

THE ADVANCEMENT TO THE CIRCULAR ECONOMY. WHERE WE ARE AND WHAT WE CAN DO AT LOCAL/REGIONAL LEVEL

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Abstract:

The unsustainable consumption of materials, short lifetimes, and polluting production systems are among the main causes of the critical situation in which we are currently. We need not only a change of behaviour but the change of the old paradigm in which extraction, production, consumption, and disposal were the pillars of the economy with a new paradigm, updated to the reality, in which almost nothing should arrive at the disposal step. The processes must be re-designed to ensure continuous recycling and recovery of useful materials reducing the pressure on the virgin raw materials and eliminating a lot of pollutants specific to the production, use, and disposal steps. The solution seems to be the Circular economy, a concept that is easy to understand but difficult to implement for numerous products and processes. This paper investigates the economic environment of Suceava County to identify the premises for the creation of cycles specific to the circular economy based on the actual industrial profile of the county. The implementation of such cycles can represent best practice models for other counties or for other industrial branches.

Key words: circular economy, sustainable consumption, recycling, recovery

JEL classification: Q57, R11

1. INTRODUCTION

The Earth was a rich planet. It still is and can remain rich if we will take care of its resources, environment, and people. For more than 150 years, the model of development for whole economies (developed, developing, and underdeveloped) was the linear one in which there is no interest in the final life stage of the products or in resources consumption. The main objectives of the linear model were the rise and diversification of production, better economic efficiency, and higher consumption. The use of the linear model led to production and consumption patterns focused solely on the companies' economic success and consumers' satisfaction in which the natural resources were considered as being infinite.

In a silent, but in a very clear and decisive manner, Earth gave us a painful lesson: we have only one planet with limited resources, in a major part, the environment is not ours but it is a gift and a loan from the Earth for future generations. It is the moment for a fundamental change in which we don't repeat the errors from the past and start to make sustainable decisions based on a different paradigm – the ecological and economic way of thinking. Economic efficiency should be the criterion for assessing business activities, but not the only one. We have to add a more complete set of indicators to evaluate and improve the economic and ecological performances of the social and economic actions.

In this context, the circular economy seems to be the solution for a long list of problems faced by our society today: the depletion of non-renewable resources, pollution, the decision-making process without any environmental criterion, single-use products, the lack of coherence and collaboration in the development process, and the list goes on.

The circular economy is nothing new, it was a way of living in the past with different levels of involvement in production and services activities across times and geographies. Repairing the products and continuing to use them for years and years was a common practice even during our grandparents' period; using the food leftovers for feeding animals or using several times a box or a jar was very normal behaviour. After the '70, when the middle class started to represent the major part of the population with good income the good habits were lost step by step. The production

sector played a very important role, with a tempting offer of goods at affordable prices. The shift would not have been possible without the strong and sometimes brutal support of the promotional and marketing campaigns that had the role of convincing the people that the products must have a short lifetime, they should be replaced quickly with other new ones for being fashionable. In all this time no one asked if we have enough resources for this huge flux of products with very short lifetimes or where are going all these products after they were out of use. Only when the prices of raw materials rose exponentially and the mountains of waste with all the associated problems were present everywhere, we had to face reality.

Returning to the old habits is impossible now due to the exceptional evolution of society during the last 40-50 years but we can extract the principles of these habits and apply them according to the actual situation but especially using the modern techniques and tools available now.

2. THE FUNDAMENTALS OF CIRCULAR ECONOMY

Become a buzzword, and considered the panacea for all the environmental and economic problems faced by the actual society, the circular economy concept was formally launched in 1990 by Pearce and Turner in their book *Economics of Natural Resources and the Environment* (Heshmati, 2015). The authors highlighted the strong connection between the environment and economics through the three roles associated with the environment (Rizos, Tuokko, and Behrens, 2017):

- resource supplier – the environment represents the source of the raw materials used in the production processes for the whole range of goods and services used by businesses and people;
- waste assimilator – unfortunately, in all stages of extraction, production, and consumption are released different types of waste which arrive in the environment and produce pollution in all components (air, water, soil, biosphere);
- source of utility – consumption of goods and services create utility and welfare but with the cost of destruction of the environment.

The conclusion of the authors Pearce and Turner is that ignoring the environment means ignoring the economy. As long as the world economy is built on the resources offered by our planet, the environment must be recognized as a core actor in all economic and social decisions. The idea of circularity was present even before the launching of the concept of the circular economy; at the end of 60', Kenneth Boulding and others discussed 'closed systems' and 'closed economy' as models able to maintain the total capital stock and limit the losses of the linear system (Rizos, Tuokko, and Behrens, 2017).

From that period until now, several concepts and approaches emerged in the scientific literature with different names and levels of overlap with the circular economy. For example, industrial ecology suggests designing industrial systems according to the model of biological ones: materials and energy are consumed/used by the organisms, and the waste resulting from an organism is consumed or used by another one in its own process. Similarly, industrial systems should consider possible alternative resources and possibilities of reusing waste in an internal loop. Closer to the circular economy concept is industrial symbiosis in which ways of using waste in the same or other industries are intentionally sought (Albu, 2017).

Another approach with a strong connection with the circular economy is cradle-to-cradle design. According to it, the products should be designed from the beginning thinking of their final life stage that must be not the end but a new beginning for another use. The concept defines two types of materials existing in products – biological materials and technic materials. It is necessary for this differentiation to define two models of cradle-to-cradle design. For the biological materials, that are biodegradable, the design involves the return to the environment, but in certain conditions of safe and efficient transformation while for the technical materials, it is necessary to be re-processed indefinitely, in a closed-loop process.

In the scientific literature, there are several definitions of the circular economy that emphasize different aspects of the concept. The most cited and used is the definition issued by Ellen MacArthur Foundation (2013a) which states that the circular economy is:

”an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models”.

The definition shows a deep and broad understanding of the concept because is not limited to the fluxes of materials and energy but affirms that the main purposes of the circular economy are the restoration and/or regeneration of the economic systems with specific methods and techniques, according to the type of activity.

The principles of circular economy, named also the 3R principles are reducing, reusing, and recycling. The practical application of these principles led to some basic techniques specific to the circular economy, presented in Table 1.

Table no. 1. Specific techniques used in the application of the circular economy concept

Design out waste	The circular economy doesn't accept waste, even if it is almost impossible to eliminate it in actual conditions. The chemical products used now on a wide scale are the main responsables for the incapacity to find new uses, recycle, or safely waste disposal in the environment. The circular economy fights for the elimination of toxic chemicals which will gradually lead to complete waste reduction.
Energy from renewable sources	One of the final aims of the circular economy is to provide energy only from renewable sources. Nowadays we are in the process of replacing conventional sources of energy with renewable ones, the actions being accelerated by the shortage of energetic raw materials and the continuous price rising of oil, gas, and coals. At the same time, the circular economy supports the efforts for improving the efficiency of actual sources of renewable energy,
Think in ‘systems ‘	For the circular economy, it is crucial to understand how the parts of a whole are interacting and mutually influencing, what are the internal and external factors involved in a process, what are their roles, and how the design of a circular process considers all these aspects. System thinking emphasizes all the connections, relations, and conditioning in the concrete context of the problem.
Waste is food	Extending the term food beyond the classical meaning of nutrients for human consumption, the circular economy considers as food all the biological nutrients able to be re-introduced in the biosphere through non-toxic, restorative loops. This technique reinforced the bond between agriculture, industries, and sustainable consumption.

Source: own elaboration with information from Ellen MacArthur Foundation, (2013a) Towards the Circular Economy. Economic and Business Rationale for an Accelerated Transition. Retrieved from <https://tinyurl.com/hzfrxyvb> and Ellen MacArthur Foundation, (2013b) Towards the Circular Economy. Opportunities for the consumer goods sector. Retrieved from <https://tinyurl.com/ztnrg24>

The circular economy system diagram, known as the butterfly diagram, illustrates the continuous flow of materials in a circular economy. There are two main cycles - the technical cycle and the biological cycle. In the technical cycle (the right part of the diagram), products and

materials are kept in circulation through processes such as reuse, repair, reconditioning, and recycling. In the biological cycle, nutrients from biodegradable materials return to Earth to regenerate nature. The diagram attempts to capture the flow of materials, nutrients, components, and products while adding aspects of a financial nature.

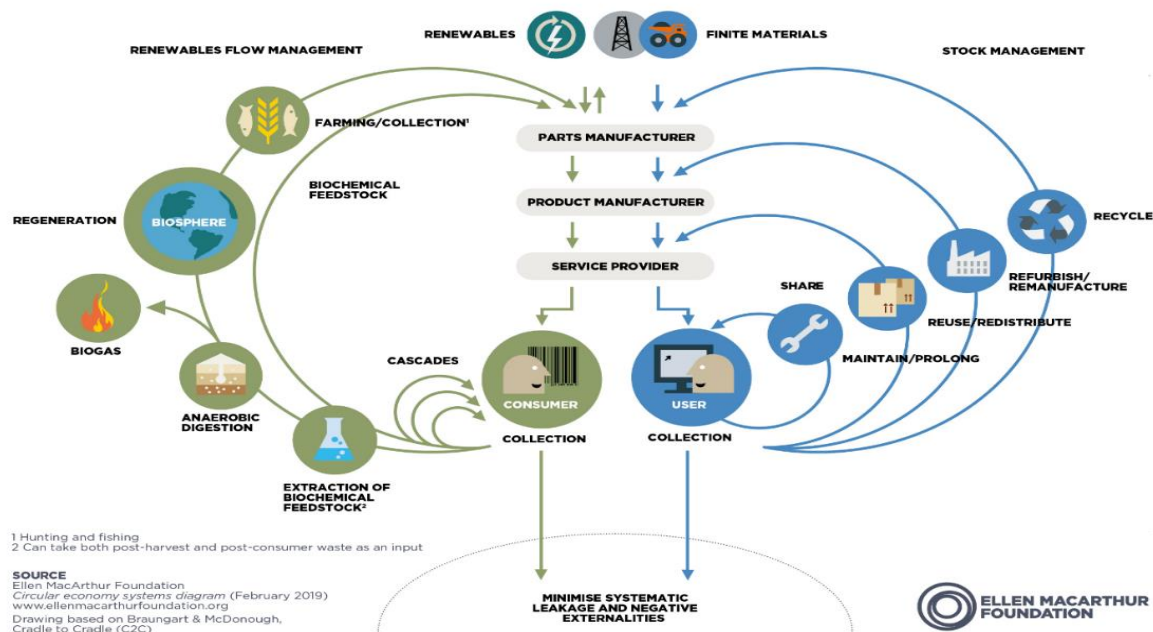


Figure no. 1. The Butterfly diagram representing the cycles of the circular economy

Source: Ellen MacArthur Foundation” The circular economy in detail. Deep drive”. Retrieved from <https://ellenmacarthurfoundation.org/the-circular-economy-in-detail-deep-dive>

The activities involved in the left part of the diagram for the biological cycle represent old and known practices specific to agriculture, fisheries, and/or raising livestock. The new activities added to this cycle are the result of the evolution of science and technology and allow better use of biodegradable waste, representing at the same time an adding value for the circular economy: anaerobic digestion, biogas production, or green chemistry.

The Butterfly diagram has both theoretical and practical value for the circular economy. For business, the practical value prevails. From the diagram, we can identify the four models of value creation specific to the circular economy. Although there are big differences between different economic sectors, the four models of value creation cover a very wide range of production and services-providing activities and can be used in any combination. The core idea of the models is the circle. According to Ellen MacArthur Foundation (2013b) “...the tighter the circles are, the larger the savings should be in the embedded costs in terms of material, labour, energy, capital and of the associated rucksack of externalities, such as GHG emissions, water, or toxic substances.” The final goal is to create value and cut costs under the level of the linear model with at least the same economic efficiency.

The first model is called ‘Power of the inner circle’ and refers to the process of maintaining the products in use with simple maintenance and repairs at the same owner (initial owner) as long as possible. In this way, the demand for new products will decrease, and it will lead to less pressure on virgin materials, less pollution, and less energy consumption, which means big potential for savings and be profitable (Guldmann, 2016). The graphical representation of the ‘Power of the inner circle’ is included in the right part of the Butterfly diagram in Share and Maintain/prolong cycles.

The second model is called ‘Power of circling longer’ and refers to prolonging the life of products through several consecutive circles and making these circles longer. Practically, this is possible if the goods are high quality and reliable and need no or minimum repairs during their lifetime. Also, a longer life is possible if the producer or other company offers post-production services for users in order to avoid malfunctions and ensure the proper functioning of the product.

The third possibility is the use of parts from the product for keeping in function other similar goods and reducing the demand for new parts. For other types of goods like glass or aluminum packages, the second model refers to the number of using cycles until the product is recycled. As many the using cycles are, as longer the circling process is. For example, a glass bottle can be reused 27 times until it will be recycled, which means a long circling (Guldmann, 2016); in all these cycles of use, the costs are minimum and consist of collection, washing, sanitation, and refilling. If the 'Power of circling longer' is discussed from the energy consumption point of view, circular economy suggests some direction of action according to the specific energy consumption of a device. If the goods have a higher energy efficiency class (minimum B class), the suggestion is to repair and continue to use the products; if not, replacement with a new one is the solution which assures less energy consumption. All these directions for circling longer are represented in the technical cycle of the Butterfly diagram in Maintain/prolong and Reuse/redistribute cycles.

The third model is connected with the second one and refers to the possibility to reuse products and materials within and between industries. It is called 'Power of cascaded use' and supports innovation to find different ways of re-using products or parts of products at their end-life stage. Discarded materials or waste from a process can be used as by-products in another one reducing the need for virgin materials and the quantity of waste disposed in the environment. The costs associated with the collection and processing of the by-products are lower than the costs of virgin materials, so the model is efficient. In the Butterfly diagram, the third model is represented both in the technical cycle – Refurbish/remanufacture and Recycle cycles – and in the left part, in Farming and Anaerobic digestion.

The last model addresses the use of uncontaminated materials in different processes or products. 'Power of pure circles' suggests that every product, in the designing stage, should be analysed from the point of view of material or mix of materials used in its production. The basic idea for 'Power of pure circles' is to design the goods from materials that can be separated one from the other at the end of life. This will lead to pure, high-quality materials which are easier to be processed with minimum losses in several consecutive cycles. The material selection for a product represents a big challenge for the circular economy as the materials must assure the product's characteristics but, at the same time, also the biodegradability or the possibility to recycle it indefinitely (Lieder, Asif and Rashid, 2017). In the Butterfly diagram, the 'Power of pure circles' is represented both on the left and on the right side; in the biological cycle, it is represented in the Extraction of biochemical feedstock, and in the technical cycle, in the Recycle process.

Based on these four models of creating value in the circular economy the business sector designed and applied customized strategies, according to the type of activity, economic, social, and legislative context. No matter the field of activity, the strategies for implementing the circular economy have three things in common (Peck and al, 2020):

- the company should adopt one or more models of implementing circularity;
- the business should make use of value propositions that enable circularity;
- a network is needed to support and enhance the circularity.

With all the successful examples from different industries, the circular economy faces limitations, barriers, and criticism. According to Korhonen, Honkasalo, and Seppälä (2018), the circular economy was promoted mainly by practitioners (managers, policy-makers) and there is still a lack of scientific knowledge in the field. Especially for the assessment of the circular economy efficiency is ongoing work on a set of relevant indicators that can be used for any social and economic activity.

Theoretically, everything can be recycled and transformed from a linear flux to a circular one, but in practice things are different. The processes must be analysed step-by-step but also their final environmental impact in relation to other processes are connected with. For example, the by-products resulting from tree cutting (branches, bark tree) are transformed into biomass and used to replace fossil fuels in a circular process. But the whole transformation needs machines and energy and generates pollution and waste. If the wood by-products are not transformed into biomass, they will remain in nature and suffer a natural degradation process contributing to environmental

regeneration and saving the machine production and energy consumption needed for their processing. So, what is the best choice? The answer should be based on an in-deep calculation of the environmental impact both for the circular solution and for the other one.

Nowadays, many circular processes are more expensive than linear ones especially due to poorly differentiated waste collection, costs of separation, and cleaning to facilitate the ulterior utilization/recycling/remanufacture of waste in circular processes. Here are two directions for action; the first one refers to the role of innovation and especially of eco-innovation in finding new solutions which will enable the extension of the circular economy with lower costs. The second one regards the education of both population and firms/companies to continuously improve the separation and collection process for easier and complete use of waste, packaging, by-products, and other useful materials.

3. CIRCULAR ECONOMY AT THE LOCAL LEVEL. PROPOSAL FOR SUCEAVA COUNTY

The scientific literature about the implementation of the circular economy in Romania is in its infancy and there are few data, comments, or studies on this subject. Botezat, Dodescu, Vaduva, and Fotea (2018) investigated the circular economy practices among Romanian companies using a questionnaire sent to companies from all over the country and clustering the results. Some local authorities from the county or city level tackle the subject of the circular economy in connection with sustainable development, but without providing practical solutions. In the Romanian Strategy for Sustainable Development 2030 (2018) the syntagm `circular economy` is used only four times in 111 pages in short phrases without any concrete aspect. I agree with the authors Botezat, Dodescu, Vaduva, and Fotea who affirmed that Romania is one of the laggard states in terms of adopting the circular economy at the conceptual level, but especially in terms of its application in practice. This is the main reason for initiating the current study.

Other scientific papers, reports, or strategies supporting the circular economy in Romania were not found; little information is present in different European projects documents published on the projects' websites from the projects with Romanian partners. For Suceava County, there is no information.

3.1. Research methodology

Any initiative connected with the concept of the circular economy should start with a detailed analysis of the current economic status of the region. The research was organized with the following steps:

- the study of the official documents issued by the local authorities and from the County's Statistics Office with information about the economic activities carried out in Suceava County;
- the search for information about sustainable development initiatives implemented in Suceava County, related to circular economy;
- establish the criteria for data analysis;
- qualitative data analysis;
- the elaboration of a synthesis of the results from data analysis;
- the elaboration of proposals for initiating the implementation of the circular economy's principles.

3.2. Economic environment of Suceava County

According to the statistics provided by the County's Statistics Office, in 2020 in Suceava County 14544 economic entities were active, of which the major part is represented by the SMEs.

The figure doesn't include agriculture and animal husbandry which are the subject of distinct statistics. Figure 1 shows the structure of these organisations according to the number of employees.

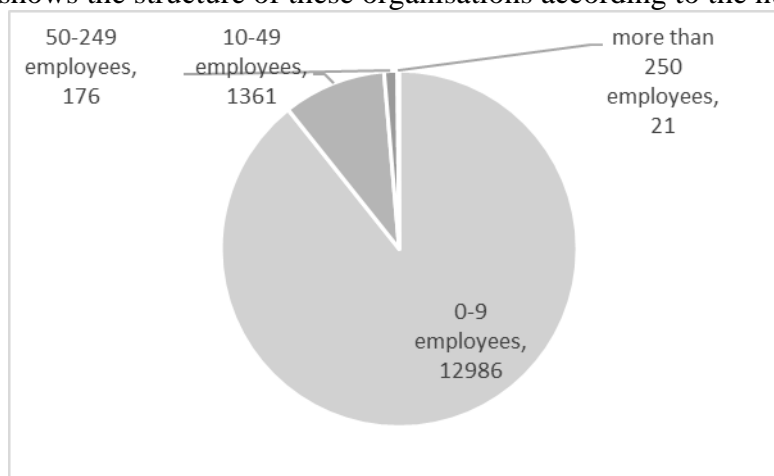


Figure no. 1. Economic entities from Suceava County according to the number of employees

Source: own elaboration with information from Suceava County's Statistics Office, <https://suceava.insse.ro/wp-content/uploads/2022/09/151-Unitati-locale-active-pe-activitati-CAEN-rev.2-si-clase-de-marime-in-anul-.pdf>

This structure can represent an advantage for the circular economy future in Suceava County, considering the fact that the SMEs are flexible and dynamic organisations, able to adopt changes easier than the big companies.

More than the type of entity, its field of activity represents the major criteria for involving it in cycles specific to the circular economy. The first five areas of activities, specific to the organisations from Suceava County are presented in Table 1.

Table no. 1. The main fields of economic activity for the organisation situated in Suceava County

No.	Field of activity	Number of organisations
1.	Wholesale and retail trade, repair, and maintenance of motor vehicles and motorcycles and personal and household goods	4541
2.	Transport and warehouse for goods	1851
3.	Different processing industries	1694
4.	Construction activity	1631
5.	Professional, scientific, and technical activities	1061

Source: own elaboration with information from Suceava County's Statistics Office, <https://suceava.insse.ro/wp-content/uploads/2022/09/151-Unitati-locale-active-pe-activitati-CAEN-rev.2-si-clase-de-marime-in-anul-.pdf>

As the circular economy initiatives are actions implemented at the microeconomic level, we need more detailed information about the type of industrial processes from the county's area. This specificity will determine what model/models of circular economy is the best choice and what connections or networks should be settled in the future. In Suceava County, the main industrial activities are:

- wood processing
- food industry, correlated with agriculture and animal husbandry activities
- textile industry
- leather processing and shoe production
- mechanical industry – different parts and bearing production

In Suceava County, agriculture and animal husbandry represent important fields of activity, especially as number of persons occupied with this work. For circular economy purposes, the

agricultural sector is one of the pillars as it has the role of environmental regeneration, source of energy, and offers solutions for biodegradable waste. The main agricultural activities carried out in Suceava County are the cultivation of cereals, sunflowers, sugar beets, potatoes, fruits, and vegetables (<https://suceava.insse.ro/wp-content/uploads/2022/09/146-Productia-agricola-vegetala-la-principalele-culturi.pdf>). From the point of view of animal husbandry, in the first place is the sheep, followed by cattle, pigs, and goats (<https://suceava.insse.ro/wp-content/uploads/2022/09/141-Efectivele-de-animale-la-1-decembrie.pdf>).

3.3. PROPOSALS FOR IMPLEMENTATION OF CIRCULAR ECONOMY IN SUCEAVA COUNTY

At first analysis, we can state that the economic structure and the combination of activities carried out in Suceava County allow the implementation of circular economy principles inside and between the companies.

From Table 1, we see a big number of enterprises specialized in the repair and maintenance of motor vehicles and motorcycles and personal and household goods. This fact represents the premise for adopting the first circular economy model - 'Power of the inner circle'. In our opinion, this is one of the few activities included activity included in the circular economy concept, existing now in the region. The clients of these services are both persons and companies which are using/working with vehicles and periodically need repairs and maintenance for them. Studying in deep the type of products that are repaired by these organisations, it found almost half are specialized in maintenance and repairment for trucks, tractors, and other vehicles used in agriculture. The result is explained by the big number of commodities transport enterprises and by the agricultural activities carried out in the region. The repair and maintenance firms have the role to close the circle and keep the devices in working status.

High quality maintenance operations and the availability of the parts are the conditions to prolong the lifetime of the products, reduce the expenses of clients and reduce the demand for new products. Also, the repair and maintenance activities can promote the circular economy third model 'Power of cascaded use' through the process of reusing or refurbishing parts of devices that can't be repaired anymore but have good, reusable parts. Table 2 summarizes some proposals to enhance and diversify the circular process, according to the models of circular economy presented above. Are integrated other industries existing in Suceava County with the potential to be part of circles and cycles specific to the circular economy: metal processing and mechanic industry, pulp and paper industry, and plastic processing industry.

Table no. 2. Proposals for circular processes in Suceava County associated with maintenance and transport services, mechanical, pulp and paper, and plastic industries

Proposal	Fields involved	Circular economy model
Extending and diversification of the repair and maintenance activities at devices/products not included in their portfolio. In this way, more enterprises will be stimulated to repair and prolong the lifetime of different products/devices/machines used in their activity.	<ul style="list-style-type: none"> - repair and maintenance services - transport for commodities and persons - agriculture and animal husbandry - construction activities - professional, scientific, and technical activities 	'Power of the inner circle'

	- private persons	
Dismantling and assessing the parts from products that can't be repaired anymore with the aim of reusing them or refurbishing for improving the quality. This can be organized as a secondary activity at repair and maintenance organisations or can be an independent business.	- repair and maintenance services - mechanical industry - metal processing industry - plastic processing industry	'Power of circling longer'
Producing paper packages from paper and cardboard waste. In Suceava City is functioning a pulp and paper factory that produces paper and cardboard for packages. The proposal is to adapt the production technology to use paper waste and to create a collection network for this type of waste.	- pulp and paper industry - local authorities - waste collection and disposal companies	'Power of cascaded use' 'Power of pure circles'
Integration of plastic waste in the economic circuit through recycling processes, especially the plastics from packages. The sources of plastic waste are the warehouses, the big hypermarkets, and the population. In Suceava City, there is a plastic production unit that can be integrated into a circular activity with the aim of reducing the plastic waste disposed of and the need for new plastic.	- plastic processing company - local authorities - waste collection and disposal companies	'Power of cascaded use' 'Power of pure circles'

The food industry plays a very important role in Suceava County's economy. There is an old tradition of processing meat and milk, and lately fruits and cereals. Here there are some incipient initiatives of circularity between the food industry, agriculture, and animal husbandry. In fact, there are old practices from the past, upgraded for our time, in which all nature gives should be used. Here, the use of by-products from the food industry for feeding animals can be extended and the use of manure for environmental regeneration and as fertilizer for biological agriculture should be strongly supported in the future.

CONCLUSIONS

The study presented in this paper is at the beginning, but even in this phase, it shows that the concept of circular economy is practically not known in Suceava County's economic environment. Apparently, it is a negative fact, but it can be transformed into a positive one if the local authorities and managers decide to adopt circular economy and to make efforts to adopt circularity in their decisions and actions. For future research, I intend to go deeper and design specific circles and cycles for certain industries or companies to help them to adopt the circular economy.

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