

The Circular Economy - From a Desideratum to its Achievement

Neculai LUPU

George Bacovia University, Bacau, ROMANIA

neculai.lupu@ugb.ro

Abstract: *The circular economy represents a new model of production and consumption that theoretically produces zero waste. It involves an economic circuit in which, from the design stage, everything is designed in such a way that what goes into a product or process falls into one of two categories: a) either it is a biodegradable component; b) either it is a component with 100% recycling potential. The concept of **circular economy** says that in order to harmonize the sustainable development needs of humanity in the long term, it is necessary to optimize the consumption of resources so that we waste as little as possible and reuse as much as possible. Improving the use of resources must reach such a threshold that the quantity of natural resources consumed net (those extracted for the first time from the natural environment) does not endanger their rate of natural recovery, in sufficient quantities for future generations. Practically, at EU level, a redefinition of the concept of sustainable development is desired, which will accelerate the transition from the economy of consumption (an economy of disposable goods), to the economy based on quality, reliability of products and services. This type of economy implies the obligation to redesign the products, pursuing two complementary objectives: a) increasing the proportions of the raw materials from recycling, in the total of the raw materials used by the companies; b) increasing the recyclability of the products at the end of their life cycle. At the same time, the EU is considering rewriting the European Waste Code, by reconsidering certain categories of waste as secondary raw materials. Achieving these goals remains a challenge for Romania, because in our country the fewest steps have been taken on the line of efficient use of resources, but also on the line of reuse, recycling, and, in particular, wastes selection. This, given that, by 2020, remains the first deadline in which, in part, the objectives set by the EU on the circular economy line had to be met.*

Keywords: *circular economy, consumption, waste, economic circuit, recycling*

Introduction

The concept of circular economy says that, in order to harmonize the sustainable development needs of humanity, in the long term, it is necessary to optimize the consumption of resources, so that we waste as little as possible and reuse as much as possible. Improving the use of resources must reach such a threshold that the amount of natural resources consumed net (those extracted for the first time from the natural environment) does not jeopardize their rate of natural recovery, in sufficient quantities for future generations.

The circular economy represents a new model of production and consumption that theoretically produces zero waste. It involves an economic circuit in which, from the design stage, everything is designed so that what goes into a product or process falls into one of two categories: a) either it is a biodegradable component; b) either it is a component with 100% recycling potential. In the first case, the product is recycled naturally through storage, under the influence of microorganisms (bacteria, algae, fungi), turning them into products that are not dangerous for the environment. In the second case, the product is recycled through a technological process to obtain either its reuse (by repair, renovation or dismantling), or by using it for ecological purposes (by melting or burning) with thermal energy production.

Recycling benefits both the environment and the economy.

Environmental Recycling Benefits:

- The amount of landfilled waste is reduced, which not only pollutes the environment massively, but also creates a desolate image for cities, destroying the health of those living near the trash pits;

- By recycling, the pollutants released into the water and the air is greatly reduced, contributing to the stopping of the factors that deteriorate the health of the population;
- The natural resources of the Earth are conserved.

The benefits of recycling for the economy:

- Long-term, community spending on energy is reduced: a single bulb can be supplied for four hours with energy saved by recycling a bottle;
- Reducing supplies with new raw materials, which are limited and with high costs, especially for developing countries, which become dependent on the countries producing raw materials. At the same time, the extraction and use of raw materials has a major impact on the environment, by increasing energy consumption and CO2 emissions;
- Through reuse, the product life cycle increases.

In conclusion, the circular economy requires an efficient use of resources so as to obtain, on the one hand, an increase in productivity, and on the one hand, a more attenuated impact on the environment, their objectives are based on the premise that waste is a resource that, through selective collection, recycling and recovery generates profit. In this way, waste becomes a raw material. There is virtually no waste. This happens in the conditions in which the resources drain, and become more and more expensive.

An increasingly determined attitude is needed, but above all, a change in the mind-set of public authorities in order to speed up the transition from their consumer economy (in which goods are disposable), to an economy based on the reliability of products and services. This fact implies the redefinition of the nation of "sustainable development", by introducing the obligation to redesign the products, in order to increase the operating life, at the same time with the increase of their recyclability at the end of their life cycle.

At the same time, it is necessary to rewrite the European Waste Code in order to reconsider waste as secondary raw materials.

1. The Strategy of the European Union on the Circular Economy

According to data from the European Commission, the EU uses 16 tons of material per capita annually. Of these, 6 tons become waste, of which, half reach the landfills. Many Member States still rely on landfills, even if they are not a sustainable solution. Landfills can contaminate soil and pollute water and air. Uncontrolled disposal of waste can lead to the release of hazardous chemicals, which can have harmful effects on our health. In addition, valuable materials that exist in waste are lost along with them. Good waste management can make a decisive contribution to growth and job creation. If the legislation in the field of waste were fully implemented, Europe could save more than 100 billion euros a year and create almost 400,000 jobs by 2020. Almost one third of municipal waste is disposed of in landfills and less than half are recycled or converted into compost, with large differences between Member States.

As previous and, in part, current models of resource utilization have led to high levels of pollution, environmental degradation and depletion of natural resources, the EU introduced in 2001 its Sustainable Development Strategy (SDS) to promote economic growth and of the number of jobs (in which an environmental component was mandatory), which provided for the efficiency of the use of resources, through structural and technological changes and, at the same time, the management and prevention of waste generation. The strategy was subsequently supplemented in 2006 (by the Lisbon European Council) to harmonize the internal dimension of sustainable development (from the Member States) with the international dimension (from the Union level).

In detail, the "Circular Economy" package sets out the following objectives at EU level:

- a) the rate of use and recycling of municipal waste to increase to a minimum of 70%, by 2030;
- b) prohibiting the storage of recyclable materials such as plastics, metals, glass, paper and cardboard, as well as biodegradable waste, until 2025 and eliminating the waste from packaging, by 80%, by

2030;c) the obligation to redesign the products in order to increase the proportion of raw materials resulting from recycling and to increase the degree of recycling of the products, in order to consider them as secondary raw materials. At the same time, the development of high quality secondary raw material markets is envisaged, by ceasing the waste status applicable to certain materials following the re-evaluation on the basis of quality criteria; d) reducing the food waste and implicitly the resulting food waste, by about 50% by 2030.

In conclusion, the circular economy does not refer only to waste management at local or regional level, but to all industrial sectors of activity that produce or market packaging, which, after use, reaches waste. All of this waste must be recycled both for their economic value and, above all, for minimizing the environmental impact.

In December 2015, the European Commission analysed how the objectives of the European Waste Management Strategy were achieved, within the circular economy and the impact on the environment. As the results of the analysis showed a partial realization of the objectives, the Commission came up with a new package of measures before the Parliament and the Council of the European Union aimed at accelerating the implementation of the objectives set.

The new measures plan envisaged four directives, namely: 1) the Waste Framework Directive; 2) the Directive on landfills; 3) Common Directive on: end-of-life vehicles, batteries and accumulators as well as waste electrical and electronic equipment.

The negotiations between the Parliament and the Council lasted three years and only in 2018 are the four EU Directives: 849, 850, 851 and 852 regarding waste. The European Commission is directly involved in pursuing compliance by the Member States, but also by the economic agents and local communities of the European legislation in the field of waste management regarding their prevention, reuse, recycling and storage. For the economic agents, measures to stimulate the industrial symbiosis are promoted, namely: transforming a by-product of one industry into raw material for another industry. Mandatory extended producer responsibility schemes are also envisaged, so that they can introduce more environmentally friendly products on the market and support verification and recycling systems for: packaging, batteries, electrical equipment and end-of-life vehicles.

The specialists in the field argue that, at least in the beginning period, such an option will cause a trend of rising costs (and implicitly, of prices), with a negative impact on demand. It is recommended that the solution "economy of functionality" in which not only the products, but especially their utilities, that is to say, the maintenance of maintenance services are sold. The problem of distributing and managing the responsibilities of the owner of the goods and the beneficiary of the utilities remains to be solved. The EU's efforts to reach its energy and climate goals, set for 2020, have already led to the emergence of new industrial sectors and jobs, as well as to increased technological innovation, thus reducing the costs of technology.

The share of energy from renewable sources in the final energy consumption increased from 9%, in 2005, to 17% at present. At the same time, the targets for the year 2030, to improve the energy efficiency of the EU by at least 32.5%, are approved, and the proposed legislation to improve the efficiency of CO₂ in cars, vans and trucks will stimulate the transition in the transport sector, climate and energy will ensure the EU contribution under the Paris Agreement, reducing gas emissions by at least 40%, by 2030, compared to 1990. Finally, the circular economy will exploit a range of advanced solutions and encourage new business models.

2. Romania and the Circular Economy

As for Romania, as a member country of the EU, the efficiency of the use of resources is at least outstanding. According to the data provided by the Ministry of Environment, the market for recyclable waste in Romania is approaching one billion euros, and the recycling rate is at present, around 5% of the total municipal waste. Although the Waste Framework Directive has also been transposed in Romania, through Law no. 211/2011, achieving the objectives remains a challenge for our country.

In 2015, Romania recorded the highest rate of waste disposal in the EU (72%), compared to the European average of 25.6%. By the end of 2017, it had to close the non-compliant garbage pits. Otherwise, EU sanctions will follow, a fact already confirmed on April 27, 2017, when the European Commission sent Romania to the Luxembourg Court of Justice for failure to fulfil the obligation to review and adopt the National Management Plan on Waste and the Waste Prevention Program, in accordance with the Framework EU Directive no. 98/2008 on waste. In the national practice, there is still a mixed waste collection (approximately 96% of household and similar waste), without separation at the source of the recyclable materials. However, for nothing we collectively collect biodegradable waste if it is mixed with other types of waste in the pit. The mixed biodegradable can no longer be recycled as compost. The structure of containers and secured storage areas in cities must be changed, so that no one else can access the ready-mixed waste mix.

In relation to the processing of biodegradable waste, we mention that, at national level, about 125 000 tons of organic waste is processed in the form of compost per year (8.7% respectively) out of the total processing capacity of 1.5 million tons. At the same time, 34.6% of the installations are unfinished, under construction, and 54.9% of the installations received, but not working. This is because, in 2020, Romania must have a rate of 50% in terms of reuse and recycling of the total mass of waste. Another important aspect is food waste, that is, we buy more than we need and then we throw away. This characteristic behaviour has been widespread in Romanians, being also counterproductive, because it generates from one year to another, increasing the amount of household waste and by improper collection, at any time constitute outbreaks of infections and diseases, but also pollution of the environment.

The circular economy requires a much more active involvement at the level of governmental public policies, but also of the political commitment of the Romanian Parliament.

Also, local public authorities play an important role in designing an efficient collection system, including at source, for all types of waste. At the conference "Euro impact" organized by the European Institute of Romania, it was highlighted that the resources, although limited, are knowingly wasted because we do not recycle and use them inefficiently. In 2020, what has not been done in the last 18 years (from the Lisbon Strategy) must be put into practice.

The responsibility for the management of municipal waste belongs to the local public administration, which, by its own means or by concession of sanitation services, must ensure the selective collection, transport, recovery and final use of these wastes. At EU level, inter-ministerial working groups have been created dedicated to the implementation of the concept of circular economy, respectively of circular biochemistry. Romania benefits from a number of opportunities, such as the adequate absorption and the focus of the structural funds on the objectives for the period 2014-2020, with the condition of adopting, in advance, a set of economic instruments, which will lead to the fulfilment of the waste recycling obligations to municipalities corresponding to the year 2020.

Romania negotiated 36 conditionalities accepted by the Government in 2014. Delaying the fulfilment of the conditionalities may lead to the suspension of all or part of the payments related to the Operational Programs, which are covered by the respective preliminary clauses. By 2020 we have the following objectives:

- a) at least 50% as a rate of reuse and recycling from the total mass of the quantities of waste (paper, mat, plastic and glass);
- b) minimum 70% level of preparation for reuse, recycling and other material recovery operations;
- c) at least 70% of the amount of non-hazardous waste from construction and demolition activities;
- d) the recovery of packaging waste from the total packaging introduced on the Romanian market by 60%.

Also, our country will endeavour to reach annually a collected quantity of electronic waste of 4 kg per inhabitant and to collect separately the bio-waste for composting and fermentation.

In these circumstances, the Romanian Government acted in a bizarre way, challenging the EU recommendations and the general interests of Romania. Thus, on June 30th, 2017, GEO no. 48, was the last day that the Government could adopt emergency ordinances that would enter into force, without the need for an extraordinary session of Parliament. Among the provisions of GEO no. 48/2017, there is also the suspension, until January 1, 2019, of the payment by the garbage dumps of the tax for the waste received in order to eliminate the final for storage.

The tax was constituted as an income to the environmental fund (30 lei / ton) and was to increase to 80 lei / ton, in 2019 and to 120 lei / ton in 2020. We mention that the application of the tax is postponed from 2013, although we are the last place to recycle municipal waste in the EU and in breach. It is important to note that the tax decreases as less and less garbage reaches the pit, so more waste is recycled or incinerated. However, another tactic was applied to us, namely, throwing garbage in non-permitted places.

The deferral of the application of the tax was requested by the mayors, because the garbage dump rolled back the "pit tax" to the salubrist, the salubrists to the mayors, and these to the inhabitants, who would not have seen the action of the town hall raising the tax as a popular one. In fact, some mayors mask the tax, not soliciting it separately from the citizens, but supporting it from the local budget. The suspension of the tax on the pit caused in time the doubling of the quantity of municipal waste (in 2017 compared to 2016) on the one hand, and on the other hand, the cessation of illegal waste storage.

The purpose of this tax was to increase the performance in the separate management of the waste at the source and to discourage the mixed collection as it is practiced in Romania. The tax also includes preventative measures, such as composting and recycling.

There are five phases in the EU waste management strategy, namely:

- 1) Warehousing;
- 2) Energy valorisation, (incineration with thermal energy production, but also polluting emissions);
- 3) Recycling;
- 4) Preparation for use;
- 5) Prevention.

In Western Europe, the first two phases are increasingly rare, due to environmental measures and very high penalties. Therefore, the emphasis is on the last three methods and especially on prevention.

In Romania, the suspension of the tax on the pit has led to the practice of lowering the cost of storage, which attracts waste from other countries as a magnet. Even if the importation of waste for disposal is theoretically forbidden, ships frequently loaded with waste, sent to Romania to be disposed of at the lowest cost in Europe, are frequently registered. The customs authorities lack the legal framework and the infrastructure for further analysis and follow-up of these quantities, so that they will be returned to their origin if they are not used. Some of these wastes are energetically used in cement factories, with toxic emissions, and another part is illegally used in landfills in Romania. Meanwhile, the Government of Romania, through the Ministry of the Environment, introduces through GEO no. 74/2018, a new tax, in the hope of avoiding waste infringement.

The Coalition for the Circular Economy of Romania takes a civic attitude towards this governmental measure that diminishes the efficiency of the economic instruments necessary to align with the European legislation in the field because it generates technical and financial problems to all the actors involved in the chain of waste management. The coalition claims that the tax name itself is uninspired: "The contribution to the circular economy". In this way, a negative message is transmitted on the concept of "circular economy", as a generator of taxes and additional taxes for Romanians.

The argument put forward by the Ministry of the Environment was that, since Romania cannot meet the targets assumed towards the EU, it will transfer the authority over the waste regime from the mayors to the Association for Inter-Community Development (ADI) that will solve this problem. The

argument is not a valid one, considering that these ADIs not only fail to achieve their proposed goals, but most of them do not even work. Moreover, the Ordinance does not provide for any penalties for the non-performance of these associations.

GEO no. 74/2018 also amends the Law no. 249/2015 regarding the management of packaging and packaging waste, forcing the producers to manage their packaging recovery targets exclusively through the ADI. In this way they become the captive financiers of a non-performing system, with a centralized and monopolistic character, with un-optimized costs and without any connection with the realities of a free and competing market. These high costs will be compulsory in the selling price of the packaged products, being paid, finally, by the citizens. And the Institute for Research in the Circular and Environmental Economy, "Ernest Lupan" (IRCEM), draws attention to the negative changes brought by GEO no. 74/2018, in the sense that they have not been publicly discussed and are not based on an assessment of opportunity or opportunity.

3. Environmental Engineering

Environmental engineering is a branch of applied technology, integrated with scientific knowledge, which addresses problems of conservation of energy and the natural environment, as well as problems of control of industrial and civil (municipal) waste. It is also concerned with finding plausible solutions in the field of public health, promoting laws that will ensure reasonable sanitary conditions in the residential (urban and rural) and leisure areas. This involves wastewater management, combating air pollution, control, recycling and waste disposal, radiation protection, industrial hygiene, as well as environmental impact studies from the construction projects envisaged as objectives.

Environmental engineering or environmental protection in industry must become a permanent concern not only of engineers but of all the responsible factors in society. It studies clean technologies or biotechnologies, that is to say processing technologies that allow the recycling of substances, waste or the use of pollutants as secondary raw materials. In this way the negative effects on the environment are reduced (cases of negative excesses: Roșia Montană, Puiesti near Bârlad etc.). Filtration technologies are also envisaged, through which the reduction of the emissions of pollutants is achieved by placing filter elements at the end of the exhaust pipes.

Environmental engineering involves investments from both economic agents and public authorities. It does not only refer to the protection of the environment against anthropogenic pollution factors that arise from human actions in relation to nature and their negative consequences. Environmental engineering also aims to protect the health of employees in the industrial environment, ensuring optimal working conditions and reducing the risks of health deterioration.

Renewable energy sources or alternative sources are also of particular importance in environmental engineering. The technologies for obtaining renewable energy are varied. Some use the photovoltaic phenomenon, which, based on solar cells (two or more layers of semiconductor material, such as silicon), converts sunlight from electricity to electricity. Others take the heat from the thermal water sources (geysers) or take the energy of the air currents (wind) or of the sea currents (tides), thermal (mainly) and electrical (as a by-product) energy. It differs from the conventional CETs (pollutants), dimensioned for the production of electricity, and the thermal energy was a by-product.

The monitoring of pollution indices is also part of environmental engineering, this notion being correlated with the analysis of the risk of disasters and hazards.

Conclusions

Due to the high degree of pollution manifested in various forms, the states of the world are increasingly resorting to environmental engineering to apply their policies, targeting the year 2050, when it is desired only the existence of renewable and non-polluting forms of energy.

Thus the global demand for resources is projected to double by 2050, but only 6% of the materials are recyclable globally, at present. Over the past 20 years, China and South Korea have created industrial

parks that use circular economy principles to link supply chains to companies and reuse or recycle common materials. China has certified over 50 such parks.

The European Commission and Japan have adopted laws on ecological design, made manufacturers responsible for the subsequent use of their products and stimulated markets for secondary raw materials. At the same time, some US states and companies have created networks for sharing and recycling resources. And Brazil and India use informal recycling systems.

Starting from these global premises, we appreciate that Romania must also align with these planetary steps in order to fulfil the EU 2030 Sustainable Development Agenda. As for the direct management of waste, at present there are public, private initiatives, public-private partnerships, but also many local and regional civil society implications.

In this context it is worth mentioning the Institute for Research in the Circular Economy and Environment - IRCEM, an independent non-governmental organization, which was founded in 2012, through an initiative of the Technical University of Cluj-Napoca, functioning as a research centre. It carries out research-development-innovation, education and training actions, entrepreneurship, in collaboration with economic agents and internal and international institutions, with European, governmental and local authorities funding. Starting with 2018, IRCEM has the status of representative of Romania within the coordination group of the European Platform for Stakeholders for the Circular Economy (ECESP) - a joint initiative of the European Economic and Social Committee and the European Commission, where it has the mission:

- to contribute with the necessary technical resources, on a voluntary basis, to attract the targets of recycling, reuse and to bring improvements to the Romanian environment and economy;
- to be actively involved in facilitating the transition from the linear (consumption) economy to the circular economy, through the efficient reuse of resources;
- to involve all stakeholders in the development of a Master Plan for the transition to a circular economy by 2030, within the ROCES 2020-2030 Strategy.

The strategy aims to substantiate the pillars that will support the implementation of the circular economy in Romania, by involving all representative actors: civil society, administration, industrial sectors, academia, social infrastructure and attracting the necessary financial support. The launching conference of the ROCES Project was held in Iasi on April 12, 2019, followed by 8 sectorial conferences and interactive workshops held in the 8 development regions in Romania. On June 11, 2019, the European Conference was held in Bucharest, which focused on "Good European practices" in the field.

Then there are regular working meetings, researching the Romanian market, involving representatives from the government departments, economy, interest groups and experts working on the Master Plan. It is expected that, from 2020, the Romanian authorities, as well as the citizens, will understand that we can no longer work chaotic, but after specialized and applied programs in other countries, and Romania can no longer remain at the top of the list with the weakest achievements on the line of resource efficiency and environmental protection. On the contrary, Romania has every chance, through an active and consistent political and technical involvement to become a leader in this area of Europe, on the line of the circular economy and of the economic growth in general.

Supplementary recommended readings

Badescu I.C., Badescu D.I., (2014), *Conversiunea sistemelor*, Mica Valahie Publishing House, Bucharest

Negrei C., Istudor N., (2018), *Circular Economy, Between Theory and Practice*, Amfiteatru Economic Publishing House, Bucharest

Negrei C., (2004), *Economia si politica mediului*, The Academy of Economic Studies, Bucharest

Popescu M., (1985), *Un posibil raspuns la problemele dezvoltarii: procesul circular activ*, Politica Publishing House, Bucharest

Eurostat - European Statistics