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CONNECTING CIRCULAR INNOVATION ECOSYSTEMS THROUGHOUT EUROPE AND MOLDOVA

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Abstract
While easing its Euro-integration process, Moldova has increasingly placed importance on the adoption of circular economy practices as a means for achieving sustainability. The circular economy model, which prioritizes efficient use of resources, gives credence to the idea of reducing waste and is in line with the other initiatives implemented by the EU under the umbrella of sustainability. In this paper, we seek to address the issue of Moldova's membership in the European Union's (EU) Circular Innovation Ecosystems (CIEs) in particular how membership in these ecosystems influences Moldova's circular economy projects. The study employs qualitative methodology and utilizes data from EU-funded programmes, policy frameworks, and interviews with stakeholders based in Moldova and the EU. The overall aim of this study is to understand the status of Moldova, from the perspective of the CIE, its accomplishments, and the hurdles it has to overcome on the way toward becoming more open to an innovative economy. So far, the evidence indicates that Moldova has efficiently worked to bring her national regulatory regimes closer to that of the EU, securing financing for circular economy policies, and strengthening ties with EU states. Moldova has benefited from the regional policy, in particular, the Neighbourhood, Development, and International Cooperation Instrument – Global Europe, and in 2023 150 million Euros were allocated for energy security and environmental protection. In the same fashion strong ties with Romania and Germany have facilitated the flow of circular technologies into the country. This transition would ensure progressive and evolving growth of the economy, environmental protection, and better quality of life for individuals. Improving engagement among end users and managing operational hurdles help enhance Moldova's coherence with EU CIEs and accelerate change in the economy in the direction of circular.

Keywords: Circular Economy, Innovation Ecosystems, Moldova, EU Integration, Sustainable Development, Comparative Advantage, Stakeholder Collaboration

JEL Classification: F10, F18, F63, F21, F59, O19

1. Introduction

The irresponsible consumption of resources, degradation of the environment, and climate change particularly in the European landscape have contributed to the demand to accelerate the changeover to a circular economy. Assessing that as an imperative for change, the EU felt obliged and made considerable progress in building circular innovation ecosystems that engage businesses, researchers, and policymakers. With its distinct geo-strategic setting and economic challenges, Moldova needs to get a chance to fit into this European network and make use of the principles of the circular economy for sustainable growth and development.

The circular economy paradigm represents an evolution from a linear model of "take-make-dispose" to a model that is regenerative, efficient, and desirably zero-waste in nature, where the basic principle is to keep resources in use for as long as possible and avoid new extraction. This includes redesigning existing products and business models, encouraging recycling, repair, and reuse of products, and innovating in resource efficiency in the ecosystem.

Moreover, a CIE is supported by conducive investment policies and governance frameworks that encourage sustainable practices and enhance collaboration among diverse actors. This comprehensive approach aspires not only to drive economic development and innovation but also to promote social equity and environmental sustainability, thereby contributing to a robust and adaptive economic structure that emphasizes long-term value creation over immediate profit maximization.

In the European Union (EU), circular innovation ecosystems have been a key focus of policy and action in recent years. The EU's Circular Economy Action Plan outlines a comprehensive strategy to transition towards a more circular economy, emphasizing the importance of innovation and collaboration (European Commission, 2020)

Circular Innovation Ecosystems (CIEs) are collaborative networks of organizations that work together to promote circular economy principles and practices. By fostering innovation, resource efficiency, and minimizing waste, they have established a reputation for being of great importance to the transition.

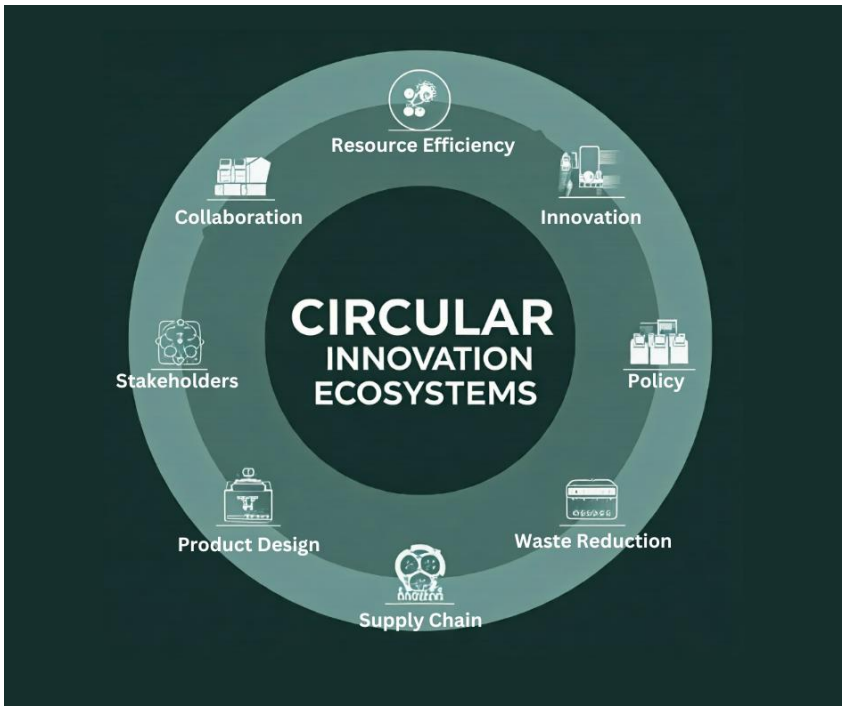

Figure 1: Circular Innovation Ecosystems

Source: Elaborated by the Author based on Bertassini, L., Gardetti, M. A., & Iraldo, F. (2023)

The Circular Innovation Ecosystems (CIEs) have these essential elements that are interconnected and interdependent, and their effective interaction is crucial for their progress and success. As illustrated in Figure 1, by fostering collaboration, innovation, resource efficiency, and waste reduction, CIEs can contribute to a more sustainable and resilient future across the European continent

Here's how the eight key elements of CIEs interact:

1. Stakeholders:

● Stakeholders collaborate to share knowledge, resources, and best practices, leading to more effective circular economy initiatives.
● Stakeholders work together to identify and develop innovative solutions to circular economy challenges.
● Stakeholders influence the development and implementation of policies and regulations supporting circular practices.
2. Collaboration:
● Collaboration facilitates the exchange of knowledge and expertise among stakeholders, leading to better decision-making and problem-solving.
● Collaborative efforts can optimize resource utilization and reduce waste.
● Collaboration can foster innovation by bringing together diverse perspectives and expertise.
3. Innovation:
● Incorporating circular design principles into the product development process significantly enhances the potential for achieving sustainability throughout the product's life cycle.
● The adoption of design strategies that prioritize reuse, repair, and recycling leads to optimization in circular design systems.
● Innovative technologies encompass energy-efficient manufacturing practices and intelligent material usage strategies
4. Resource Efficiency:
● Innovative technologies, whether they are physical, chemical, or digital, can enhance the efficiency of waste management processes, including composting, recycling, and energy recovery.
● Circular design principles promote the enhanced recovery of materials and the creation of more resource-efficient products
5. Waste Reduction:
● Circular design aids in conceiving products in such a manner that less material and energy are needed.
● Through design for ease of disassembly and recyclability, the circular principles contribute significantly to waste minimization
● This approach can foster the development of new products and business models, as it allows for a broader scope of design possibilities
6. Product Design:
● This approach emphasizes a commitment to eschewing the production of goods intended for rapid consumption, which adversely affects the environment, in favor of more resource-efficient alternatives.
● By minimizing material and energy usage during the design phase, products can attain a more sustainable nature.
● Moreover, designing products with considerations for easy disassembly and recyclability, as well as for repairability, can significantly reduce waste.
● Circular design acts as a driving force for innovation, encouraging the development of novel product concepts and business models.
7. Supply Chain Management:
● Good supply chain management helps in minimizing waste and optimizing the use of available resources.

- Active engagement of every player in the supply chain is an important requirement for the success of circular practices.
- Emerging tools can also be applied in supply chain management to disrupt waste generation.

8. Policy and Regulatory Framework:

- Policies and regulations if well structured can encourage industries to practice circularity.
- Breaking the regulatory obstacles could potentially increase the support for the implementation of many proposed circular economy activities.
- Policymakers can seek the engagement of various stakeholders in designing appropriate policies to enhance the circular economy.

After completing the discussion of the elements, it is essential to appreciate the different types of CIEs that exist, each having a distinctly defined scope and constituency. The key typologies of CIEs were captured in the figure 2, elaborated by the author based on the references, which include:

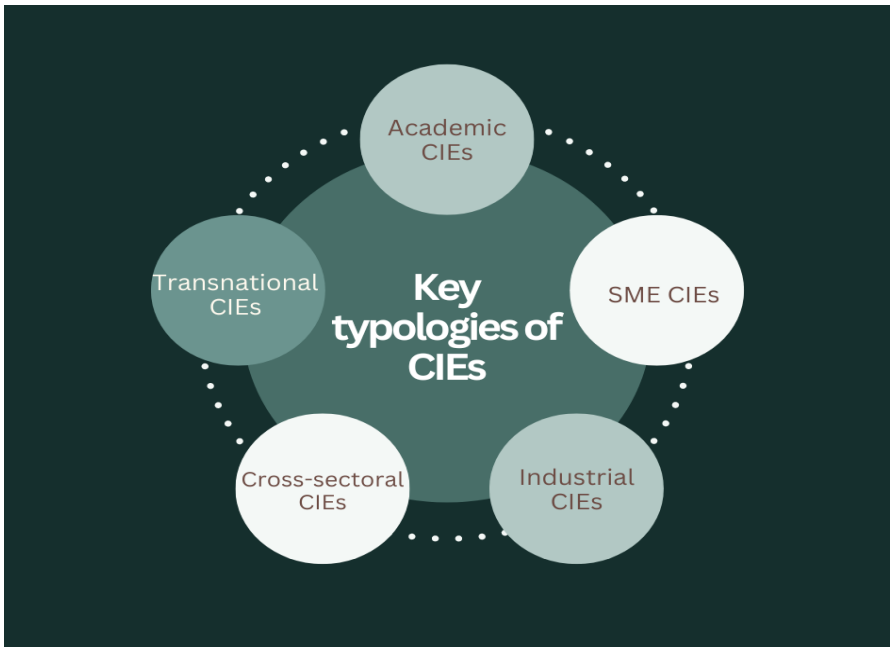

Figure 2: Key Typologies of CIEs

Source: Elaborated by the author based on the European Commission's 2015 Circular Economy Package, 2020 Green Deal, 2021 Action Plan, 2023 Stakeholder Platform, and TEXDAN's 2024 initiative.

Key typologies of CIEs:

- **Academic CIEs:** These ecosystems are centered around universities and research institutions, focusing on developing knowledge, conducting research, and educating future generations about circular economy principles. Among exemplary models are the Circular Economy Centre at the University of Cambridge and some initiatives are run with the support of the Technical University in Moldova
- **SME CIEs:** These ecosystems involve clusters of small and medium-sized enterprises collaborating on circular initiatives like resource sharing, innovative product design, and joint marketing strategies. Forefront runners establishing good practices and funding circularity shifts of businesses are West Midlands Combined Authority (WMCA) with their Community Environment Fund, Circular Economy Hub in Eindhoven, Netherlands of the Eindhoven University of Technology and Moldova joining the EU LIFE program allows for funding of SMEs in their process of becoming more circular and sustainable.

- **Industrial CIEs:** Large companies form the core of these ecosystems, working with suppliers, customers, and research institutions to implement circular practices within their supply chains and production processes. One of the large corporations that have assumed the transition is IKEA, stating that they commit to "secure the future of the IKEA business and value chain, and the livelihoods of the millions of people that contribute to it."
- **Cross-sectoral CIEs:** These ecosystems encompass a diverse range of stakeholders, including businesses of all sizes, research institutions, government agencies, and NGOs, working collaboratively to develop comprehensive regional or national circular economy strategies. Circular Copenhagen's commitment to working collaboratively with all key stakeholders, both national and international, in industrial and academic settings, to help support this shift to circularity and sustainability makes it a role model for other CIEs.
- **Transnational CIEs:** These ecosystems involve collaboration across national borders, bringing together stakeholders from different countries to address shared challenges and opportunities. These can develop a variety of forms be it around a value chain such as TEXDAN (TEXDAN, 2024), which is a transnational CIE focused on promoting circularity in the textile and fashion value chain or the European Circular Economy Stakeholder Platform (EC,2023) set up as "a joint initiative by the European Commission and the European Economic and Social Committee (EESC) in March 2017" is focused on circular economy promotion throughout the European continent.

These typologies of CIEs demonstrate the diverse range of approaches and stakeholders involved in driving the transition to a circular economy. By understanding these different types of ecosystems, policymakers, businesses, and other stakeholders can identify the most appropriate models for their specific needs and goals.

The EU as a Catalyst for CIE Development

A key driver of CIEs has been the EU's comprehensive Circular Economy Action Plan, which outlines a strategic roadmap for transitioning to a circular economy. This plan has provided a clear direction and set ambitious targets for reducing waste, promoting resource efficiency, and fostering innovation. Accordingly, Table 1 examines notable policies that foster CIEs in the European Union, revealing how complex it has been to implement circular economy principles.

Table 1: Drivers for CIE development in the European Union

Drivers	Description
Circular Economy Action Plan	Outlines a strategic roadmap for transitioning to a circular economy.
Waste Management Legislation	Encompasses regulations like the Waste Framework Directive, Packaging and Packaging Waste Directive, and End-of-Waste Regulation.
Product Policy	Promotes sustainable product design, ecodesign requirements, extended producer responsibility, and the right to repair.
Resource Efficiency	Encourages measures to improve resource efficiency in energy, water, and materials.
Financial support	Offers various support mechanisms for SMEs and industrial symbiosis
Research and Innovation	Supports research and development through programs like Horizon Europe.
Capacity Building	Promotes the development of circularity and sustainability professionals in different
International Cooperation	Collaboration among nations is facilitated through the sharing of knowledge.

Source: Elaborated by the author based on the mentioned EU legislation and Alberich, J. P., 2022

When the Circular Economy (CE) is viewed from the lens of policy areas (Alberich, J. P., 2022), it is evident that other policy frameworks such as this may help implement CE by reconstructing the regular processes:

- **Waste Management Frameworks:** To ensure the minimization of waste and maximization of recycling and recovering activities, proper waste management frameworks are within the CE approaches as needed for a resilient Europe. The European Union (EU) has introduced key policies, including the Waste Framework Directive (Directive 2008/98/EC), the Packaging and Packaging Waste Directive (Directive 94/62/EC), and the End of Waste Regulation (Regulation No. 333/2011), which aim to encourage recycling, reuse, and the prevention of waste (European Commission, 2020a). Furthermore, the Circular Economy Package (2015) obliges member states to take all necessary steps to meet constitutional goals for increasing the recycling rate and promotes measures for the prevention of waste generation through sustainable management of waste (European Commission, 2015). Together these frameworks intend to adjust waste management systems to be more sustainable, less dependent on landfilling, and more effective in resource recovery.
- **Product Policy Frameworks:** The EU has put in place substantial policies that promote the designing and making of sustainable goods. Policies like the New Circular Economy Action Plan (2020) stress the importance of the sustainability of every product throughout its lifecycle starting from the design stage (European Commission, 2020b). The Sustainable Products Initiative (2021) complements this even more by adding more requirements to products under importation to the EU so that they do not adversely affect the environment and promote CE's aims (European Commission, 2021). Ecodesign requirements, extended producer responsibility schemes and the right to repair stimulate technology development and push companies to be more environmentally conscious about their product design and development.
- **Resource Efficiency Frameworks:** Resource efficiency is fundamental to the EU's transition towards a CE, as has been formulated in the European Green Deal of 2019. This approach highlights the role of decreasing resource use and enhancing environmental measures in different sectors for climate neutrality (European Commission, 2019). Further, the EU Biodiversity Strategy for 2030 containment of resources emphasizes their efficient use and ecosystems' conservation, which makes this equally in consonance with the CE objectives (European Commission, 2020c) . Energy efficiency authority in various industries is bolstered through directives like the Energy Efficiency Directive (Directive 2012/27/EU) and Water Framework Directive (Directive 2000/60/EC) which promote efficiency for energy and water consumption which are crucial for resilience and sustainability in various industries.

Collectively, the three frameworks represent a toolkit that can be utilized to enhance waste management practices, foster sustainable product development, harmonize resource efficiency on all volumes, and target the EU states with the transition towards a circular economy.

Besides these policy frameworks, the EU has also made a notable contribution to research and innovation efforts related to the circular economy. The financial support for the initiatives related to the circular economy has been made available through various funding schemes. Circular technologies research and development are funded under Horizon Europe whereas the European Regional Development Fund finances projects concerning the circular economy at the regional level. The Cohesion Fundis oriented towards less developed areas of the EU and aims at promoting

environmental protection and balanced growth. It is such funding mechanisms that contribute greatly to the development of CIEs across Europe.

The above-mentioned instruments have also contributed to capacity building in the circular economy through various initiatives, including training programs, knowledge-sharing platforms, and research projects, contributing to a strong foundation for circular economy initiatives across Europe

Since 2011, the EU has established an activity on a number of issues relating to the circular economy in the international cooperation context involving both countries of the EU and other countries. In doing so, knowledge and practices would be combined, and under the aegis of EU countries circular economy principles would be fostered, including global collaboration networking creating an opportunity for addressing the circular economy agenda.

The lion's share of work done by the EU in addressing the issues of circular economy can be attributed to its broad policy of expansion of CIEs across the European continent. The cohesion of the EU's policy framework, provision of financial allocation, implementation of research and innovative activities as well as achieving international ties have connected the dots for the businesses and other entities to embrace circularity and make the world more sustainable.

Methodology

To analyze the effectiveness of circular economy policies in landscaping within the TEXDAN project, the author conducted a document analysis with surveys and interviews to assess the performance of circular economy initiatives. To that end, an analysis of the selected policy frameworks, reports, and strategic documents related to the TEXDAN project and circular economy in Moldova was conducted. To empirically capture the experiences, challenges, and perceptions of SMEs on circular initiatives, they were sampled and surveyed for the quantitative aspect of the study. Furthermore, semi-structured interviews were held with major target respondents of the Ministry of Environment, the SME Agency, and selected non-profit organizations involved with circularity promotion. This triangulation was meant to investigate how the existing policies and the views of different stakeholders, including circular economy policymakers, would increase the potential for partnership among the various sectors. This Multi-dimensional analysis therefore provides insight into the role of policy, practice and stakeholders in the implementation of circular economy initiatives in Moldova.

Moldova's Circular Economy Journey: Findings and Conclusions

Moldova's participation with the European Union's (EU) Circular Innovation Ecosystems (CIEs) has catalyzed a transformation in perspectives, fostering essential support for the progression of circular economy initiatives. Through its active involvement in EU-funded projects, partnerships with European stakeholders, and the alignment of national regulations with EU standards, Moldova has garnered substantial knowledge, expertise, and resources for furthering its circular economy agenda.

Findings

- Moldova has done quite well in terms of obtaining finances for its circular economy programs. Bringing itself into compliance with EU standards and growing economically and politically is a clear demonstration of its intent to harmonize with them. Having become a candidate country in June 2022, Moldova has already benefited from specific EU-funded tools such as the Neighbourhood, Development and International Cooperation Instrument -Global Europe (NDICI-Global Europe), which provided 150 million Euros of financing for energy security and environmental protection in 2023.

- With most EU member states, especially Romania and Germany, Moldova has built up strong bilateral relations that influence joint efforts and the transfer of circular economy emerging technologies (ET) practices. Programmes such as TAIEX and Twinning have added to the unblocking of bottlenecks in the administrative dimension of cooperation and implementation of the EU's legislative framework and best practices.
- Most of the activities that Moldova undertook like building networks with the Circular Economy Network and the EU Environment Program made it possible to build up the country's capacity, expose it to best practices, and foster environmental governance. These networks assisted Moldovan SMEs in implementing Resource Efficient and Cleaner Production (RECP) methodologies increasing competitiveness and sustainability.
- As a result of partnerships with universities from the EU, Moldova has been able to promote such research and innovations as the circular economy which complements social capital and social knowledge. These partnerships are reinforced by the strategic placing of Moldova in projects such as the one under the LIFE Programme on 'Circular Economy and Quality of Life' which deals with environmental and climate-related projects
- Moldova's attempt to bring into coalescence its regulatory framework with those of the EU such as the Green and Circular Economy Promotion Program for years 2024-2028 has enabled the country to practice and integrate sustainable business operations and increased penetration into EU markets. Recently, initiatives like the European Commission Growth plan of €1.8 billion for Moldova have been able to further emphasize its commitment to reforms and development of projects under circular economy concepts.

Moldova's links with Europe's circular innovation ecosystems (CIEs) allow the country to leverage valuable resources and expertise by strengthening these links and using effective strategies Moldova can significantly accelerate the transition to a circular economy.

As part of national development plans and policies, Moldova should prioritize initiatives related to the circular economy. Because it provides strategic forecasts regarding future independence from external resources. Investing in infrastructure and technology can create additional benefits for adopting circular practices, such as waste management facilities. Renewable energy sources for optimal management to drive innovation and a supportive environment for circular economy initiatives across government, business and academia. and civil society organizations. Working together across government, businesses, universities, and civil organizations is key to encouraging innovation and supporting circular economy efforts. Advocating for the benefits of a circular economy and getting consumers involved is crucial for increasing demand for circular goods and services. Finally, it is essential to continuously monitor progress and adapt strategies to ensure effective implementation and address emerging issues

In conclusion, moving towards a circular economy environment as such has several competitive advantages for Moldova:

- Sustainable Development – Creates opportunities to reduce waste and pollution, and develop and conserve energy and resources.
- Economic Growth – Creating opportunities for new businesses, jobs, and revenue streams in different sectors of the economy.
- Improved competitiveness – Enhancing competitiveness on a global level with the help of innovative and newer versions of circularity.

● Improved Quality of Life – The effect on the citizens when on economy increases so does other measures such as pollution and environmental quality.

By forcefully implementing the above measures, Moldova would be at the forefront of the global circular economy and derive all the advantages that a sustainable economy boasts of such as economic growth, environmental development, and improved standards of living for her citizens.

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