the proportion of women was 51.1% in 2016 going to51% in 2019 and comparing to the smaller percent of the women from the rural area (from 4.9% to 49.6%), it can be said

that the migration of women from rural areas was higher than that of men from the same territory.

Agriculture is an important part of the Romanian economy considering the size of the rural population and the degree of employment. There are important differences between rural and urban areas, the former being marked by a significant level of poverty and a correspondingly lower standard of living. In addition, both internal and external migrations are more accentuated in rural areas, experiencing a phenomenon of population aging.

Statistical analyses operate with several categories of data in terms of labour force:

- *Active population* includes all people aged 15 and over who provide the labour force available for the production of goods and services during the reference period, including the employed population and the unemployed.
- *Occupied population* refers to all people aged 15 and over who have carried out an economic or social activity producing goods or services for at least one hour during the reference period (one week), in order to obtain an income in the form of wages, payment in kind or other benefits. In this category there are also included the people working for a minimum of 20 hours per week in the auxiliary household for the production of goods exclusively for their own consumption

Considering this distinction, at the level of 2019 there were9,034,000 active people from which 4,082,000 living in rural area and 8,680,000 occupied persons in all country and 3,897,000 from the rural environment. The number also includes the people working in their household, (according to the above definition) very common situation in the rural villages.

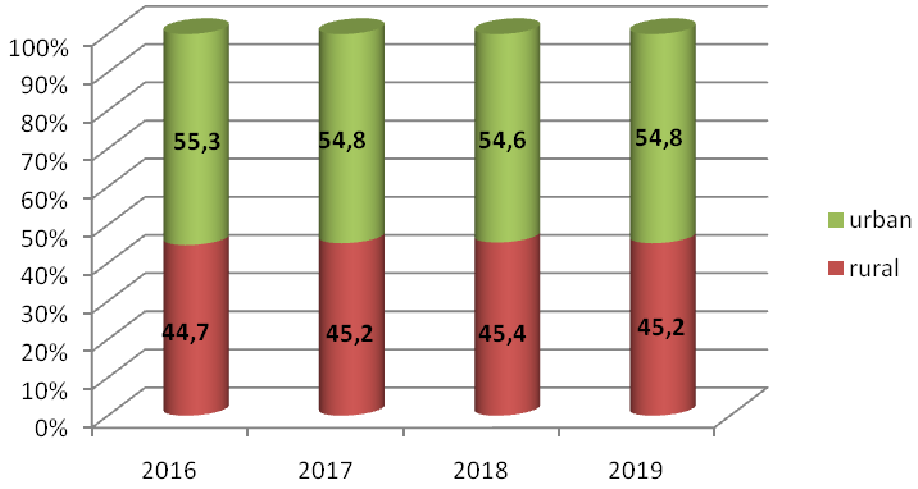


Figure 3.7 Labour force in Romania. Active people by living area

Note: In the graph, the percentages are expressed in US English

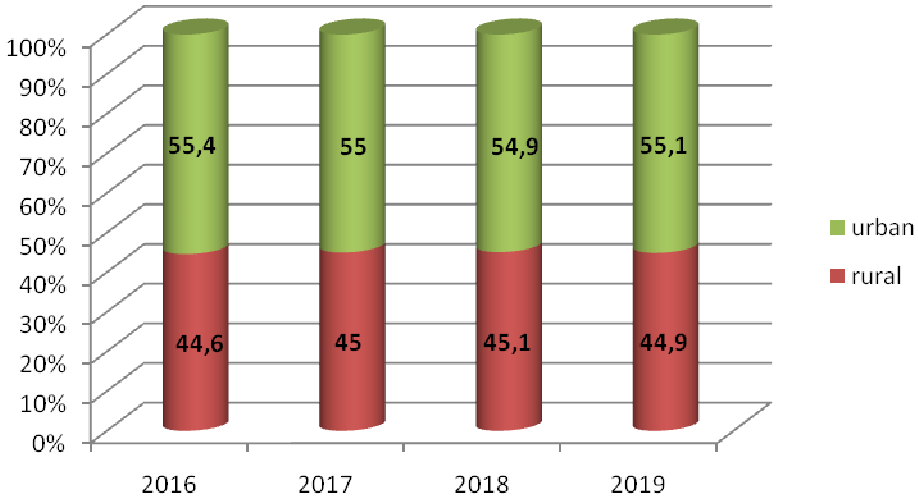


Figure 3.9 Labour force in Romania. Occupied people by living area

Note: In the graph, the percentages are expressed in US English

According to the last statistical data offered by the NIS, in 2018, there were around 1,760,000 persons working in agriculture, forestry and fishing which represent 21% of the total of employed people. The Table 2 presents the last four years situation of the employed people from the private sector working in the previously mentioned domain.

Table 3.2 Private sector employees working in specific rural area fields [3]

	Employed people[thousands of people]			
	2015	2016	2017	2018
All economic sectors	8,340.6	8,317.6	8,366.8	8,407.5
Agriculture, forestry and fishing	2,003.1	1,726.8	1,741.7	1,759.5

At the level of the EU the average of population working in rural activities is 4%, which places Romania on the first place from this point of view.

3.1.1.3.2 Economic activities of rural areas

The types of rural economic activities performed in any country are closely related to the forms of relief and the climate. The diversity of the Romanian territory determines the diversity of agricultural crops.

The inventory of the land fund of Romania determined a surface of 23839071ha, which is divided into 61.37% agricultural land and 38.63% non-agricultural land, having included in this last percentage the surface of forests and waters, buildings, roads and as well as non-cultivable areas[8].

Table 3.3 Distribution of the Romanian land fund [3]

Type of lands[1]	Dimension [ha]	Percent from total country surface[2]
Agricultural lands:	**14,630,072**	**61.37%**
- arable area	9,395,303	39.41%
- grasslands	3,272,165	13.73%
- hayfields	1,556,246	6.53%
- vineyards and vine nurseries	209,417	0.87%
- orchards and fruit tree nurseries	196,941	0.83%
Non-agricultural lands:	**9,208,999**	**38.63%**
- forests and other forest vegetation	6,734,003	28.25%
- waters and ponds	831,495	3.49%
- buildings	758,285	3.18%
- roads and railways	389,795	1.63%
- degraded and unproductive lands	495,421	2.08%

[1)]data for 2019 [8]
[2)]related to an area of 23839071ha

An image of this distribution can be seen in the Figure 3.10.

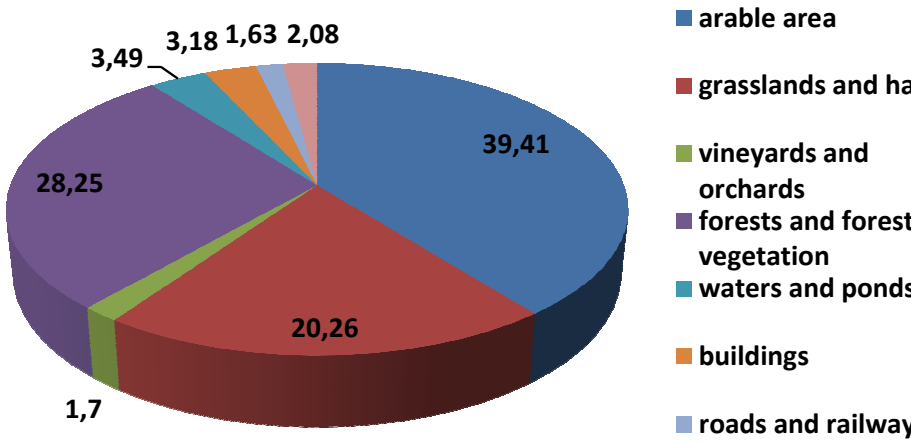


Figure 3.10 Distribution of the Romanian land fund
Note: In the graph, the percentages are expressed in US English

Vegetable agricultural production

The mainagricultural crops of Romania can be seen in the Figure 3.11. In 2019 the main surface was dedicated to maize, representing 3.6% of the total agricultural lands, followed by 24.8% for wheat and 20.6% for oily plants. In the category of other crops, there is a multitude of cultures: textile, medicinal and aromatic plants, sugar beet, green fodder, mushrooms, etc.

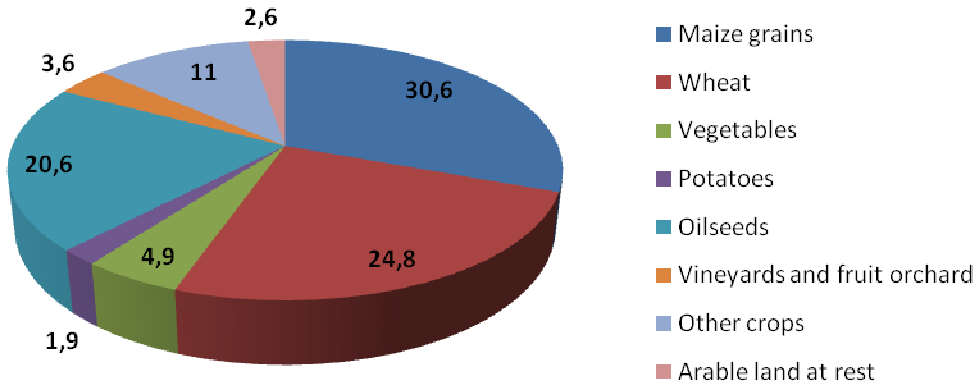


Figure 3.11 Surface with vegetable crops in 2019 [3]

The percentage of vegetables includes the surface cultivated with vegetables for grains as well as the one in the inhabitants' own gardens.

From one year to another, the area occupied by different agricultural crops has not undergone substantial changes in the last 4 years.In fact, it is the agricultural production obtained in these last years, presented in the Table 3.4, which is relevant.

Table 3.4 Vegetable agricultural production [3]

	2016	2017	2018	2019
	[thousand tons]			
Grain cereals from which	21765	27139	31553	30412
❖ wheat	8431	10035	1014	1030
❖ rye	26	28	29	26
❖ barley and two barley	1817	1907	1871	1880
❖ maize grains	10746	14326	18664	17432
Legumes for grains	99	302	191	236
Potatoes	2690	3117	3028	2627
Oily plants	3597	4986	5146	4792
Vegetables[1]	3358	3638	3797	3530

Fruits[2]	1242	1058	1813	1487
Grapes[2]	737	1067	1144	978

[1)]*Including production from family gardens, greenhouses and solariums, intercropped and successive crops*
[2)] *Including production from family gardens.*

Animal agricultural production

The animal husbandry is a traditional activity in rural areas. In big farms or in the own household, people raise animals for meat, milk, work and even for entertainment.

Leaving aside the industrial livestock farms, in the hill and mountain areas many privet people/households have flocks of sheep and goats or cattle herds, this being a means of providing their living. In the last two years, there was an increase in the number of sheep up to10.176.000 of head. Also, the raising poultry is a common activity in any rural household, especially for theirown consumption, as it can be understand from the Table 3.5.

Table 3.5 The number of animals raised in farms and households [3]

	2015	**2016**	**2017**	**2018**
Categories	thousands of heads			
Cattle	2092	2050	2011	1977
Swine	4927	4708	4406	3925
Sheep	9809	8976	9982	10176
Goats	1440	1483	1503	1539
Horse	503	520	480	448
Birds/hens/chickens[1]	78648	75690	73289	73993
Bee families	1393	1437	1602	1690
Rabbits	292	297	278	259

[1)]*Including production from families.*

The above table includes the big farms and also the the number of heads from the households. The bee families counted are in majority inprivate properties, being raised by individual beekeepers or grouped in associations.

The production obtained from these different categories of animal husbandry can be seen in the Table 3.6.

Table 3.6 Animal agricultural production [3]

	2015	2016	2017	2018
Categories	Thousands of tonnes of live weight			
Total agricultural production of meat[1]	1431	1465	1462	1484
from which				
• beef	200	206	196	188
• pork	562	588	583	550
• sheep and goat	110	114	116	116
• chicken	558	555	566	628
Milk-Total [thousands of hectolitres]	49156	48133	46615	46741
Wool production [tones]	22343	22277	22401	23459
Eggs [million pieces]	6555	6182	5996	5713
Extracted honey production[tones]	27893	21202	30177	29162

[1)] *meat production represent the weight of the animals slaughtered for consumption.*

According to the data provided by the National Institute of Statistics, on the first positions there is pork and poultry meat production which together represent around 78.5% of the total country meat production.

Comparing the Table 5 and 6 a discrepancy can be observed between the number of sheep and the meat production. The explanation is given by the fact that the Romanians people are not big consumers of this type of meat, the majority of production being for export.

3.1.2 Companies working in the rural area or connected with the rural production

The number of commercial societies is an important indicator concerning the dynamic of one sector or another and how profitable the activity can be in a specific field of the country's economy.

In order to analyse the economic life of the rural area, the potential of this primary sector as well as the impact on the economic development of the country, there were considered not only the vegetable and animal agricultural farms but also the industrial activities which use and process products generated by the rural area. According to this principle, the number of the commercial societies working in the rural area or connected with the rural production was in 2015 of 27222 and increased in 2018 to 30451 commercial societies. This dynamics can be seen in the graph below.

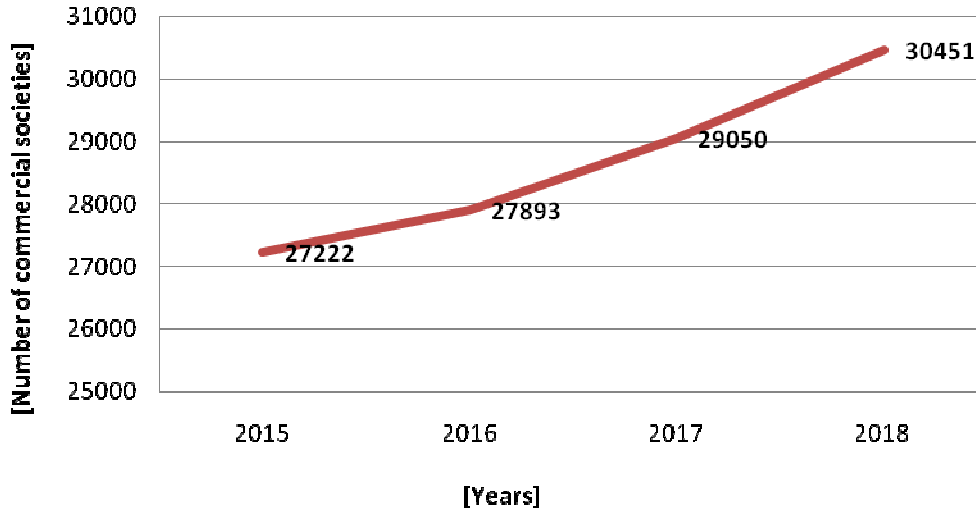


Figure 3.12 Evolution of the number of commercial societies [7]

The number of commercial companies included those which meet the above-mentioned criteria. Corresponding to Classification of activities in the national economy, from 2007 (CAEN, rev 2) the companies from the section A: Agriculture, Forestry and Fisheries and from Section C: Manufacturing Industry, the subsections 10 - Food industry and 11 - Manufacture of beverages belong to this category. The economic activities of authorized natural people, individual enterprises and family enterprises were not included towards the counting of the commercial societies.

The increase of the number of commercial companies proves the development potential of the agriculture sector as well as of the food and beverage industries through productivity improvement by using new technologies and equipment.

3.1.3 Circular economy indicators: realisation and perspectives

According to the decision of the European Union the transition to a circular economy is essential in order to ensure a sustainable development, a smart use of natural resources and to prevent dramatic changes of the climate on earth. In order to evaluate the progress to a circular economy of each country, ten indicators have been established by the European Commission. These indicators can be grouped into the following areas:

- ***Production and consumption*** –with the goal to monitor the intelligent use of the raw material for industrial production, simultaneously with the diminishing of waste from the economic activities or produced by households. The indicators from this category are as follows [9]:
  - Self-sufficiency of raw materials for production in the EU
  - Green public procurement (as an indicator for financing aspects);
  - Waste generation (as an indicator for consumption aspects);
  - Food waste.
- ***Waste management*** – takes into consideration the quantity of the recycled waste which is returned to economy in order to produce new values. Two indicators correspond to this area, such as:
  - Recycling rates (the share of waste which is recycled);
  - Specific waste streams (packaging waste, biowaste, e-waste, etc.).
- ***Secondary raw materials*** – this category takes into consideration the materials and products recovered and reintroduced in the economic cycle to replace the raw materials extracted directly from the nature. In this way the environmental footprint of new products is reduced and the raw materials are used in a sustainable manner.
  - Contribution of recycled materials to raw materials demand;
  - Trade of recyclable raw materials between the EU Member States and with the rest of the world.
- ***Competitiveness and innovation*** – counts the innovation and prosperity brought by the application of circular economy in terms of design of new products, new technologies and job creation in the area of reuse, repair and recycling sector. The indicators used to measure the achievement of this area are:
  - Private investments, jobs and gross value added;

- Patents related to recycling and secondary raw materials as a proxy for innovation.

Part of these indicators can be reported by countries and part on European scale, as can be observed from the above paragraph.

*Self-sufficiency of raw materials for production in the EU*indicatoris expressed in percentage [%] and measured the capacity of the EU in order to provide from their own resources the raw materials from critical categories, being independent from this point of view from the rest of the world. The critical raw materials are those that are of high economic importance for the EU and vulnerable to supply disruption [9].

Green public procurement is an indicator which measures the share of public procurement which uses the sustainable criteria in their acquisitions. This means to introduce the circularity conditions in the public acquisition, such as: reparability, reusability, recyclability – the well-known three R, etc.

Waste generation indicator can be divided into three categories:

- *Generation of municipal waste per capita*- expressed in Kg per capita – indicates the quantity of waste collected from the territory of a municipality.
- *Generation of wastes excluding major mineral wastes per GDP unit* – evaluates the quantity of waste collected in a country (expressed in mass unit), per GDP unit (expressed in Euro) excluding major mineral wastes. The measure unit of the indicator is Kg per thousand Euros. The calculus of this indicator includes all type of wastes (from economic/ industrial sectors and from households) but excludes the major mineral waste as from construction/demolition or mining activities.
- *Generation of waste excluding major mineral wastes per domestic material consumption* - indicator which reports all waste generated in a country (in mass unit), excluding major mineral wastes, to the domestic material consumption (DMC) of a country. It is expressed in percentage (%) as both factors are measured in tonnes.

Food waste indicator evaluates the quantity of the waste generated in food industry, this including all the stages: production, distribution and consumption. It is expressed in tonnes.

The two types of indicators from the w*aste management*area,group several specific categories:

- Recycling rate of municipal waste (%):
- Recycling rate of all waste excluding major mineral waste (%);
- Recycling rate of overall packaging (%);
- Recycling rate of plastic packaging (%);
- Recycling rate of wooden packaging (%);
- Recycling rate of e-waste (waste electrical and electronic equipment - WEEE) (%);
- Recycling of biowaste (kg per capita)
- Recovery rate of construction and demolition waste (%).

*Contribution of recycled materials to raw materials demand*end-of-life recycling input rates (EOL-RIR) indicator (%), from the *Secondary raw materials* area, defines the quantity of some specific raw materials re-entering into the economic circuit, being recovered from other products at the end of their life.

Circular material use rate indicator (percentage of total material use) is the expression of the share of materials recovered and brought back into the economy from the total of material used.

Trade in recyclable raw materials (tonne)–measures the quantities of several specific selected wastes and by-products that are marketed between the EU Members States and the extra EU. This indicator takes in consideration five categories: plastic; paper and cardboard; precious metal; iron and steel; copper, aluminium and nickel [9].

According to the Eurostat, following results are in Romania:

Table 3.7 Generation of municipal waste per capita *[kg per capita]* []

	2015	**2016**	**2017**	**2018**
Romania	247	261	272	272
EU 28*	481	488	488	489

Eurostat: https://ec.europa.eu/eurostat/databrowser/bookmark/703ee585-6d76-448d-b0d7-0b3f62603fb2?lang=en
** estimated data*

It can be observed that the quantity of collected municipal waste per capita is smaller in Romania than the European average (Table 7) so, it could be

estimated that not all the wastes produced on a municipality territory are managed correctly. On the other hand, the ratio between the total wastes collected (excepting the mineral ones) from the country surface and the GDP, expressed in Kg per thousand euro (Table 8), is higher in Romania than in the EU 28. The explanation is given by the difference between the GDP in Romania and in European Union and not by the lower cost of the waste in Romania compared to the European level.

Table 3.8 Generation of waste excluding major mineral wastes per GDP unit
[Kg per thousand euro]

	2010	2012	2014	2016
Romania	188	178	150	140
EU 28*	67	66	66	65

Eurostat:https://ec.europa.eu/eurostat/databrowser/view/cei_pc032/default/table?lang=en
** estimated data*

An interesting circular economy indicator, which brings an image concerning the resources productivity, is presented in the Table 3.9. *Generation of waste excluding major mineral wastes per domestic material consumption*, an indicator showing the efficient use of the materials through a comparison between the quantity of waste produced on the country territory and the domestic material consumption.

Table 3.9 Generation of waste excluding major mineral wastes per domestic material consumption [%]

	2010	2012	2014	2016
Romania*	8,6	6,5	5,6	4,7
EU 28*	12.4	12.8	13.2	13.6

Eurostat:
https://ec.europa.eu/eurostat/databrowser/view/cei_pc033/default/table?lang=en
* estimated data

A smaller value of this ratio indicates a high level of efficient use of the materials. The domestic material consumption (DMC), according to the Eurostat definition, represents "the total amount of material directly used in an economy and equals direct material input (DMI) minus exports". As it can be

seen in the Table 3.9, Romania makes some progress but still is under the European level.

Table 3. 10 Recycling and recovery rate in Romania and EU

***Recycling rate of municipal waste* [%]**	**2015**	**2016**	**2017**	**2018**
Romania	13.2	13.3	14.0	11.1
EU 28*	44.7	46.0	46.5	47.0
***Recycling rate of all waste excluding major mineral waste* [%]**	**2010**	**2012**	**2014**	**2016**
Romania	26	28	27	30
EU 28	55	55	56	57*
***Recycling rate of packaging waste by type of packaging* [%]**	**2014**	**2015**	**2016**	**2017**
Romania	54.8	55.9	60.4	60.4
EU 28	65.5	65.8	67.2	67
***Recycling rate of e-waste* [%]**	**2014**	**2015**	**2016**	**2017**
Romania	21,3	22,5	25	-
EU 28	32.2	35.8	41.2*	39.4*
***Recycling of biowaste* [kg per capita]**	**2015**	**2016**	**2017**	**2018**
Romania	18	18	18	9
EU 28*	75	81	82	83
***Recovery rate of construction and demolition waste*[%]**	**2010**	**2012**	**2014**	**2016**
Romania	47	67	65	85
EU 28*	-	-	89	89

Source: Eurostat
** estimated data*

The principles of the circular economy demand the reuse and recycle of the waste, as much as is possible. The indicators from the Table 3.10 are very important to appreciate the progress of a country towards a high valorisation of raw material and the implementation of a circular economy.

There are two criteria which bring Romania closer to the EU 28*: Recycling rate of packaging waste* which grew from the 54.8% in 2014 to 60.4% in 2017,

being close to 67%, the European average of the same year and *Recovery rate of construction and demolition waste*which reached 85% in Romania 2016 and 89% in the same year in the EU 28.

Table 3.11 Circular material use rate [%]

	2014	2015	2016	2017
Romania*	2.1	1.7*	1.7	1.8*
EU 28	11.5	11.7*	11.9	11.7*

Source: https://ec.europa.eu/eurostat/databrowser/view/cei_srm030/default/table?lang=en
** estimated data*

The *Circular material use rate* is one of the most important indicators and expresses the share of materials recovered and brought back into the economy from the total of material used. It can be observed, in the Table 11, that Romania realises only 10% from the European rate and important progress has to be done on this domain. As a consequence, a poor result was obtained also at the *Trade in recyclable raw materials* indicator (Table 3.11).

Table 3.12 Trade in recyclable raw materials [tonne]

	2016	2017	2018	2019
Romania	19,795	19,638	27,028	24,903
EU 28	-	-	-	-
EU 27	8,729,722	9,317,020	9,271,636	8,877,945

Source: https://ec.europa.eu/eurostat/databrowser/view/cei_srm020/default/table?lang=en

The implementation of circular economy demands the improvement of the creativity and research activities in order to generate new technologies, new equipment, new products. The necessary investment and the emergence of new jobs will conduct to the economic development and to a healthier environment. The comparative situation from these points of view between Romania and EU 28 is shown in the Table 3.13 and 3.14.

Table 3.13 Private investments, jobs and gross value added related to circular economy sectors

***Value added at factor cost* [Mio euro]**	**2014**	**2015**	**2016**	**2017**

Romania	1,027.9	1,134.2	1,280.9	1,485.2
EU 28	140,429.1	145,797.3*	146,742.7*	154,790.1*
Value added at factor cost- percentage of gross domestic product (GDP)	**2014**	**2015**	**2016**	**2017**
Romania	0.68	0.71	0.75	0.79
EU 28	1	0.98*	0.98*	1*
Gross investment in tangible goods (Mio euro)	**2014**	**2015**	**2016**	**2017**
Romania	285.4	326.8	333.3	387.8
EU 28	15,156.2	17,171.3	17,490.1	18,447.7*
Gross investment in tangible goods – percentage of gross domestic product (GDP)	**2014**	**2015**	**2016**	**2017**
Romania	0.19	0.2	0.2	0.21
EU 28	0.11	0.12	0.12	0.12*
Number of persons employed	**2014**	**2015**	**2016**	**2017**
Romania	131,293	131,461	132,908	133,062
EU 28	3,884,595	3,903,451*	4,027,354*	3,985,720*
Persons employed – percentage of total employment	**2014**	**2015**	**2016**	**2017**
Romania	1.52	1.54	1.58	1.54
EU 28	1.71	1.7*	1.73*	1.69*

Source: https://ec.europa.eu/eurostat/databrowser/view/cei_cie010/default/table?lang=en
**Eurostat estimated data*

Table 3.14 Patents related to recycling and secondary raw material

[per million inhabitants]

	2012	2013	2014	2015
Romania	0.25	0.12	0.25	0.23
EU 28	0.73	0.67	0.65	0.7

Eurostat: https://ec.europa.eu/eurostat/databrowser/view/cei_cie020/default/table?lang=en

Before analysing the data in the Table 3.13 and 3.14, some remarks have to be made. The indicators "*Gross investment in tangible goods*", "*Number of persons employed*" and "*Value added at factor costs*" are considered for the sectors connected with circular economy respectively the three well known R: recycling, repair, reuse and also the rental and leasing sector. Detailed information of these sectors is presented in the *NACE Rev. 2 classification* [10].

According to the Structural Business Statistics (SBS) [11] the following definitions are accepted:

- *Value added at factor cost* is defined, according to SBS, as the gross income resulted "from operating activities after adjusting for operating subsidies and indirect taxes". This is determined as the values of the turnover, the capitalized production and other income operating increases being added up from, from which we reduce the decreases of stocks and also the duties and taxes linked to production, other taxes on production which are linked to turnover (non-deductible), purchases of services and goods. An important mention is that value adjustments are not subtracted.
- *Gross investment in tangible goods* represents the investment made in the respective year in new or existing goods, not matter if they are bought or produced for own use, under the condition that it has a lifetime of over one year. In this category are included also non-produced tangible goods, such as land, but the investments in intangible and financial possessions are excluded.
- *Number of persons employed*, in fact the number of jobs created, takes in consideration the persons working in a company and paid by it. This includes the persons acting on the headquarters of the firm or outside of the company proprieties, as sales agents, maintenance or repair team, etc.

A relevant comparison concerning the implementation of the indicators from the Table 3.13, expressed in [Mio Euro], can be made relating the corresponding amount to the number of inhabitants. In 2017 the EU 28 had 511,378,572 inhabitants and Romania counted 19,643,949 resident populations.

So, referring to the *Value added at factor cost* indicator for the year 2017 (the last official data from the Eurostat), in Romania correspond 756 Euro per inhabitant while in EU 28, correspond 302 Euro. When this indicator is related to *gross domestic product,* Romania decreases under the European level. Therefore even if, in absolute numbers in 2017 Romania is over the EU 28 level, in percentage it is with approximate 20% under the EU 28, because of the smaller GDP of the country.

Regarding the *Gross investment in tangible goods* indicator, for the same year, 2017, in Romania corresponds 19.7 Euro per inhabitant and in EU 28 results 3.6 Euro per resident person. The Romanian advantage on this indicator is preserved (considering the great difference) also in percentage related to GPD, as can be seen in Table 3.13.

The indicator from the Table 3.14, *Patents related to recycling and secondary raw material*, takes in consideration only the patents from the area of recycling and new products and processes for secondary raw materials relating to the millions of inhabitants. Analysing the Romania data it can be concluded that the research activity and innovation efforts are under the European average and one of the causes is represented by the small budget allocations for this sector. In 2015 Romania had 0.23 patents per 1 million inhabitants and EU 28, in the same year, has announced 0.7 patents per 1 million of inhabitants.

Conclusions

The general conclusions concerning the circular economy implementation in Romania show a slow and shy start which needs an adjusting of the legislations and financial incentives for more determined steps in this field.

Compared to the average European values, Romania has an important gap. However, there are areas in which important progress has been made: generation of municipal waste, recycling of paper and cardboard packaging, plastic materials, even wood. Other achievements, still below the European ones but important, in terms of investments in tangible goods as a percentage of GDP and the number of people employed in the circular economy, should also be highlighted.

3.2. BACAU COUNTY AND CIRCULAR ECONOMY

3.2.1. Presentation of Bacau County

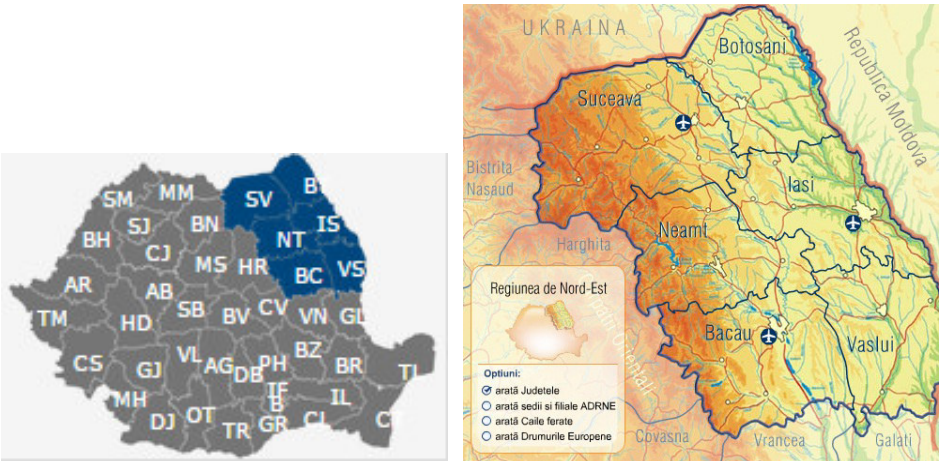


Figure 3.13. N-E Development Region, source: [ADR N-E]

Bacău County is part of the NE development region, a region with a population of 737,629 inhabitants, representing 16.94% of the total population of Romania. Besides Bacau County, the queen also includes the counties of Suceava, Botoșani, Iași, Neamț and Vaslui, fig 6-1. The surface of the NE Region (36,850 square kilometers, representing 15.46% of the total area of the country), includes all forms of relief: 30.00% mountains, 30.00% sub-Carpathian relief, 40.00% hills and plateaus. The largest counties in the region are Suceava (8,553 square kilometers) and Bacau (6,621 square kilometers) [13].

3.2.1.1. Description of the territory and the rural area

Surface, geography

Bacău County, located in the central-eastern part of Romania, between 45^0 55 ' and 46^0 40' north latitude and 26^0 66 'and 27^0 30' east longitude, has an area of 6,621 km2 (4th place in the country and 2nd place in the NE Region after Suceava county) which represents 2.8% of Romania's surface. It is bordering on the north with Neamț County, on the south with Vrancea County, on the east with Vaslui County, on the west with Covasna and Harghita counties. Benefiting from a varied relief, arranged in steps that decrease from west to east, with a rich hydrographic network and various resources of the subsoil, the territory of Bacău County offered favorable conditions for human community cohesion many years ago. The eastern location of the main peak of the Eastern Carpathians determines a temperate continental climate, characterized by hot and relatively dry summers and cold winters [14].

The temperature distribution is between 12 - 20 °C - July averages and (-4) - (-7) °C January averages (coldest). Precipitation varies between 1400 mm on mountain peaks and 400-500 mm annually in plain areas [15].

Bacau County is part of the mountain counties of Moldova (maximum altitude: Grindușu Peak - M. Tarcău - 1,664 m, Nemira Peak 1,648 m, Șandru Mare Peak 1,639 m - M. Nemira) and includes in its territory the eastern slope of Carpathians (in the west) and Tutova hills (in the east). The relief developed in the form of steps, bordered by the Trotus river basin in the west and Bistrița and Siret Valley in the east, includes in various proportions, all forms of relief: mountainous region 34%, hilly region 28% and plain 38% (Moldavian Plateau 11% and Lunca Siretului 27%).

In addition to these important water courses, its territory is also covered by Tazlau, Doftana, Slanic, Oituz, Casin, Berheci and Zeletin. The county territory is also covered by a series of lakes Bălătău (natural dam), Belci, Poiana Uzului (water supply), Racova, Gârleni, Șerbănești and Lilieci (hydropower). Siret, the most important river that crosses Bacău County from north to south, is the main collector of the hydrographic network that stretches over a length of 145 km for tributaries such as Trotuș, Bistrița, Tutova, Zeletin or Răcătău. Most of the lakes in Bacău County were born as a result of the arrangements made on the

rivers Bistrița (Gârleni, Bacău I and II) and Uz (Poiana Uzului) and naturally, such as Lake Balătău, formed in 1883. The mountainous territory in the western part is crossed by two steps, which constitute two important connections with Transylvania. Ghimes-Palanca Pass (720 m altitude) at the border between the Tarcaului Mountains (located in the northeast) and the Ciuculu Mountains (located in the southwest) crossed by the railway that connects Transylvania with Moldova and the Oituz Pass (866 m altitude) between the Mountains Nemira - to the north and the Bretcului Mountains to the south, crossed by the national road 11. The mountains are forested with beeches, spruces, pines and many birches. The depressions are almost completely devoid of forests. Their place was taken by orchards. The ravines are partially covered with sea buckthorn, thorns or forest weeds.

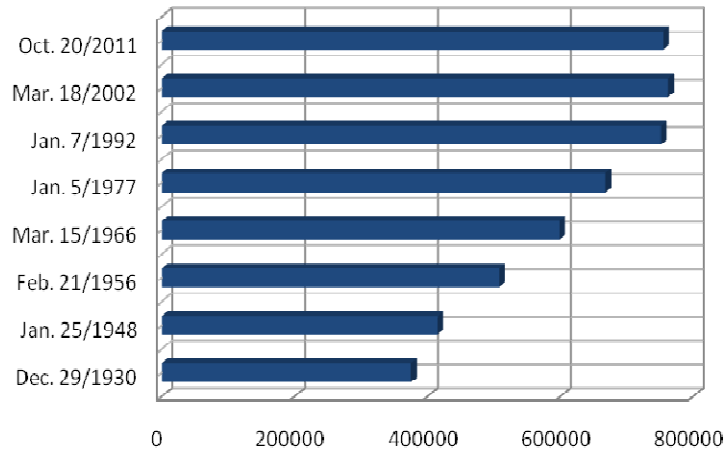
Figure 3.14. Harta judetului Bacau

Tectonic movements in the mountain region have led to the existence of an important mineral resource: the acid waters of Slanic and the Oituz valley. However, the essential mineral riches of the region are lignite and oil from the Darmanesti basin and the Moinești region, salt throughout the sub-Carpathian area, salt springs (the most important in Slanic), salt rocks and saline efflorescences. The rational exploitation of salt is done in Târgu-Ocna. The

county is covered in proportion of 48.5% of arable land and 39.8% of forests (beech, oak, pine, spruce, fir) [14].

Population, cities and villages

At the last census, in October 2011, Bacău County had 754,964 inhabitants. The evolution of the number of inhabitants in the county since 1992 (the first census after the 1989 revolution, when a number of 751,282 inhabitants was registered) had an ascending trend until 2003 (maximum registration 762,369), figure 3. Since 2003, there has been a demographic decline due mainly to labor emigration to other Western European countries. The trend of the last six years remains on a downward level, as can be seen in Figure 4, but, this time, it is due to the negative natural increase and internal migration. This emerges from the analysis of internal and external migration and natural growth, analyzes that will be done later.



	Dec. 29/1930	Jan. 25/1948	Feb. 21/1956	Mar. 15/1966	Jan. 5/1977	Jan. 7/1992	Mar. 18/2002	Oct. 20/2011
Series1	375035	414996	507937	598321	667791	751282	762289	754964

Figure 3.15. Evolution Bacau county population according to the census of 1930-2011
Source our compilatioin by INSSE data

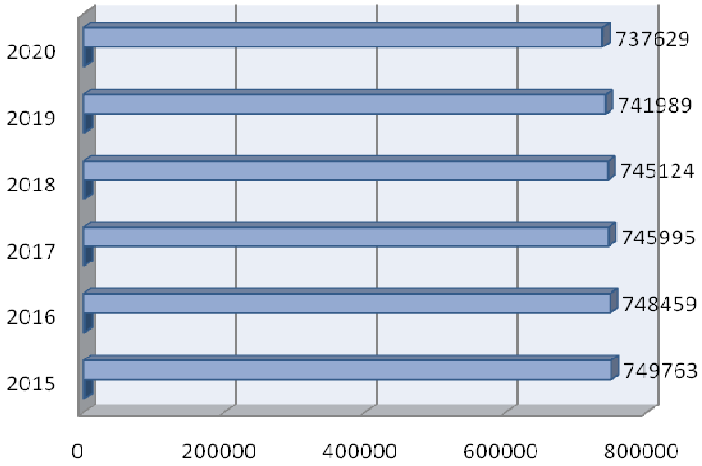


Figure 3.16. Evolution of the population of Bacau County (2015-2020), Source our compilatioin by INSSE data

Intense emigration after 2003 negatively affected the county's labor force. However, the analysis of the evolution of the county's population in the last 6 years highlights the reduction of the decrease rate, figure 3.16.

Also, the population density reported per square kilometer, registered a slight decline in the same period, 2015-2020, figure 3.17.

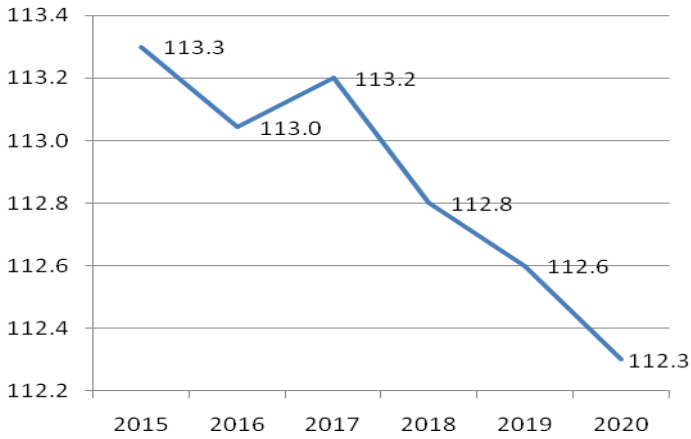
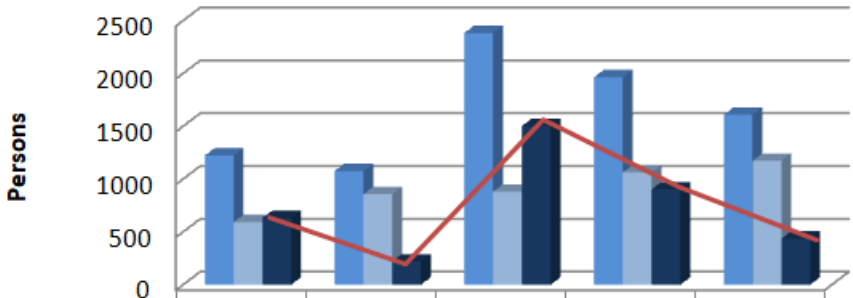


Figure 3.17. Evolution of the population density of Bacau County,

Source: our compilation by INSSE data

Of course, external migration after 2003 was a decisive factor in reducing the local workforce.



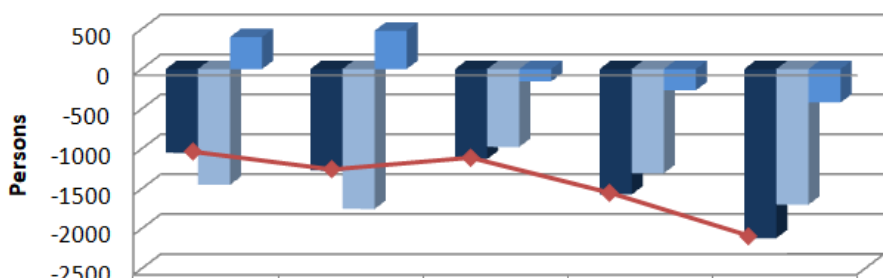
	2015	2016	2017	2018	2019
Immigrants	1222	1075	2382	1964	1608
Emigrants	592	856	880	1062	1172
Sold	630	219	1502	902	436

Figure 3.18 Evolution of the external migration in 2015-2019

Source: our compilation by INSSE data

The analysis of the immigration vs emigration trend for the last 5 years, according to the data provided by the National Institute of Statistics, shows a positive balance (figure 3.18), which could contribute to the restoration of the local labor force.

While the immigration rate has increased relative to the emigration rate, there is an increase in internal migration to areas with a higher standard of living, figure 3.19, from both urban and rural areas in the sense of depopulation of the county. But the percentage is not caring, given the trends

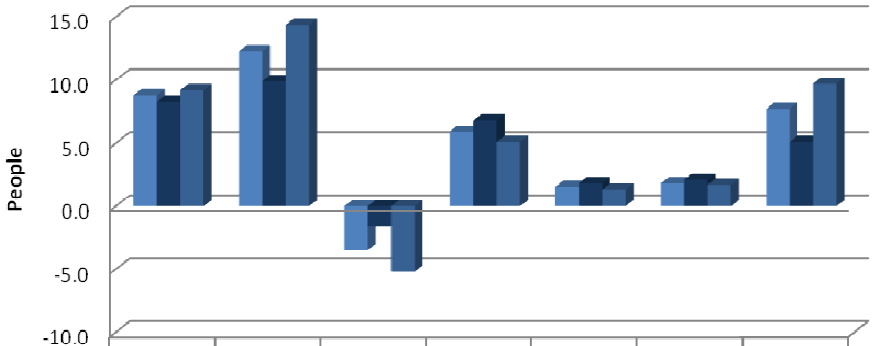


	2015	2016	2017	2019	2020
Sold	-1050	-1272	-1129	-1571	-2119
Urban	-1451	-1753	-976	-1306	-1699
Rural	401	481	-153	-265	-420

Figure 3.19. Evolution of the internal migration in 2015-2019

Source: our compilation by INSSE data

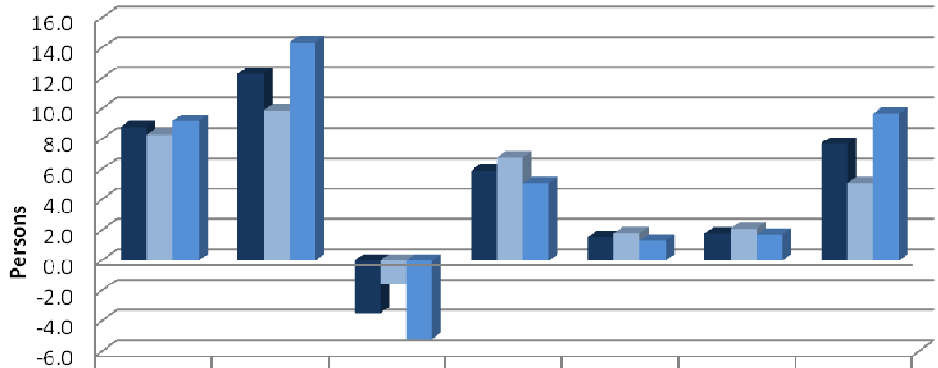
Regarding the natural movement of the population, by averages, in 2019 there is a negative trend for natural increase, both in rural and urban areas (figure 3.20).



	Born alive	Deaths	Natural increase	Marriages	Divorces	Births-dead	Deaths und.1yr. age
Total	8.8	12.3	-3.5	5.9	1.54	1.8	7.7
Urban	8.3	9.9	-1.6	6.8	1.81	2.1	5.1
Rural	9.2	14.4	-5.2	5.1	1.30	1.7	9.7

Figure 3.20. The natural movement of the population in 2019,
Source: our compilatioin by INSSE data

Reported per thousand inhabitants, the data show that in Figure 3.21.



	Born alive	Deaths	Natural increase	Marriages	Divorces	Births-dead	Deaths und.1yr. age
Total	8.8	12.3	-3.5	5.9	1.54	1.8	7.7
Urban	8.3	9.9	-1.6	6.8	1.81	2.1	5.1
Rural	9.2	14.4	-5.2	5.1	1.30	1.7	9.7

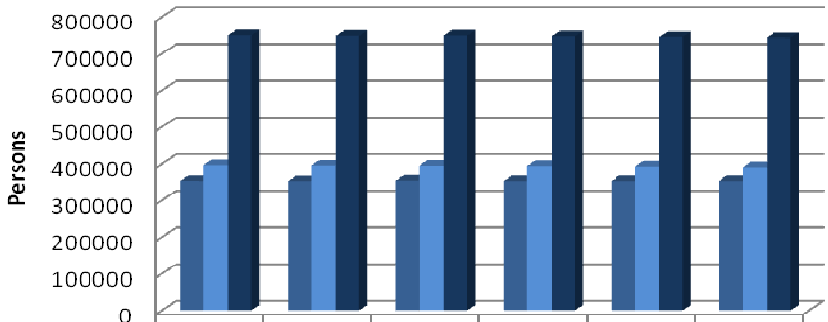
Figure 3.21. Rate per 1000 inhabitant,

Source: our compilatioin by INSSE data

Next we will make an analysis of the county's population taking into account several criteria. The data provided by the National Institute of Statistics from 2015-2020 will be considered.

In this sense, a first analysis of the population depending on the environment - urban or rural, illustrates that the population in rural areas is slightly higher than in urban areas, relative to the total population.

It is a natural tendency if we take into account the deindustrialization of the county in the last decades and the return of the population in the native areas, ie in the rural area.

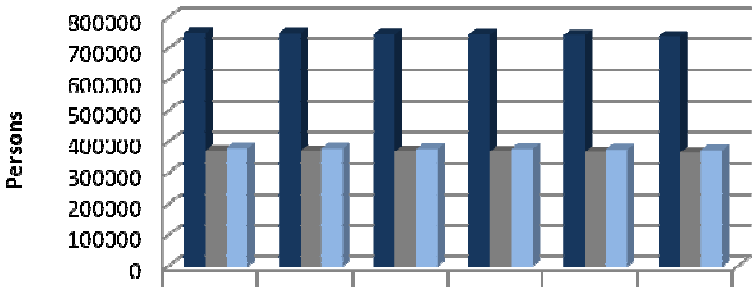


	2015	2016	2017	2018	2019	2020
Urban	352807	352179	353755	352346	352214	352415
Rural	397287	396223	395592	394754	393242	391159
Total	750094	748402	749347	747100	745456	743574

Figure 3.22. Evolution of the population of Bacau County (2015-2020) by area,

Source: our compilatioin by INSSE data, 2020

The analysis of the county's population from the point of view of sex, highlights that the two categories are substantially equal, as can be seen in Figure 3.23.

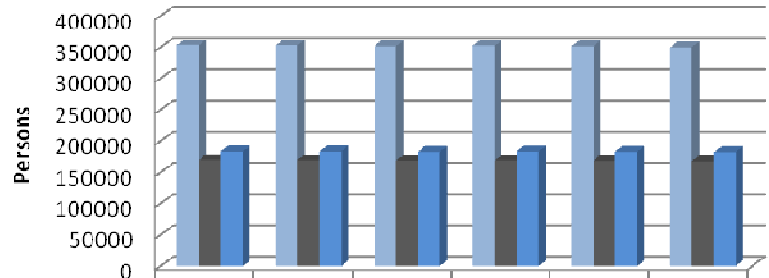


	2015	2016	2017	2018	2019	2020
Total population	749763	748459	745995	745124	741989	737629
Male	370979	370230	368994	368561	366725	364356
Female	378784	378229	377001	376563	375264	373273

Figure 3.23. The distribution of the Bacau County population by sex,

Source: our compilatioin by INSSE data

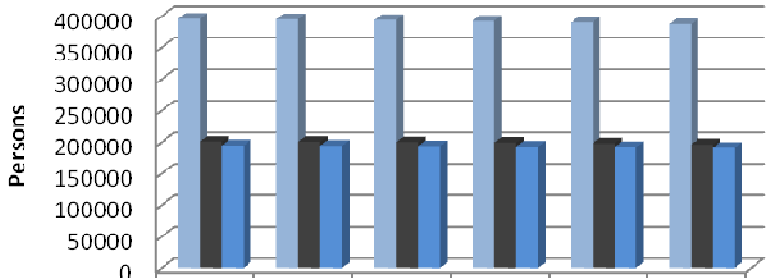
For these two categories, urban / rural, the distribution of the population by sex is slightly different. It is observed that in the urban area the share of the female population is higher than in the rural area, figure 3.24a, 3.24b.



	2015	2016	2017	2018	2019	2020
Total urban	353549	353222	351960	352690	351858	350153
Male	169861	169528	168865	169201	168665	167668
Female	183688	183694	183095	183489	183192	182485

Figure 3.24a. The distribution of the Bacau County urban population by sex,

Source: our compilatioin by INSSE data



	2015	2016	2017	2018	2019	2020
Total rural	396214	395237	394035	392434	390131	387476
Male	201118	200702	200129	199360	198059	196688
Female	195096	194535	193906	193074	192072	190788

Figure 3.24b. The distribution of the Bacau County rural population by sex,
Source: our compilatioin by INSSE data

3.2.1.2. Administrative institutions

Administratively, Bacau County is organized according to the Law of local public administration no. 215/2001, modified by Law no. 738/2001 and of Ordinance no. 53/2002, approved by Law no. 96/2003. The administrative structure of Bacau County includes 3 municipalities, 5 cities, 85 communes and 491 villages, as shown in table 3.151.

Table 3.15. The administrative organization of the county, on 2020, September

Total surface of Bacau County - 6622 km^2				
Year	Number of cities and municipalities	Municipalities	Number of communes	Number of villages
2016	8	3	85	491
2017	8	3	85	491
2018	8	3	85	491
2019	8	3	85	491
2020	8	3	85	491

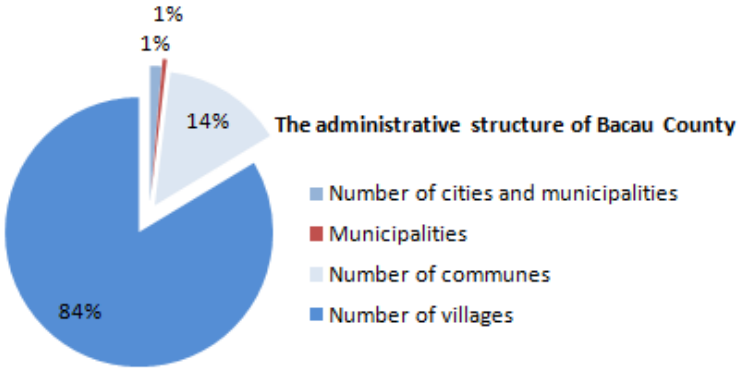


Figure 3.25. Administrative map of Bacau county,

Source [https://bacau.insse.ro]

The administrative map of Bacau County is showed in figure 3.25

The public administration authorities achieve local autonomy in municipalities, cities and communes.

The representative of the Government in the territory is the Institution of the prefect, a public institution with legal personality, with its own patrimony and budget organized in order to exercise the prerogatives of the prefect. The prefect is the representative of the Government at local level, subordinating the deconcentrated public services of the ministries and of the other bodies of the central public administration subordinated to the Government, organized at the level of the administrative-territorial units.

The County Council is an authority of the local public administration, for coordinating the activity of the communal, city and municipal councils, in order to achieve some public services of county interest.

The authority of the local public administration at the county level is the County Council, an institution that coordinates the activities of the municipal, city and communal councils, in order to achieve some public services of county interest.

Local public administration authorities fall into two categories: deliberative authorities (municipal, city and communal local councils) and executive authorities (town halls).

The local public administration authorities are: local, communal, city and municipal councils, as deliberative authorities and town halls, as executive authorities. Public administration authorities achieve local autonomy in communes, cities and municipalities.

3.2.1.3. Contribution to the country economy

The gross domestic product of Bacau County in the share of the national gross domestic product is around 2%. Romania's gross domestic product in 2019 was 223 billion euros (up about 9% compared to 2018), a share of 1.6% in the GDP of the European Union. In absolute figures, the budget of Bacau County is illustrated in figure 3.26. Compared to the value from 2013, there is a constant increase of this value in the last 6 years. In an analysis made by *www.cursdeguvernare.ro* regarding the development gaps, it is shown what is the place of Bacău county in the region and at national level.

According to information published by the National Commission for Strategy and Forecast, each region has a representative of the top of the county shares in GDP at national level. If last year's general trend saw a slight reduction in intra-regional disparities, there is a notable exception, the West region, where Timiș exceeded half of total GDP (50.3%) and reached a level of production and services of three neighboring counties taken together. However, the maximum gap (approximately 6 to 1) occurs in the southeastern region, where, with 43% of the total, Constanța exceeds Tulcea (only 7%).

In the NE Region, Iași contributes 30% to the region's results, and Bacău, 20%.

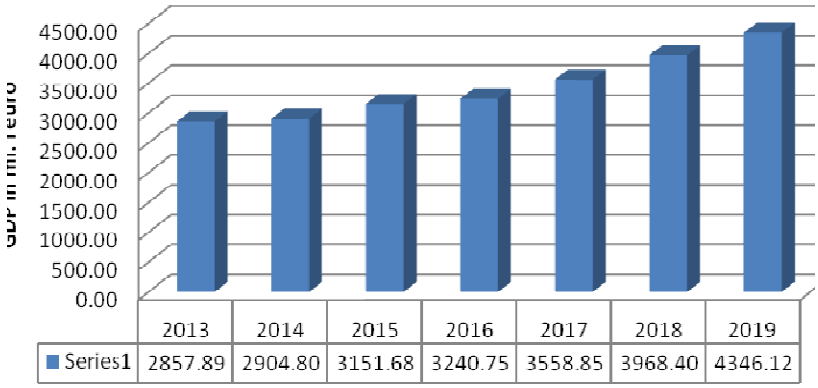


Figure 3.26. The gross domestic product of Bacau County
Source: our compilatioin by INSSE data

From the same point of view, of the gross domestic product, Bacău county occupies the second position in the NE region, increasing compared to 2018. The data are presented in figure 3.27.

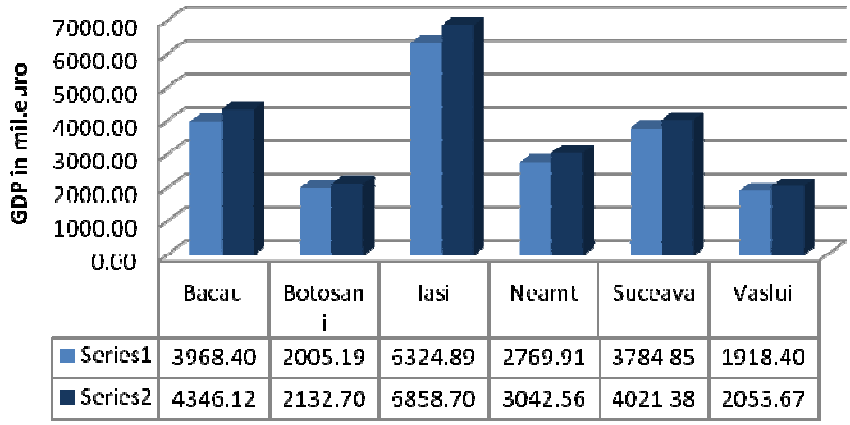


Figure 3.27 The gross domestic product of Bacau County in NE Region

Source: our compilatioin by INSSE data

From the point of view of the gross domestic product per capita, Bacau county occupies the same position within the region, as can be seen from figure 3.28.

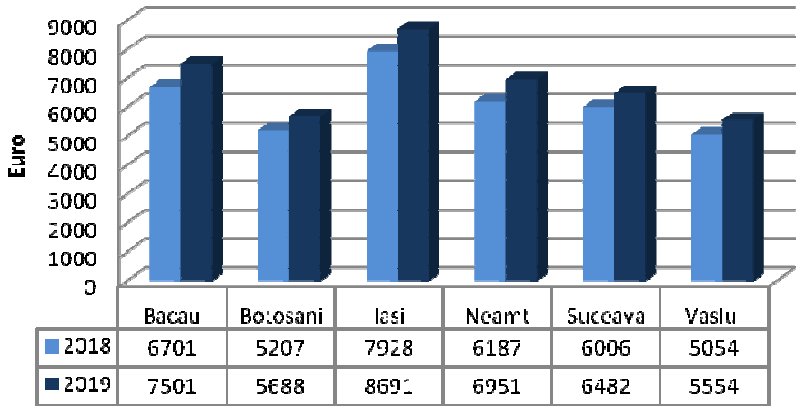


Figure 3.28. The gross product per capita of Bacau County in NE Region

Source: our compilatioin by INSSE data

3.2.2. Economic activities and population structure

The oil industry has been known in Bacău County since the 15th century. In the 20th century, the two large refineries Dărmănești and RAFO Onești were built, but also in the Carom and Chimcomplex annexes, the oil industry reached its maximum production in 1988. Currently the two refineries are closed, Carom is demolished and Chimcomplex processes only sodium chloride.

The oil industry has been known in Bacău County since the 15th century. In the 20th century, the two large refineries Dărmănești and RAFO Onești were built, as well as the Carom and Chimcomplex annexes. The oil industry peaked in 1988. The two refineries are now closed, Carom is demolished and Chimcomplex processes only sodium chloride.

Comanesti is located in the center of a coal basin that includes 34 surrounding villages, of which 7 are exploitable mines. There are also oil resources in the area, but to a lesser extent. In the nearby villages there are mines from which brown coal has been extracted since 1836. From the nineteenth century until the end of the twentieth century, 75% of the inhabitants worked as miners, the area being mining and having huge coal deposits (EMC Comănești). This led to the development of the Comanesti depression, transforming it into a heavily

industrialized area during the communist period. The mines, which in 1989 had 5,000 employees, were permanently closed in 2005, and the last 260 miners still working here remained unemployed.

Salt extraction has been a well-known activity in Bacău County since the beginning of the 14th century. Currently, the extractive industry has a 370 thousand tons per year.

An important role is also played by the nutritional industry, the wood and paper industry, the textile industry, the mechanical industry and the aeronautical industry. After the decline of all areas in 1990, with the fall of the communist regime, in 1993 industrial production began to be stable, followed by continuous development.

The agriculture of Bacău county is developed on an area of 320.597 ha. The forestry sector, with an afforestation area of 267 ha, is one of the largest assets of the county.

Bacau County has a population of 737629 inhabitants. It is a relatively large county, but with a low level of foreign investment. There are about 800 foreign companies in operation, with about 8,000 employees. Their total turnover amounts to about one billion lei, with a net profit of 73 million lei [17].

Most investors came from Italy (424 companies, with a turnover of almost 380 million lei). The 12 Cypriot companies are in second place in terms of turnover, ie 249 million lei. The ranking, according to the same indicator, of the turnover, also includes the Dutch (28 companies, 106 million lei), Austrians (35 companies, 92 million lei), French (58 companies, 61 million lei), Swiss (20 companies, 50 million lei), Germans (130 companies, 35 million lei), Americans (19 companies, 12 million lei), Greeks (30 companies, 8.4 million lei).

For a more comprehensive analysis, the categories of enterprises and housing units will be reviewed, by types of activities, turnover and average number of employees. The considered data are provided by the County Directorate of Statistics.

For a good understanding it is necessary to clarify two notions:

The active enterprise is the entity that, from the point economically, it is active in the period of observation, respectively performs goods or services, records expenses and draws up balance sheets.

The local unit is an enterprise or part of (workshop, factory, warehouse, office, mine or station, etc.) located at an identifiable address. In this place an economic activity is carried out for which one or more people work (part – time in whole or in part) for the same undertaking.

3.2.2.1. Type of activities

The types of activities will relate to the important sectors of the economy. Their distribution, in accordance with the above criteria, are illustrated in the figure 3.29.

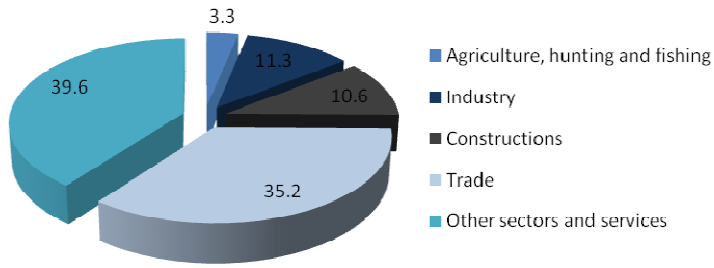


Figure 3.29. The structure of local units active on the main activities, 2019 (in percentage)
Source: our compilatioin by INSSE data

Hiring the available labour force in the county is a challenge for keeping the active population of the county. Compared to the same branches of the economy, as shown in Figure 3.30, most of the labour force is employed in trade. But there is also a part engaged in agro food, a sector of interest in our analysis.

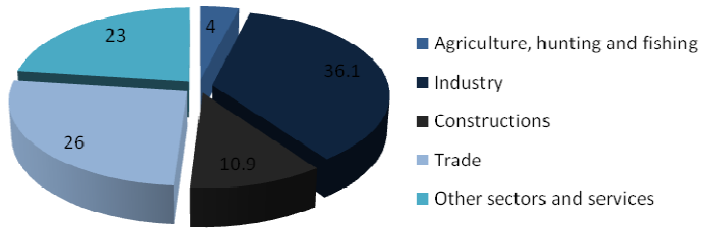


Figure 3.30. The labor force distribution on the main activities, 2019 (in percentage)
Source: our compilatioin by INSSE data

The distribution of profit on the same activities of the national economy is shown in figure 3.31 activities of the national economy, 2019. It is observed that industry and commerce have a fairly good yield.

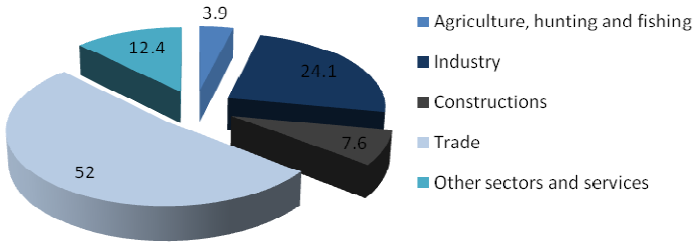


Figure 3.31. The repartition of profit on the main activities, 2019 (in percentage)
Source: our compilatioin by INSSE data

Although the agricultural area occupies about 320,756 ha, agriculture represents a rather small share in the county's economy. However, Agriculture remains an important sector with great potential. The structure of the agricultural area according to the way of use is shown in the figure 3.32.

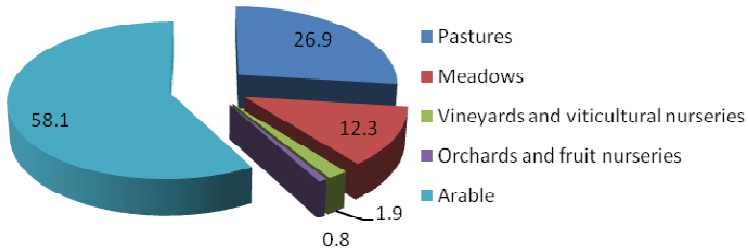


Figure 3.32. The structure of the agricultural area according to the way of use (in percentage)

Source: our compilatioin by INSSE data

The surface cultivated with the main cultures on property forms, in Bacau County, is is illustrated in the figure 3.33. It is observed that the most important part of the cultivated area is occupied by cereal crops.

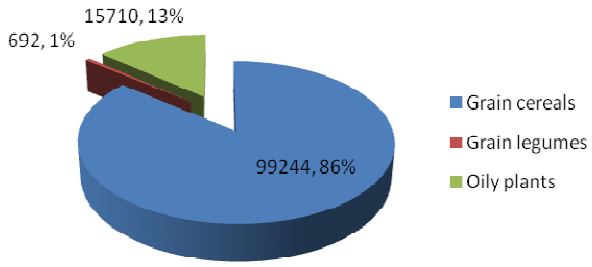


Figure 3.33. Cultivated area in Bacau County (in hectares)

Source: our compilatioin by INSSE data

The value of the production of the agriculture branch is shown in figure 3.34.

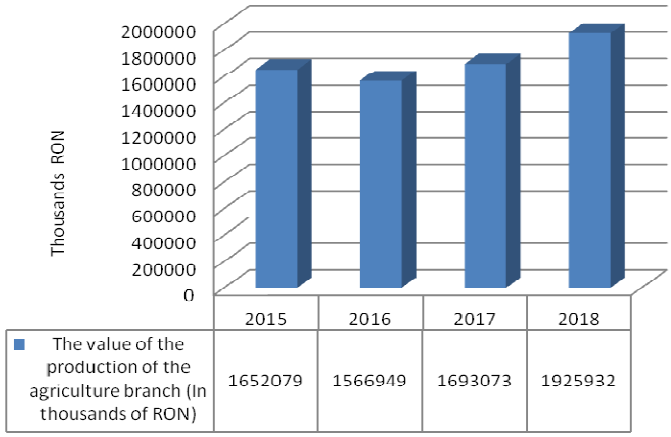


Figure 3.34. The value of the production of the agriculture branch

Source: our compilatioin by INSSE data

3.2.2.2. The number and dimension of companies

There are over 112500 active companies in Bacău County, whose cumulative turnover reaches approximately 10 billion lei. Although our 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.

From 2015 until now, there has been a continuous increase in the number of

companies, as shown by the data provided by the Statistics Department of Bacau County (figure 3.35).

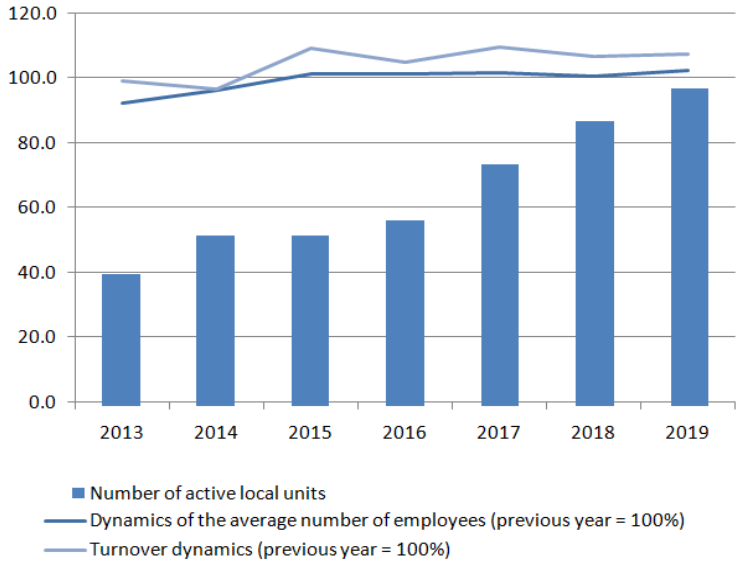


Figure 3.35. The evolution of indicators of active local units

Source: our compilatioin by INSSE data

From the point of view of the share of small and medium active local units with up to 249 employees in the total active local units, the results show that in figure 3.36. Their share is dominant both in terms of number and in terms of turnover and number of employees.

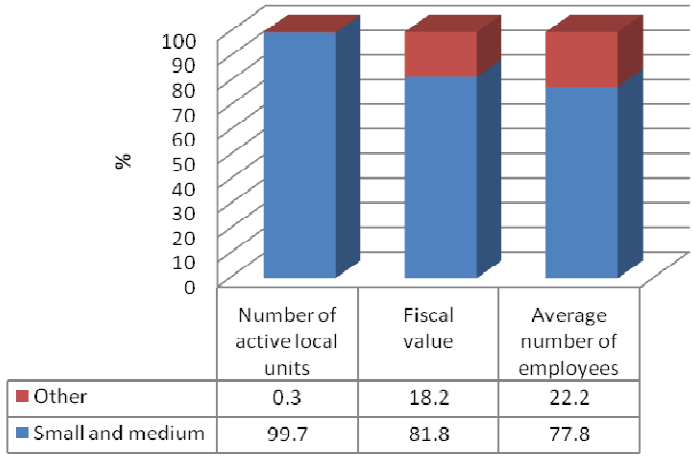


Figure 3.36. The share of small and medium active local units, 2019
Source: our compilatioin by INSSE data

3.2.2.3. The social environment

From this perspective, 2 universities operate in Bacau County, one public and the other private. Table two shows the number of public and private educational institutions in Bacau County, NE Region and Romania.

Table 3.16. *Bacau County Employed population, by activities of the national economy CANE*
Source: Bacau County Directorate of Statistics

		2012	2013	2014	2015	2016	2017
ROMANIA	Total	7.069	7.074	7.127	7.108	7.010	7.047
	Public property	6.549	6.468	6.422	6.406	6.309	6.261
	Privat property	520	606	705	702	701	786
NE Region	Total	1.093	1.113	1.132	1.130	1.104	1.100
	Public property	1.003	1.019	1.033	1.030	1.009	1.010
	Privat property	90	94	99	100	95	90
Bacau County	Total	739	739	735	748	752	754
	Public property	692	692	690	703	705	705
	Privat property	47	47	45	45	47	49

3.2.2.4. The existing workforce and the level of qualification

Table 3.17. *Employed population, by activities of the national economy CANE* *Source: Bacau County Directorate of Statistics*	
	Thousen persons
Bacău County	**2018**
Total economy	**199.4**
Agriculture, forestry and fishing	47.6
Industry, of which:	43.0
- Extractive industry	1.6
- Manufacturing industry	37.5
- Production and supply of electricity and heat, gas, water	1.1
- Water distribution, sanitation, waste management, decontamination	2.8
construction	26.3
Trade	28.8
Transport, storage	7.7
Hotels and restaurants	3.3
Information and communications	1.7
Financial intermediation and insurance	1.5
Real estate transactions	0.7
Professional, scientific and technical activities	2.5
Administrative and support service activities	4.4
Public administration and defense, social insurance in the public system	4.7
Education	11.6
Health and social work	10.9

Cultural and recreational entertainment activities	1.2
Other service activities	3.5

Table 3.18 ***Average number of employees, by activities of the national economy CANE rev.2***	
Bacău County	**2018**
Total economy	**109.091**
Agriculture, forestry and fishing	2975
Industry	30484
Extractive industry	1600
Manufacturing industry	25306
Production and supply of electricity and heat, gas, water	1069
Water distribution; sanitation, waste management, decontamination	2509
construction	10295
Wholesale and retail trade; repair of motor vehicles and motorcycles	21312
Transport and storage	4012
Hotels and restaurants	3178
Information and communications	1582
Financial intermediation and insurance	1286
Real estate transactions	514
Professional, scientific and technical activities	1901
Administrative and support service activities	4048
Public administration and defense; social insurance in the public system	4,506
Education	10923

Health and social work	9832
Entertainment, cultural and recreational activities	1187
Other service activities	1056

- The number of employees on 31.05.2020 in Bacău County was 113209 people.
- The average net earnings in Bacău County in May 2020 was 2893 lei.
- The unemployment rate registered on 31.05.2020 in Bacău County was 4.8%.

3.2.2.5. County contribution of rural area to the region economy

Regarding the turnover of companies in Bacau County, there is an upward trend in recent years (Figure 3.37), a trend due to both the increase in the number of companies and the development of economic sectors.

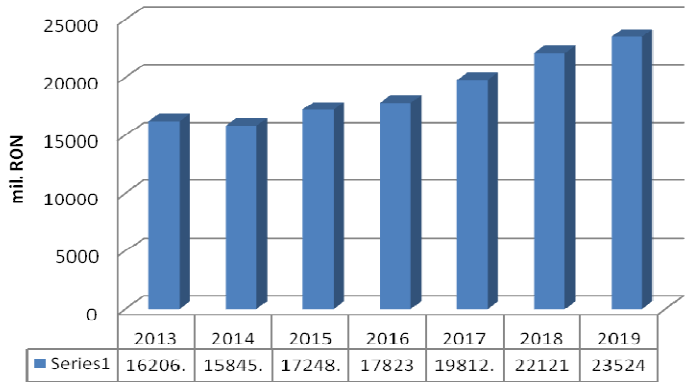


Figure 3.37. Turnover of Bacau County (in mil RON)

Source: our compilatioin by INSSE data

According to www.topfirme.com, in Bacau County the first 10 companies in the top registered a profit rate of over 400 million euros. The highest profit rate is registered in the field of sales, the leader being the Retailer DEDEMAN. The next ranked activity is in the field of road and highway construction. The third position work in wholesale of unprocessed cereals, seeds, fodder and tobacco.

The fourth place company works in manufacture of aircraft and spacecraft. The next oane acts in manufacture of parts and accessories for motor vehicles and their engines. The company on positions 6 and 7 are specialized in agrofood. The 5th position is occupied by a company working in the field of car construction. The company from positions 8,9,10 works in the field of wood processing.

The amount of profits from the cultivation of cereals (excluding rice), leguminous plants and oilseeds and their wholesale trade, feed and raw tobacco, manufacture of biscuits and biscuits, manufacture of cakes and preserved products and confectionery of 30 million euros, figura 3.38.

If we extend to the top 20, for the same sector of activity another 15 million euros are added, reaching a total of 45 million euros.

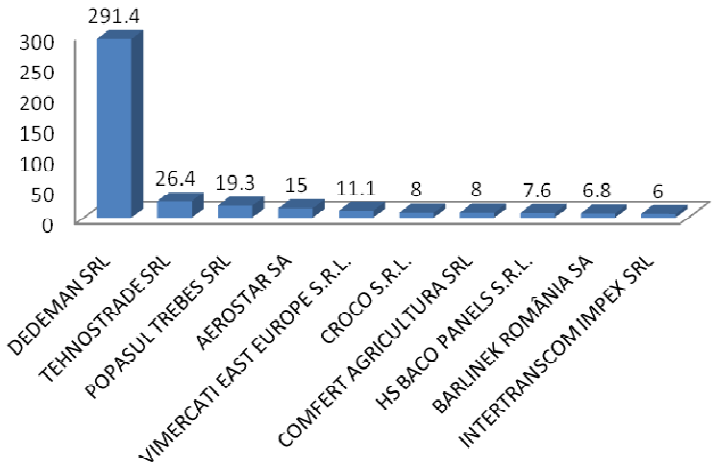


Figure 3.38. Profit rate of the top ten companies in Bacau

Source: our compilatioin by www.topfirme.com

3.2.3 Natural resources for sustainable development

The region has the following exploitable resources:

- subsoil resources: manganese, polymetallic sulfides, carbonated mineral waters, sulphurous and ferruginous mineral waters, limestone, sandstones, sands, peat, salt, sulfur deposit, bituminous shale deposits, natural gas. In terms of mineral resources, Bacau County has an important potential which, at present, is not sufficiently exploited in the interest of developing Bacau County. Crude oil and associated gases, free gases, natural mineral waters, therapeutic mineral waters and carbon dioxide, rock salt, potassium salts, brown coal, andesitic tuffs, Falcau tuff, gypsum, common clays, calcareous sandstones, quartz sandstones, quartz sands , sand and gravel (ballast), limestone and other resources, all these are just a few examples of insufficiently exploited resources.
- soil resources:

✓ agricultural potential: over 58% of the county's agricultural area, an unpolluted, fertile soil, rich in micro and macroelements that ensure a productive culture. In addition, cereals, vegetables, fruit growing and viticulture are areas where investment can pay off, especially as Bacau is recognized for its potential in these areas. In this sense, in table 3 is synthesized the vegetal agricultural production, for the main crops. The data come from the County Statistics Directorate.

Table 3.19 . Vegetable agricultural production, for the main crops (Bacău county)

Years	Cereal grains	Wheat and rye	Barley and barley	Corn grains	Sunflower	Sugar beet	Potatoes
	tons						
2017	500866	66074	8979	421313	26954	5054	38444
2018	656932	70467	9333	572482	27792	3473	45626

✓ animal production should not be neglected either. Table 4 summarizes the county's animal agricultural production for 2018.

Table 3.20 .Animal agricultural production, in 2019

Bacău County	**Total**	**of which: Private sector**
Meat - total (tonnes live weight)	83270	83251
Beef (tonnes live weight)	2080	2080
Pork (tons live weight)	11966	11953
Meat of sheep and goats (tonnes live weight)	2237	2231
Poultry meat (tonnes live weight)	66965	66965
Milk - total (thousand hl)	1097	1096
Cow's milk and buffalo (thousand hl)	938	937
Wool - total (tonnes)	486	485
Eggs - total (millions of pieces)	195	195
Extracted honey (tons)	745	745

✓ the forest fund: an important part of the county is forested. Figure 3.39 provides data on forested areas for the last five years

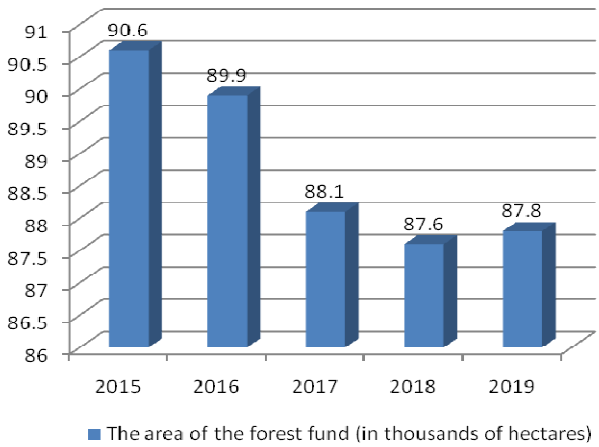


Figure 3.39. Bacau County forest fund area

Source: our compilatioin by INSSE data

✓ viticulture and fruit growing: Bacauand NE Region is an old wine and fruit growing area. There is the possibility of transmitting this tradition and renewing it in areas where crops have declined.
A good example of this is the young entrepreneur, 33 years old, who developed, on an area of 10 ha, a vineyard of Pinot Gris, Sauvignon Blanc and Cabernet Sauvignon, at this time being in the stage of exports, under its own brand, its production of over 25 tons of wine annually.

It is an example of putting into practice that can be multiplied relatively easily on the hills in our county, especially since, in the next period, financing lines of the structural funds that support these activities are opening. Initiatives of this kind must be encouraged and supported by all decision-makers - local, county authorities and relevant institutions.

Also in the field of agriculture, the large areas of pastures - over 40% of the total area of the county - favor investments in animal husbandry.

✓ hydrographic resources: These are not used to their full capacity, neither for irrigation, nor for fish farming, nor for their tourist and entertainment potential. The construction of power plants and micro-hydropower plants can be another activity through which the hydrographic network of the county can be capitalized.

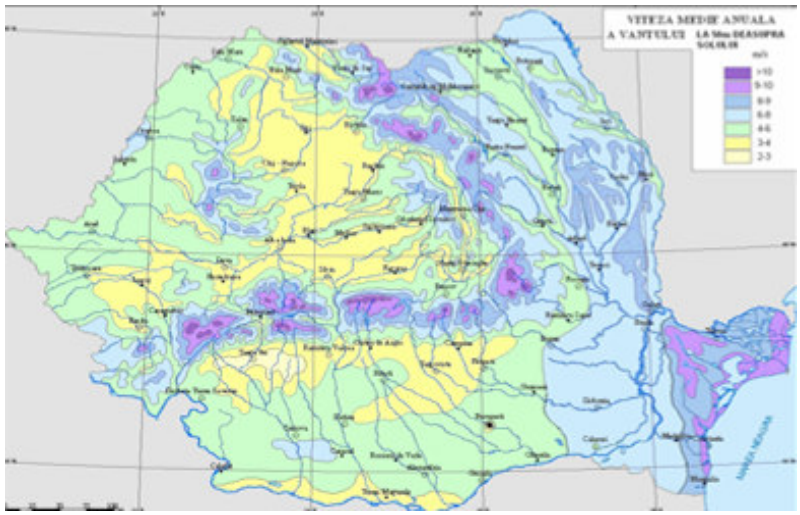
The hydrographic network is well developed, being represented by the rivers Siret, Bistrita, Trotus and their tributaries. The Siret River flows through Bacău County from the north (near Lereşti), to the south (near Costişa), is the main collector of the hydrographic network that runs for a length of 125 km. The Siret River has as main tributaries the Trotuş and Bistriţa rivers. The Trotuş River has a total length of 158 km, of which 125 km, in Bacău County, between Făgetu de Sus and Slobozia localities, having a basin with an area of 4,440 km2 (90% in Bacău County), figure 3.40.

The largest artificial lake in the county, from Poiana uzului are a flight of over 90 million cubic meters of water.

Figure 3.40. Hydrographic network of Bacau county

Source: http://www.rowater.ro

✓ renewable sources: The wind potential of Bacau County is significant for the western part, the mountainous part of the county, figure 3.41. The wind potential of Bacau County is significant for the western part, the mountainous part of the county. Here the average wind speed is between 8-10 m / s, while in the other areas the average speed is 6-8 m / s.



Fgure 3.41. The map of wind potential in Romania

Source: National Meteorological Agency

The solar potential is more intense in the central and southern part, being around 1650 kW / m^2.

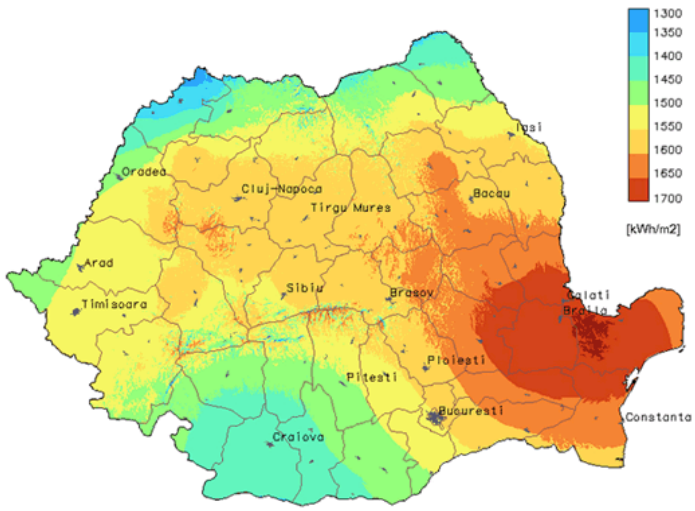


Figure 3.42. Map of solar potential in Romania

Source: National Meteorological Agency

The value of plant biomass resources with energy potential in Bacau County is 132.0 thousand cubic meters corresponding to 7411 Tj of which: 87, 36% agricultural biomass and 12.64% forest biomass, figure 3.42.

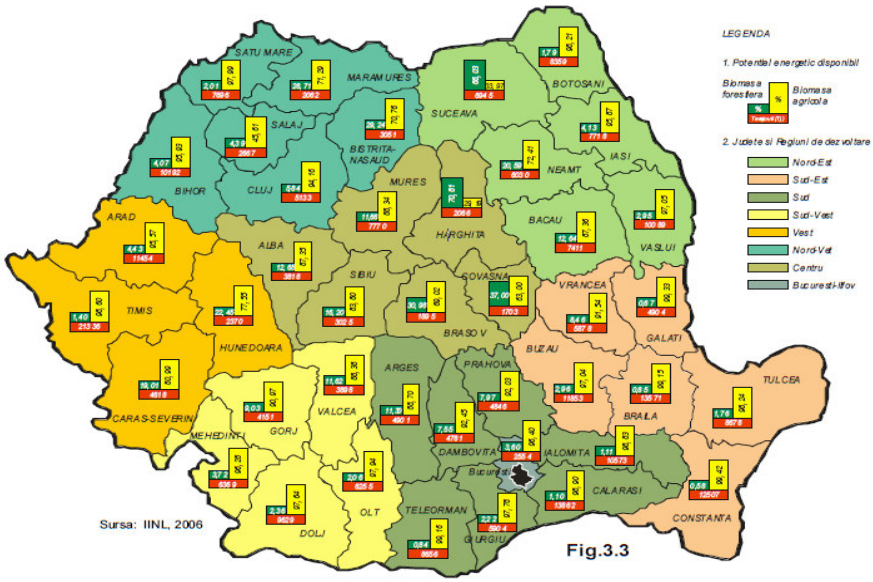


Figure 3.42. Map biomass potential in Romania

Source: National Meteorological Agency

3.2.3. Secondary products and waste volume

The statistical data from the Bacau County level do not provide information regarding the amount of waste and secondary product resulting from agro-food activities. The agro-food industry is an important economic branch of Bacau County especially from the point of view of the number of employees, but there is a large diversity of the fields of activity

The first five economic branches (according to https://www.topfirme.com/) which had the most important contributions to the GDP of the county are presented in the next paragraphs. The area of activity is named according to the Classification of Activities in the National Economy (CAEN):

- *Retail trade of ironwork, glassware and paintwork in specialized stores*, area in which are acting 52 companies which realise a profit of 383.3 million euros, representing 26.90% of the net profit made in Bacau County.

- *Road and highway construction works* where 54 companies operate with profit of 45.9 million euros, representing 3.22% of the net profit made in Bacau County.

- *Manufacture of other basic inorganic chemicals* domain is represented only by two big companies which obtain together 110. 3 million euros as profit and realise 7.74% of Bacau County profit.

- *Wholesale of wood and construction materials and sanitary equipment* is the main activity of 162 economic agents which produce 3.52% of the county profit.

- *Construction works of residential and non-residential buildings* with a number of 1.023 companies and realise 2.18% of the net profit made in Bacau County.

In the area of *Cultivation of cereals (excluding rice), leguminous plants and plants producing oil seeds* there are 145 small and big companies which produce 1.54% of the profit of the county. The first position is occupied by Moldova Farming SRL with turnover around 65.5 million euro in 2020.

The next economic activity of Bacau County is represented by Processing and preservation of poultry meat. The branch contribution to the profit of the county is around 0.35% and the main company is Agricola Bacau S.A.

Agricola Bacau S.A. is one of the main producers and processors of poultry meat, with a market share of around 10% of the level of the country. The Agricola group includes the following companies: Aicbac (breeding dairy cows), Suinprod (breeding and fattening pigs), Conagra (boiled-smoked meat preparation factory), Salbac Dry Salami (raw-dry salami factory), Europrod (factory of semi-prepared and prepared meat products), Comcereal (purchase of cereals), Avicola Lumina Constanța (raising hens for consumption eggs and marketing eggs), Agriconstruct, and Bac Print. The group had a turnover around 116 million euros in 2020 and has over 1850 employees.

In the area of *Manufacture of meat products (including poultry*) the first two positions are held by companies from the Agricola group: Salbac S.A. and Europrod S.A. Together they have a turnover around 51.5 million euros. In the

area of *Manufacture of meat products* are registered 14 companies which create 0.47% of the profit of the county.

Meat production and preservation branch includes 15 companies and realises 0.10% of the county profit.

Other economic activities developed in Bacau County are:

- *The manufacture of milling products*, realises 0.67% of turnover of Bacau County and the main company is PAMBAC S.A. with a number of 543 of workers and with a yearly profit around 6.3 million euros.
- *Manufacture of dairy products and cheeses* which contributes to the profit of the county with 0.01%, includes 6 firms which a number of employees between 1-8 persons.
- *Production of bread, production of cakes and fresh pastry* products includes 132 firms which produce 0.20% of the net profit made in Bacau County.
- *Activities in mixed farms (vegetable culture combined with animal breeding)* is an activity embraced by 32 farms, involve a number of 213 employees and determine 0.49 of the Bacau County profit.
- *Forest exploitation* as economic are is represented by 123 firms which produce 0.42% of profit of the county.
- *Forestry and other forest activities* which has a different classification of the national level from the previous one, creates 0.13 of the county profit with 24 companies and 158 employees.

As can be seen, the agro-food industry isn't among the big branches of the county but it has important and many representatives. The application of circular economy in this area can generate loss reduction between 7-9% according to the estimation of the specialists. It has to be mentioned that a part of big companies already valorise by-products and waste for creating new products (extraction of components, food for pets, products for animal food, etc.). The smaller firms prefer to sell the waste and by-products.

Considering the agricultural area of the county and the number of companies acting in food industry, the introduction of circular economy principles will have an important impact on the company's profit, environment and economic power of the county.

3.2.4 Study case – implementation of circular economy in rural area of Bacau County

The transition of Romania from the linear economy to the circular one is at the beginning. The strategy in this direction has to be created until 2022. There are punctual initiatives, promoted by big companies and smart mangers but the actions in this area have to be political sustained by national and regional authorities, by legislative measures and financial support.

The Regional Development Agency North-East started for many years an initiative to promote the sustainable development of the region. The actions in this direction were encouraged and promoted, and of course, the same, those of the circular economy. The company having a complete implementation of circular economy in the agro-food area were not found.

However, a good example could be offered by Serban Group, a company with farms in some of North-East Development Regional counties.

Serban Grup Holding S.A. is an important agro-food player of Bacau County. It represents a family of companies with Romanian capital, with an integrated structure that operates in the following fields: agriculture (cereals, oilseeds and legumes), bakery, pastry-confectionery, public catering (Băcăniile Șerban), distribution and transport, poultry farming [18].

The mission of the Șerban Holding group of companies is to offer to the partners quality products and services, to create an environment where employees can maximize their potential, and to develop a trusted brand for Romania and beyond. The company's strong point is its human resource, which totals over 400 employees, involved in the activities of the group's five companies and six fields of activity:

- S.C. Şerban Bread Factory S.R.L. - Bread making; manufacture of pastry and baking products;

- S.C. Ferma Avicola Șerban S.R.L - Mixed agricultural activities (vegetable cultivation combined with animal breeding);
- S.C. Interagroaliment S.R.L. - Mixed agricultural activities (vegetable cultivation combined with animal husbandry;)
- S.C. Euro Rin S.R.L. - Cultivation of cereals (except rice), legumes and oilseeds;
- S.C. Şerban Distributie S.R.L. - Transport of good.

All areas of activity of Grup Șerban include new projects, aiming at the fruition of all opportunities for the consolidation of the current business. The production and consumption model involving the sharing, reuse and recycling of materials and products resulting from the company's fields of activity, aims to minimize waste. The effort aims to move from the traditional, linear economic model based on large quantities of cheap, easily accessible materials and energy to the circular economic model, where the life cycle of products is extended.

Company's activity includes:

- 6 areas of activity;
- 3 chicken breeding farm;
- 5 stores under the Băcănia Şerban brand;
- agricultural crops - over 12,000 ha cultivated;
- reception of cereals - 400 tons/hour;
- drying of cereals - 1800 tons/24h;
- milling - wheat grinding capacity 100 tons/24 hours;
- grain and oilseed storage - total storage capacity over 130,000 tons;
- bakery/patisserie - production capacity - 20 tons/24h;
- combined fodder - production capacity 7 tons/h.

Grup Șerban aims at performance, which is why the company's activity was rewarded at the national level, with two silver and bronze medals respectively in the Granero Awards, UGAL INVENT 2019 under the patronage of the Ministry of Research and Innovation:

- ✓ Gold Medal – Bread with Hemp, Quinoa, Chia seeds;
- ✓ Bronze Medal – Prokorn Multigrain Bread mix of 8 seeds and cereal.

The activity of the group of companies values the principles of the circular economy by using the by-products from one sector of activity as raw material for another sector. Moreover, the company's activity is based on the use of local resources: the irrigable potential of the Siret River and the five accumulation lakes with an average area of 1500 ha and 7m depth for each and the green energy produced by hydro resources on the riverbed.

Their own laboratory of research and development of biodiversity, continuously analyses the soil microbiology and its influence on commercial agriculture.

To increase productivity, the company continuously invests in state-of-the-art agricultural equipment and modern technologies. Investments in pivoting, mobile irrigation systems with sprinklers exceed 400 m in length and can cover 600 ha. Future plans foresee an expansion of the areas cultivated with vegetables up to 1400 ha in the first phase and in the next 5 years up to 15000 ha. This requires investment in irrigation systems and a smart rotation of the types of vegetables grown.

The company aims to exploit biologically active soils. The recovery of poultry manure obtained from the group's farms allows the replacement of chemical fertilisers. The natural fertiliser obtained is extremely fertile and has important benefits for crops, especially vegetables. In poultry farming, spe-cial attention is paid to environmental conservation, food security and sustainable development.

The farm benefits from a unified production system, the food being produced in the combined feed production plant, with a granulation and crushing capacity of up to 7 tons / hour, 70% of the feed recipe being cereals produced within the group.

Figure 3.43 Products of Serban Group [18]

Grup Serban is a responsible company, which returns part of the profit to the community, getting involved in social activities: donations - supporting the education of disadvantaged groups, supporting performance; environmental protection - actions regarding the reduction of the factors involved in the destruction of the environment.

The Şerban group of companies stands out among other commercial companies active in the agro-food field, by including within the company all the links necessary for an independent and successful business in the field: the production of the raw material, its transformation into the final product, transport and distribution in own locations. This integrated concept is completed with all the elements of a circular economy: the valorisation of secondary or qualitatively non-compliant products within the company or through commercialization, respect for nature, renewable energy sources.

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