

THE CURRENT STATE OF WATER IN CIRCULAR ECONOMY IN ROMANIA

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Abstract

The circular economy approach has an increasing interest in water reuse, reclaimed water, or recycled wastewater in connection to water scarcity concerns and increased water demands by all sectors.

Given pollution and degraded ecosystems, inequity, and low numbers or, in some cases, the lack of a sustainable urban drinking water and sewerage service, in response to the closure of the water loop and to extend the life of water resources, consider water reuse, with economic costs, social and environmental benefits. Circular economy initiatives can also help attract the private sector by creating new business models, adding new funding sources. The European Union policy identifies the use of treated wastewater as one potential solution to water scarcity. The International Water Association (IWA) developed the 5Rs approach to water management – Reduce, Reuse, Recycle, Restore and Recover – for companies to consider and adopt as common practice.

This paper explores the relationship between the principles of the circular economy and sustainable water management, identifying the opportunities that are offered through applying these principles to water systems in Romania.

Key words: circular economy, water, EU policy.

INTRODUCTION

Water provides the basic needs for the population and it is the most important motor for supporting the economy through all the activities from agriculture, industry, transportation, tourism, etc. (Sandu & Virsta, 2021). Life's existence on earth depends on maintaining both the quantity and the good quality of water so it is imperiously necessary to think of new ways to use and reuse water because we are in a continuous world population growth which means increased consumption of natural resources, especially water resources (Virsta et al., 2020)

In addition to the problems related to water resources, we must also take into account the natural phenomena that can cause serious problems regarding the quality of water needed to carry out daily activities, such as: volcanic eruptions, floods, natural disasters, etc. (Ene, 2011; Global Water Partnership, 2020).

Now, 97.5% of the total amount of water covers two-thirds of the planet's surface; the rest of 2.5% is freshwater from which only 1%

is easily accessible, with much of it trapped in glaciers and polar caps (Gleick, 1996). Therefore, it can be easily understood that freshwater sources are finite and vulnerable resources and the key to solving some of the related water problems is to use the water in such ways that allow to protect in any possible ways both the quality of water and refreshing the water resources.

Many studies were made in order to show the importance of protection of water resources (Blanco et al., 2022; Calmuc et al., 2021; Crovella et al., 2020; Murariu et al., 2018; Voiculescu et al., 2011).

Society is on the verge of collapse and the effects on the environment and climate will be irreversible if current consumption patterns will continue and, therefore, will be needed to reinvent itself (Momete, 2016). This reinvention implies an authentic approach of sustainable economic growth which needs different approaches regarding efficient use of natural resources, and optimization of water uses (Momete, 2020).

The traditional linear economy is based on large quantities of cheap and easily accessible materials, energy and water and after the product is consumed it is thrown away because it was designed to have a limited lifespan in order to encourage consumers to buy it again (Virsta et al., 2020). Still, when a product reaches the end of its life, its materials can be kept and used again and again, thereby creating further value. That is why in this moment more and more producers lift back the linear economy and look forward to circular economy. An important role in circular economy and industrial development is played by water which is a fundamental need for both animal and plants life forms (Decision No 1386/2013/EU, 2013)

In the recent years, in the context of world and EU policy development regarding the circular economy, this concept has gained increasing

prominence in promoting of sustainable production and consumption and new business practices.

The European Union Action Plan for the Circular Economy was adopted for the first time in 2015 (*First circular economy action plan (europa.eu)*). In March 2020 EU adopted a new circular economy action plan (European Commission, Action Plan, 2020) Circular economy refers to a model that describes the way on how the life cycle of a product is extended. This means the producers try to find a model of production which involves “to reduce” waste to a minimum, “to reuse” materials, “to recycle” products, “to restore” and “to recover” as long as possible, in order to obtain a finite product with minimum impact on the budget, on the environment and on the human health (Figure 1).

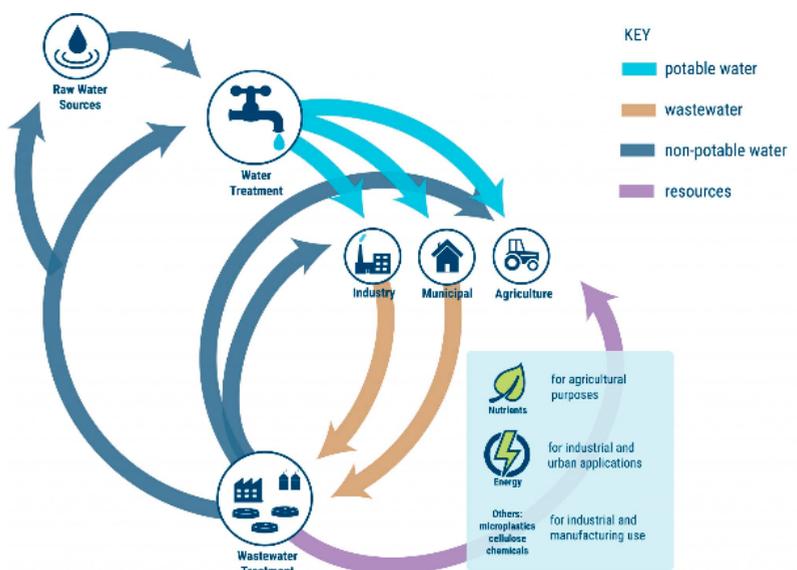


Figure 1 Water in the circular economy
 (Water in the circular economy - Water Reuse Europe (water-reuse-europe.org))

Basically, the circular economy is based on three principles: *eliminate* waste and pollution, *keep* products and materials in use and *regenerate* natural systems. It is an inclusive economic model and it is based on new ways to obtain renewable energy and materials using (digital) innovation.

By the new water reuse regulation circular approaches to water reuse in irrigation,

landscape irrigation, industrial reuse, groundwater recharge, etc. will be encouraged (European Commission, Action Plan, 2020; Pikaar et al., 2020). As a result of the actions aimed at creating circularity, the EU expects an improvement regarding the competitiveness and economic growth and decreasing the environmental impact and dependence on resources (Calisto Friant et al., 2021).

Circular Economy

Circular Economy (CE) is described by Korhonen et al. (Korhonen et al., 2018) as a topical notion with various meanings that has political support and is a “promising concept” among the business community. As this approach could lead to the exclusion of certain valences, the same authors argue that it is impossible to draw up a single definition of the circular economy.

Because of the limitation of the linear economy and the anthropogenic activity which conduct to environmental damage and climate change it is an increase interest in application of the Circular Economy (CE) objectives. The concept and the transition process of CE are different impact on perception and level of awareness of the stakeholders: researchers, economists and administration (Kevin van Langen et al., 2021).

In response to environmental issues, the transition to the CE has emerged as one of the best solutions at the same time as more sustainable global development (Cainelli et al., 2020). Also, it is a prerequisite to halt biodiversity loss and to achieve the EU’s 2050 climate neutrality target (European Commission, Action Plan, 2020).

The main objectives of CE established by EU Commission refer to reducing the pressure on natural resources and creating sustainable growth and jobs. Since 2015 when were adopted the first action plan for the CE, EU Member States try, in their own way, to achieve CE objectives. With the help of the quantitative indicators that assess the degree of transition in the implementation of CE achieved by each member state were evaluated both their actions and their impacts on it. There are studies that clearly indicate a positive correlation between the rate of the implementation of CE objectives and the socio-economic development of a specific country. For example, countries that have a strong economic development have the most developed circular economy, too (Germany followed by the Netherlands, France, and Austria). On the opposite pole, countries with less economic growth have a less rate of implementation of CE (Romania, Bulgaria). (Marino & Pariso, 2020; Stanković et al., 2021).

Different state adopted different strategies but only a few of these can be effective in achieving the CE objectives of the European Union. Although in EU implementation of circular economy is a popular concept, Romania is still in the “well-intended actions” state. However, it is necessary to specify the fact that there are projects which are developed and implemented in Romania among other EU member states such as:

- ✓ “The Danube Goes Circular” is under the Interreg MOVECO project which involved sixteen partners from the ten Danube countries. This project is a circular economy platform. (Chamber of Commerce and Industry of Slovenia et al., n.d.);
- ✓ “Circular Economy Coalition (CERC)” is a platform that promotes the key objectives of the EC Circular Economy Action Plan. CERC communicates with Romanian authorities to improve the legislative framework on circular economy and monitors both national and EU policies in the field of circular economy (Coaliția pentru Economie Circulară (economicirculara.eu)).

The Member States made efforts to shift their social and economic activities towards “circularity” and had fostered changes in the business model and labour market. A new business model and new opportunities were results from the implementation of the Reduce, Reuse, Recycle, Restore and Recover (5Rs), models that conducted to an increasing by 5% for the number of jobs linked to the circular economy in the EU, between 2012 and 2018, that means an approximatively 4 million new jobs (European Commission, Action Plan, 2020).

Water in Circular Economy

In the context in which, now, it was demonstrated that we are big consumers of water resources, the possibility of using this resource less and less and reusing it more and more must be considered. Therefore, water in the circular economy is a concept and a very current topic much discussed at European level. According to EU Action plan in circular economy, the Commission will monitor and support the implementation of the requirements of the Drinking Water Directive in order to reduce dependence on bottled water and

prevent packaging waste (European Commission, Action Plan, 2020).

The full value of water regarding its source of energy and carrier of materials or nutrients or as an input to processes, and as finite resource demonstrate the necessity of using it in a circular economic way (Delgado et al., 2021)

The main cause of water waste and, implicitly, its incorrect use is the inability to recognize the value of water. There are massive water leaks in distribution systems around the world, leaks that represent 25 to 50% of the total amount of water that is supplied to the population and which, in some cases, reach 75% (Delgado et al., 2021). These losses overlap with few and even non-existent incentives to encourage the lowest possible water consumption by the population and/or industry, agriculture, farmers, etc. In fact, in low water areas it is used more wastefully and inefficiently than in areas with more water precisely because of inadequate policies, prices and incentives (Damania, 2017).

EU policies. Romanian policies

To make Europe cleaner and more competitive, the European Commission adopted a new Circular Economy Action Plan (CEAP) in March 2020 and has a new priority – European Green Deal. CEAP is based on laws relating to waste (*Waste Framework Directive*), batteries (*Proposal for a Battery Regulation*), plastics (*Disposable Plastics Directive*) and water reuse (*Water Reuse Regulation*).

The *Waste Framework Directive* (Directive 2008/98/EC, 2020) has been issued to make clarifications that have been deemed necessary and sets out measures to protect the environment and human health. These measures are intended to prevent or reduce the negative impact of waste, the overall impact of resource use and to improve the efficiency of such use.

The European Parliament and the European Council have proposed in December 2020 a new regulation on batteries and used batteries (*Proposal for a Battery Regulation*), which is intended to repeal Directive 2006/66/EC and to amend Regulation (EU) 2019/1020 (European & European, 2020).

The *Disposable Plastics Directive* primarily aims to reduce the amount of waste generated,

gives priority to sustainable and non-toxic reusable products and reuse systems over disposable products and, most importantly, promotes circular approaches (European Council, 2019);

The *Water Reuse Regulation* is a regulation that creates a favourable framework for those Member States that want or need to practice water reuse and has stated the purpose of facilitating water reuse, regardless of the number of times this reuse is applied in a way that ensures economic efficiency (Parliament European & Council European, 2020)

All new regulations that are related to circular economy have as main subject chemicals, plastics, secondary raw materials, and sustainable development.

Thus, in addition to the Action Plan for the New Circular Economy and the First Action Plan for the Circular Economy (2015-2019), there are new strategies related to the main topics mentioned above: Chemical Strategy for Sustainability, Zero Pollution Action Plan, Biodiversity Strategy for 2030, Plastics Strategy, Critical Raw Materials Action Plan, New Industrial Strategy.

In 2008, one year after Romania's accession to the EU, the Romanian Government approved the National Strategy for Sustainable Development "Horizons" 2013-2020-2030 and in 2016, the Romanian Senate adopted a decision certifying Romania's openness to the circular economy model and declaring the Romanian state's intention to build a legislative framework to support this model.

The National Strategy for Sustainable Development "Horizons" 2013-2020-2030 proposed practical objectives for the transition to sustainable development. The results obtained had to be reflected in an economic growth that would significantly reduce the economic gaps between Romania and the other EU member states.

In the Horizon Strategy for the period 2013-2020-2030, the following specifications can be made (Târțiu et al., 2019):

- ✓ a report on the state of implementation of the strategy adopted in 2008 is still not yet available
- ✓ In order to monitor the National Strategy, 13 sustainable development indicators applicable at national level and 10 territorial

sustainable development indicators were developed;

- ✓ to align with the 2030 Agenda for Sustainable Development, in 2018 a process of revision of the National Sustainable Development Strategy began under the direct supervision of the Department for Sustainable Development within the Romanian Government.

So far, in Romania, the following pieces of legislation have been adopted:

- ✓ Law no. 211/2011 on waste management (based on the Waste Directive 2008/98 / EC (Waste Framework Directive),
- ✓ Law no. 249/2015 on the management of packaging and packaging waste (based on Directive 94/62 / EC),
- ✓ Law no. 2012/2015 on vehicle management (this is the result of the transposition of Directive 2000/53 / EC),
- ✓ GEO (Government Emergency Ordinance) no. 5/2015 on waste electrical and electronic equipment (Directive 2012 / 19 / EU) - with subsequent amendments.

One of the concrete actions undertaken by the Romanian Government meant to consolidate and promote the implementation of the EC is to participate in the meeting of the Visegrad + 4 group (Informare de presă - Participarea delegației Ministerului Mediului la cea de-a 5-a Conferință a Părților la Convenția - cadru privind protecția și dezvoltarea durabilă a Carpaților (Convenția Carpatică) | Ministerul Mediului (mmediu.ro)).

The current state in Romania

The incidence of water in circular economy is known in Romania, here are some facts to prove this statement:

- In 2012 an independent non-governmental association has been established as “The Institute for Research in Circular Economy and Environment “Ernest Lupan” – IRCEM, through an initiative of the Technical University of Cluj-Napoca. In 2017, IRCEM/CIOS became the official partner in the Circular Economy Platform of Stakeholders (ECESP) from the European Economic and Social Committee of the European Commission. More information about this subject can be found on IRCEM.RO or

<https://circulareconomy.europa.eu/platform/en/dialogue>.

- IRCEM implemented the project “Romania’s strategy for the transition to a circular economy (ROCES) 2020-2030”, aiming to define the pillars which will support Romania’s transition to a circular economy by involving all relevant stakeholders (i.e., civil society, public administration, industry, academics, social infrastructure), and by attracting the necessary financial support. The study aimed to collect all the opinions from relevant actors on the level of penetration of the circular economy in terms of regional collaboration, such that we achieve our vision of Romania being a leader in Central and South-East Europe in the circular economy.

- Aquademica Foundation, <https://aquademica.ro/open-source-aqua-circular-2020/>, uses an open-source approach, to create, socialize and globally disseminate solutions for building local circular economies. Aqua Circular On-line Conference 2020 promoted the innovative solutions for all the interested stakeholders in Western Romania, but also from neighbouring regions of Hungary and Serbia. The main purpose of the conference was to organize the frame for matching demand and supply in the circular water sector, with the aim to improve the competitiveness of local stakeholders within the regional water market. The conference was an innovative mixture of circular water project presentations and debates, with the aim of creating business opportunities in regional markets and building strong partnerships among regional water operators, decision makers and technicians from regional utilities, local industry and agriculture, local start-ups, regional universities and R&D centers, technology providers, local and central administrations. In October 2021, a new conference, organized on-line, with the same topics regarding water and circular economy (<https://aquademica.ro/conferinta-internationala-aqua-circular-2021-un-eveniment-stiintific-timisoarean-de-anvergura/>).

- Conditions for Circular Water Solutions - NextGen Water project, 2018-2022 - partners from 9 EU countries plus Romania - City of Timisoara - AQUATIM - (Horizon 2020) - for Timisoara - with technologies for Sludge management with production of by products

and/or energy and Reuse of effluent for urban industrial and agricultural applications.

- NanoTermo - Patented technology for the circular economy. Increasing the efficiency and reducing the operating costs of existing and new, small, and medium treatment plants, by KEMATRONIC SRL, Romania.

- Interesting article on “Industrial Symbiosis through the Use of Biosolids as Fertilizer in Romanian Agriculture”, elaborated in 2021, and published in *Recycling* 2021, <https://www.mdpi.com/journal/recycling>, showing the application of Biosolids enhancing soil fertility and crop yield in amended soils. Still, “the characteristics of the biosolids must be controlled and monitored to minimize the potential impact on the environment and human health. At the same time, the characteristics of the land must be monitored too, in order to receive the permit for biosolids’ use in agriculture. Additionally, Romanian legislation prohibits the use of sludge in vegetable and fruit crops growing in shrubs, vines, pastures and restricts the use of sludge in orchards. The use of sewage sludge is profitable also from the point of view of the savings it assumes. Thereby, at the country level, if all the sludges had been used in agriculture, the fertilizer replacement value would be worth the equivalent of about 3 million Euros for 2018 only and 2.9 million Euros for 2019. Moreover, water suppliers can achieve exceptional savings if they avoid discharge of sewage sludge at landfills. In this way, the water operators can maintain their operational costs at lower levels.”

- In the Operational Program for Sustainable Development under Priority Axis 2: Development of water and wastewater infrastructure and the transition to a circular economy, projects and investments would be implemented.

- In the National Recovery and Resilience Plan, under the Component 1 - Water Management, projects and investments would be implemented for water in connection with the circular economy.

- on the website of the Romanian Water Association, in the section dedicated to members, there are monthly newsletters, in which a special section is dedicated to the topic on circular economy, with news on research

and findings regarding national and international best practices.

CONCLUSIONS

An analysis of several basic, internal macroeconomic indicators was made following which it was found that at the level of "absorption" of the circular economic model "Romania is the least performing economy in the European Union" and "uses more and more natural resources, but it produces low economic value" (Is Romania prepared for the circular economy? (green-report.ro)).

Thus, regarding water, in the same analysis, it is specified that Romania "is again on the last place in Europe, producing an economic value of 10 euros for every m³ of water extracted from the natural environment".

In Romania, the very poor performance in terms of water productivity is the direct result of public policies in the field of water resources management, policies which, as they are presented, encourage excessive use of water to the detriment of the economy of this precious resource (Vermeşan et al., 2020).

Therefore, the efforts to implement the principles of the circular economy must be intensified so that the 5 Rs (*Reduce, Reuse, Recycle, Restore and Recover*) can be applied in Romania to a greater extent. In this regard, lessons of good practice can be considered from other EU Member States with experience in implementing the objectives and applying the principles of the CE. The involvement of specialists and the education and training of new specialists in the field of water and the CE is a key factor that could make, in Romania, a faster and better implementation of European directives of this domain than it is made today.

It is also necessary for the Romanian authorities, responsible for issuing legislative acts in the field of water protection, to draft a package of laws through which the European directive on water reuse can be implemented in Romania.

In addition, in order to make a better transition to a CE, this paper addresses the need for public policy development in which the results of scientific research in the field of water are intertwined with the legislative, economic, social, and educational components.

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REFERENCES

- Blanco, E., Raskin, K., & Clergeau, P. (2022). Towards regenerative neighbourhoods: An international survey on urban strategies promoting the production of ecosystem services. *Sustainable Cities and Society*, 80(September 2021), 103784. <https://doi.org/10.1016/j.scs.2022.103784>
- Cainelli, G., D'Amato, A., & Mazzanti, M. (2020). Resource efficient eco-innovations for a circular economy: Evidence from EU firms. *Research Policy*, 49(1), 103827. <https://doi.org/10.1016/j.respol.2019.103827>
- Calisto Friant, M., Vermeulen, W. J. V., & Salomone, R. (2021). Analysing European Union circular economy policies: words versus actions. In *Sustainable Production and Consumption* (Vol. 27, pp. 337–353). <https://doi.org/10.1016/j.spc.2020.11.001>
- Calmuc, V. A., Calmuc, M., Arseni, M., Topa, C. M., Timofti, M., Burada, A., Iticescu, C., & Georgescu, L. P. (2021). Assessment of heavy metal pollution levels in sediments and of ecological risk by quality indices, applying a case study: The lower danube river, romania. *Water (Switzerland)*, 13(13). <https://doi.org/10.3390/w13131801>
- Chamber of Commerce and Industry of Slovenia, And, M. of the E., & Spatial Planning, R. of S. (n.d.). *The Danube goes circular- Transnational Strategy to Accelerate Transition Towards a Circular Economy in the Danube Region*.
- Coaliția pentru Economie Circulară (economiecirculara.eu)
- Crovella, T., Paiano, A., Lagioia, G., Stanković, J. J., Janković-Milić, V., Marjanović, I., Janjić, J., Chen, Z., Huang, L., Petrescu-Mag, R. M., Petrescu, D. C., Azadi, H., Momete, D. C., Predeanu, G., Slăvescu, V., Bălănescu, M., Dorina Mihalache, R., Mihaly, M., Marin, A. C., Czirok, L. (2020). Optimizing the Methodology of Characterization of Municipal Solid Waste in EU under a Circular Economy Perspective. *Journal of Cleaner Production*, 136(June), 124132. <https://doi.org/10.1016/j.jclepro.2021.100150>
- Damania, R. (2017). Uncharted Waters The economics of water scarcity and variability. In *Oxford Review of Economic Policy* (Vol. 36, Issue 1). <https://doi.org/10.1093/oxrep/grz027>
- Decision No 1386/2013/EU. (2013). Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 “Living well, within the limits of our planet.” *Official Journal of the European Union*, 1600, 171–200. <http://eur-lex.europa.eu/legal-content/en/txt/pdf/?uri=celex:32013d1386&from=en>
- Delgado, A., Rodriguez, D. J., Amadei, C. A., & Makino, M. (2021). Water in Circular Economy and Resilience (WICER). *International Bank for Reconstruction and Development / The World Bank*.
- Directive 2008/98/EC. (2020). Directive 2008/98/EC of the European Parliament and of the Council. *Fundamental Texts On European Private Law*, 3–30. <https://doi.org/10.5040/9781782258674.0028>
- Ene, S. A. (2011). *Studii privind amprenta ecologica a apei si aplicatii in managementul integrat al resurselor de apa - rezumay teza doctorat*.
- European Commission, Action Plan, 2020 a. (2020). Circular Economy Action Plan. In *Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions*.
- European Council. (2019). *Directive 2019/904 of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment*. 2019(March), 1–19. <https://www.plasticseurope.org/en/resources/publications/1689-working-together-towards-more-sustainable-plastics%0Ahttps://www.plasticseurope.org/en/resources/publications%0Ahttps://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0904&from=EN>
- European, P., & European, C. (2020). Proposal for a regulation of the EUROPEAN PARLIAMENT and of the EUROPEAN COUNCIL concerning batteries and waste batteries. *European Commission*, 0353(2019). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020PC0798>
- First circular economy action plan (europa.eu)
- Gleick, P. H. (1996). Basic water requirements for human activities: Meeting basic needs. *Water International*, 21(2), 83–92. <https://doi.org/10.1080/02508069608686494>
- Global Water Partnership. (2020). *GWP in Action: 2020 Annual Report*. <https://gwp.org/annualreport2020-green-report.ro>
- Informare de presă - Participarea delegatiei Ministerului Mediului la cea de-a 5-a Conferință a Părților la Convenția - cadru privind protecția și dezvoltarea durabilă a Carpaților (Convenția Carpatică) | Ministerul Mediului (mmediu.ro)
- Kevin van Langen, S., Vassillo, C., Ghisellini, P., Restaino, D., Passaro, R., & Ulgiati, S. (2021). Promoting circular economy transition: A study about perceptions and awareness by different stakeholders groups. *Journal of Cleaner Production*, 316(June), 128166. <https://doi.org/10.1016/j.jclepro.2021.128166>
- Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular Economy: The Concept and its Limitations. *Ecological Economics*, 143, 37–46. <https://doi.org/10.1016/j.ecolecon.2017.06.041>

- Marino, A., & Pariso, P. (2020). Comparing European countries' performances in the transition towards the Circular Economy. *The Science of the Total Environment*, 729, 138142. <https://doi.org/10.1016/j.scitotenv.2020.138142>
- Momete, D. C. (2016). Building a sustainable healthcare model: A cross-country analysis. *Sustainability (Switzerland)*, 8(9). <https://doi.org/10.3390/su8090836>
- Momete, D. C. (2020). A unified framework for assessing the readiness of European Union economies to migrate to a circular modelling. *Science of the Total Environment*, 718, 137375. <https://doi.org/10.1016/j.scitotenv.2020.137375>
- Murariu, G., Murariu, A. G., Iticescu, C., Timofii, M., & Georgescu, L. (2018). Investigation of water quality state dynamics of danube river in the eastern part of Romania. *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM*, 18(1.5).
- Parliament European, & Council European. (2020). Regulation (EU) 2020/741, Minimum requirements for water reuse. *Official Journal of the European Union*, 177/33(May 2020), 32–55.
- Pikaar, I., Guest, J., Ganigué, R., Jensen, P., Rabaey, K., Seviour, T., Trimmer, J., Kolk, O. Van Der, Vaneckhaute, C., & Verstraete, W. (2020). *Resource recovery*.
- Sandu, M.A., & Virsta, A. (2021). *The water footprint in context of circular economy*. 10(2).
- Stanković, J. J., Janković-Milić, V., Marjanović, I., & Janjić, J. (2021). An integrated approach of PCA and PROMETHEE in spatial assessment of circular economy indicators. *Waste Management*, 128, 154–166. <https://doi.org/10.1016/j.wasman.2021.04.057>
- Târțiu, V. E., Ștefănescu, M., Petrache, A.-M., & Gurau, C. R. (2019). *Tranziția către o economie circulară. De la managementul deșeurilor la o economie verde în România Autori*. www.ier.gov.ro
- Vermeșan, H., Mangău, A., & Tiuc, A. E. (2020). Perspectives of circular economy in Romanian space. *Sustainability (Switzerland)*, 12(17), 1–29. <https://doi.org/10.3390/SU12176819>
- Virsta, A., Sandu, M.A., & Daraban, A.E. (2020). Dealing with the transition from in line economy to circular economy - public awareness investigation in Bucharest. *Agrolife Scientific Journal*, 9(1), 355–361.
- Voiculescu, M., Georgescu, L. P., Dragan, S., Timofii, M., & Caldaru, A. (2011). Study of anthropogenic effects on the quality of the lower Prut river. *Journal of Environmental Protection and Ecology*, 12(1).