CIRCULAR ECONOMIC CONCEPT: CONTRIBUTION TO MACROECONOMIC GROWTH

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ABSTRACT

In the context of deepening global environmental challenges and the depletion of natural resources, there is an urgent need to find alternative options for ensuring the sustainable development of the world economy and individual countries in particular. The aim of the study is to identify the macroeconomic efficiency of the circular economy and to substantiate its impact as a factor of sustainable growth. The research methods include empirical analysis, monographic and graphical analysis, correlation analysis, cluster analysis, scientific hypotheses and abstraction, analysis and synthesis. The theoretical foundations of the circular economy were analyzed and its differences from the linear economic model were identified. The relationship between the implementation of circular practices and key macroeconomic indicators was studied using the example of EU countries (2014-2023) and Ukraine (2010-2023). International experience in integrating the circular economy into the macroeconomic policy of individual countries was assessed. The main factors of economic efficiency of circular models at the global level and in individual countries, particularly in the context of modern challenges and threats, have been identified and substantiated. It has been established that the economic efficiency of circular models in the world and in individual countries depends on resource efficiency, innovation, state regulation, international cooperation, adaptation to challenges, human capital development, financial support, and the environmental culture of society.

Keywords: macroeconomics, green investments, gross domestic product, circularity, efficiency, economy, enterprise, digital economy, information technology, human resources, digital technologies, smart economy, digital tools, information systems.

INTRODUCTION

Against the backdrop of escalating global environmental challenges, growing resource constraints, and increasing demands for sustainable development, new economic models focused on ensuring long-term growth through more efficient use of resources are becoming increasingly important. Countries with higher levels of circular economy

practices demonstrate better environmental performance, better resource efficiency, and reduced environmental degradation. The linear economic model is being replaced by the circular economy, which offers a systematic approach to minimizing waste, optimizing resource flows, and stimulating innovation. Prioritizing innovation in the circular economy contributes to balancing the negative impact of fossil fuels and sustainable economic growth (Zhang, 2024). Research into the macroeconomic efficiency of the circular economy contributes to a renewed systematic analysis of definitions and conceptualizations of the problem, which serves as an empirical description of current scientific thinking. This provides a basis for further research into whether conceptual consolidation is needed and how this can be facilitated for practical purposes (Kirchherr et al., 2023).

Researchers emphasize the need to expand the database on reuse and shared consumption, as well as the importance of studying the impact of repair and remanufacturing in different regional contexts (Knäble et al., 2022). New technologies, especially digital technologies within digital and, all the more so, smart economy landscape, create economic and environmental opportunities through efficiency gains and innovation, but require overcoming challenges of integration, transparency, skills, and regulatory adaptation, which determines the directions for further research (Sánchez-García et al., 2023). Scientific and theoretical approaches to the interpretation and significance of the circular economy in the modern economic environment are considered (Frodermann, 2018).

Despite the active implementation of circular strategies in the world's leading economies, the issue of their macroeconomic efficiency and role in ensuring economic growth remains underdeveloped in the scientific literature. The circular economy is seen as a sustainable alternative to the linear model of production and consumption. The advantages and barriers to implementation have been identified, and the need for the development of environmental innovations, new business models for enterprises, and mechanisms for closing resource flows has been outlined. The study emphasizes the importance of raising awareness and collective action by businesses for the successful integration of circular practices (Herrero-Luna et al., 2021; Herrero-Luna et al., 2024). Existing studies mainly focus on the microeconomic level or on the analysis of individual sectors. Therefore, a comprehensive analysis of the circular economy as a driver of macroeconomic growth is relevant, which will deepen the theoretical understanding of this phenomenon and provide practical guidelines for the formation of effective sustainable development policies at the global and national levels (Bauwens, 2021).

Literature review

With the world facing growing environmental challenges, the circular economy solves the problems of the linear model by reducing resources, waste, and environmental impact. It is based on the 10R principles and requires the participation of the state, business, and consumers. Success depends on changes in production, consumption, government policy, and awareness. The example of Vietnam shows that without support from the state and business, the implementation of a circular economy is difficult (Chung & Phuong Le, 2023). The circular economy is considered as a concept for the formation of sustainable development based on an integrated approach to its conceptualization. The importance of taking into account environmental aspects, factors of competitiveness and profitability in order to increase the relevance of research in the field of management is outlined. The necessity of forming a paradigm of sustainable development based on theoretical analysis and practical implementation of the circular economy is determined (Frodermann, 2018; De Angelis, 2020). At the same time, competitiveness remains the main factor of economic development and management, taking into account the volume of trade turnover, production productivity, changes in exchange rates and the development of institutions. For a comparative analysis of the competitiveness of macroeconomic indicators, the World Economic Forum's methodology based on composite indices that reflect global development trends is considered the most appropriate (Grujić, 2023).

The circular economy is seen as a new paradigm of economic development that contrasts with the traditional linear model and is based on the principles of rational resource use, waste reduction, and closed cycles. The main focus is on the conceptual foundations for implementing the circular economy in agriculture (Usata, 2023). To ensure sustainable development, the transition to a circular economy in the energy sector is particularly important. An analysis of scientific literature has identified the main obstacles and drivers for the implementation of circular strategies: low awareness, ill-considered policies, lack of incentives, and lack of infrastructure. It has been established that the circular economy is an innovative basis for energy security, efficiency, and resource conservation, and requires the integration of efforts by the public and private sectors (Ghazanfari, 2023). The main prerequisites are innovative support for the agro-industrial complex, financial support for the transfer of innovations in resource-saving technologies (business models and relevant infrastructure) aimed at minimizing waste and its recycling, the development of inter-sectoral links in the agro-industrial complex, the improvement of regulatory and legal regulation and the promotion of a closed economy, as well as the level of socio-cultural development of society

in the context of spreading the necessary views on protecting the environment from the harmful effects of waste (Maksym et al., 2024). Particular attention should be paid to supporting small and medium-sized enterprises through the provision of advice, financing, and technical assistance (Radivojević et al., 2024).

The transformation of the economic growth model based on innovation with a focus on the introduction of a circular economy is becoming particularly important in a global context, especially for developing countries such as Vietnam. The philosophy of the circular economy is based on stimulating economic development by preserving the environment, producing environmentally friendly products, and ensuring a healthy lifestyle for the population of different regions of the world. This paradigm defines innovation as a key tool for the development of the circular economy with its specific forms, including product, process, organizational, and marketing innovation (Van Hieu et al., 2023). An analytical review of the main macroeconomic factors (using the example of EU countries for the period 2004–2022) showed a positive impact on investment in the circular economy with an increase in government spending and tax revenues, a decrease in inflation, while an increase in unemployment and interest rates have a negative impact. This emphasizes the importance of shaping a sustainable development policy with the support of a closed-loop economy (Kalaš et al., 2024).

Analytical studies prove the existence of a positive long-term relationship between real GDP and circulation, the dependence of the efficiency of the circular economy on the size of environmental taxes on increasing the level. The example of 28 European countries proves the presence of regional differences between European countries by geographical distribution. Southern European countries demonstrate a significantly lower level of circulation compared to northern countries (Hondroyiannis et al., 2024). The assessment of the circular economy development processes using macroeconomic models has shown the need to take into account the interaction between different sectors and the effect of macroeconomic feedbacks. It has been established that the result of the modeling directly depends on the growth rate of production productivity, on the interchangeability of materials and changes in consumer behavior (McCarthy et al., 2018).

To ensure the macroeconomic efficiency of the circular economy, it is necessary to use risk management and internal audit of financial transactions, in order to ensure financial transparency, sustainability of business models and build trust in circular practices as a driver of growth (Levytska et al., 2022).

The introduction of digital innovations into the economy is an important factor in increasing the macroeconomic efficiency of the circular economy. This helps to increase the efficiency of the use of material and technical resources, optimize business processes, and promote the development of digital marketing to popularize circular models as a driver of sustainable development (Bielialov et al., 2023). The driving force of the circular economy for developing countries is “green” management, where small and medium-sized businesses are a priority. A survey of 621 respondents from 207 entities of such businesses showed a direct positive relationship between green HR management, the implementation of circular practices and sustainable development (Arsawan et al., 2024). It should be noted that increasing the efficiency of the circular economy largely depends on the implementation of new management approaches and the principle of co-creation in public administration, which opens the way to interdisciplinary interaction, the development of innovative skills and the creation of effective strategies for sustainable development (Serhieiev et al., 2025). Another determining factor in the macroeconomic efficiency of the circular economy in modern conditions is the impact of international migration. Strengthening international migration processes of human capital requires a balanced migration policy aimed at reinforcing the circular model as an incentive for the development of innovation and promoting sustainable economic growth and ensuring financial and economic security (Pavlovskyi et al., 2024). In today's global economic environment, migration diplomacy is becoming an important tool for promoting sustainable development: attracting talented migrants to innovative sectors helps countries protect national interests and strengthen human capital (Pasichnyi et al., 2024).

Supporting intellectual capital through educational programs, development of innovation clusters, and local governments helps increase the macroeconomic efficiency of the circular economy (Pyatnychuk et al., 2024). To form sustainable development at the national and global levels, the circular economy requires a combination of socio-economic and environmental spheres. Such a strategy can take into account challenges and threats at all levels of social life, introduce the ESG paradigm into public administration, and increase national security through sustainable financial and economic management (Sydorchuk et al., 2024).

To ensure the financial stability of the circular economy, it is important to adhere to international norms and standards, especially in the areas of financial and accounting ethics. Financial stability and adherence to international norms and standards are important factors in the effective financing of the circular economy. Financial crimes, sanctions and geopolitical risks pose serious obstacles to investments in sustainable development, but financial institutions that effectively manage risks and support green business are becoming important drivers of macroeconomic growth and the implementation of circular models (Poliova et al., 2024).

Aims. To assess the effectiveness of the circular economy according to macroeconomic indicators in the context of modern transformational changes in the global economy and identify the main factors for its improvement to ensure sustainable economic growth.

MATERIAL AND METHOD

Methodology. The empirical method of analysis was used to generalize the theoretical foundations of the circular economy at the national and global levels and identify the main differences from the linear business model. Using monographic and graphical methods, the dynamics of changes in macroeconomic indicators of economic development using circularity approaches were highlighted using the example of 27 EU member states (2014–2023) and Ukraine (2010–2023). EU member states were grouped based on the results of an analysis of the effectiveness of circular economy implementation and various macroeconomic indicators for the period 2014–2023 using cluster analysis. The study used official data from the World Bank, Eurostat, and the State Statistics Service of Ukraine. Correlation analysis was used to identify the relationship between the implementation of circular practices and key macroeconomic indicators in the EU and Ukraine. Using scientific hypothesis and abstraction, analysis, and synthesis methods, an analysis of international experience in integrating the circular economy into the macroeconomic policies of individual countries was conducted, the main factors of economic efficiency of circular models at the global level and in individual countries were identified and substantiated, particularly in the context of modern challenges and threats, and final conclusions and recommendations were formulated.

RESULTS AND DISCUSSION

In the current context of global environmental challenges and resource constraints, the transition from the traditional linear economic model to a circular economy is becoming particularly important (Gorokhova et al., 2023). The modern global economy faces numerous challenges, including growing waste volumes, economic risks, resource shortages, and the depletion of natural capital, which call into question the effectiveness of the linear economic model. The transition to a resource-efficient circular economy based on the 6R principles (reduce, reuse, recycle, repurpose, rethink) is now inevitable. The circular model offers more sustainable and long-term solutions, ensuring not only a reduction in negative environmental impacts but also positive economic, social, and environmental outcomes, unlike the linear model, which focuses solely on damage reduction (Rashid & Malik, 2023).

Industry 4.0 has brought about economic changes that have stimulated the transition from a linear to a circular (regenerative) economy, which is actively supported by the European Commission through new circularity indices. This requires businesses, especially industrial ones, not only to implement green technologies and waste-free production processes, but also to fundamentally transform their business models to comply with European standards. The study analyzes the state of the Bulgarian economy according to these indices, identifies key requirements for change, and systematizes the rules for transitioning to circular business models, emphasizing the importance of national policy to avoid economic isolation from the EU (Sterev, 2019).

The linear model ("take – produce – use – dispose") has a vector logistic orientation of the use of material resources: the extraction of raw materials, their processing into goods, the use of production products, the formation of waste that requires disposal. The result is the depletion of natural resources and the deepening of the environmental crisis (RBS, 2023).

The circular economy offers a radically opposite approach, which involves preserving natural exhaustible resources as much as possible, reducing production waste and implementing waste-free production (Kirchherr et al., 2023; Das et al., 2025).

The dominant feature of the linear model is the increase in gross production and consumption, while in the circular model, the effective use of resource potential with a closed production cycle through the transfer of innovations and minimizing waste, ensuring environmental safety (OECD, 2019). While in a linear economy the final product of consumption is waste, then in a circular economy, consumption waste is returned to the production cycle as raw materials for the production of a new product (Afteni et al., 2024).

Product design in a linear system assumes a limited life cycle, often with a defined moral or technical obsolescence, while in a circular system, the emphasis is on durability, reuse, and recycling (Mesa et al., 2022). The environmental impacts of the linear model include pollution, ecosystem degradation, and climate change, while the circular model seeks not only to minimize negative impacts but also to create positive environmental effects, for example through the restoration of natural systems (Islam et al., 2024). Let us highlight the main theoretical principles of the circular economy (Figure 1).

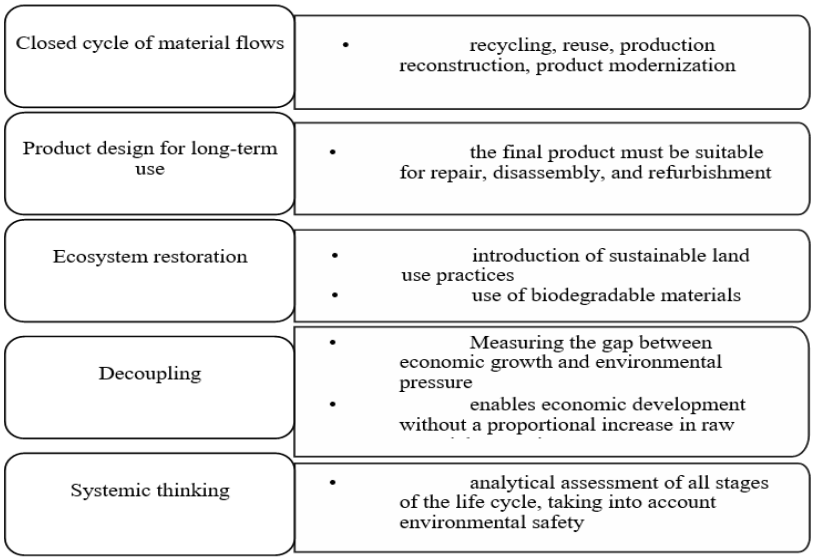

Figure 1. Basic theoretical principles of the circular economy
Source: compiled on the basis of (OECD, 2019; Bauwens, 2021; De Angelis, 2020; Bakhriddinugli, 2021; Chung & Phuong Le, 2023).

Thus, the circular economy is a key concept of sustainable development that offers a theoretically sound and practically feasible alternative to linear approaches, aimed at harmonizing economic activity with environmental and social needs. Its implementation requires systemic changes at the level of policy, business, and consumer behavior, as well as the development of innovative technologies and management solutions that will ensure an effective transition to a new economic model. In the 21st century, the circular economy is seen not only as a tool for environmental transformation, but also as an important factor influencing key macroeconomic indicators such as gross domestic product (GDP), employment, productivity, foreign trade balance, innovation activity, and economic competitiveness. The implementation of circular approaches at the global level is changing the structure of production, stimulating the development of new markets, and creating the conditions for reducing countries' resource dependence. One of the main macroeconomic effects is increased resource productivity, an indicator that reflects the relationship between economic output and resource consumption. By transitioning to circular models, the economy can achieve GDP growth without a proportional increase in the use of raw materials and energy (the decoupling effect). This ensures more sustainable growth rates even in conditions of limited natural resources.

In addition, the circular economy has a positive impact on employment, as it creates new jobs in recycling, repair, maintenance, innovative design, and green technologies. According to international studies, the transition to circular models can offset job losses in traditional industries through employment growth in new sectors. However, it is important to consider the need for workforce retraining and investment in human capital, in particular with the introduction of HRM digital tools and information systems. At the global level, the circular economy contributes to balancing the foreign trade balance, especially for countries that import raw materials. Reducing dependence on primary resources reduces import costs and increases economic resilience to fluctuations in global raw material prices. For export-oriented economies, the introduction of circular solutions opens up new niches in the markets for environmental goods and services, which increases competitiveness in the global arena. It is important to emphasize that the circular economy also stimulates innovation, as it requires new business models, technologies (e.g., digital platforms for resource sharing), and management practices. This, in turn, has a positive impact on overall economic development and lays the foundation for technological leadership.

However, it should be noted that the macroeconomic effects of the circular transition are heterogeneous: their scale and nature depend on the structure of the national economy, the level of infrastructure development, political incentives, and private sector involvement. In addition, the global effects of the circular economy are cumulative and only become apparent with broad international cooperation, harmonization of standards, and coordination of policies at the level of states, regional associations (EU, OECD, etc.), and international organizations. Therefore, the introduction of a circular economy is an important factor in the modernization of the global economic system, which can positively influence macroeconomic indicators while contributing to the achievement of sustainable development goals, strengthening environmental sustainability, and creating new competitive advantages in the global economy.

In European Union (EU) countries, the implementation of circular economy principles is one of the key strategic objectives enshrined in the European Green Deal (n.d.) and the EU Action Plan for the Circular Economy (EDA, 2020). The transition to a circular economy not only contributes to achieving environmental goals such as reducing greenhouse gas emissions, reducing waste, and preserving biodiversity, but also has a significant impact on the macroeconomic indicators of member states (Figure 2).

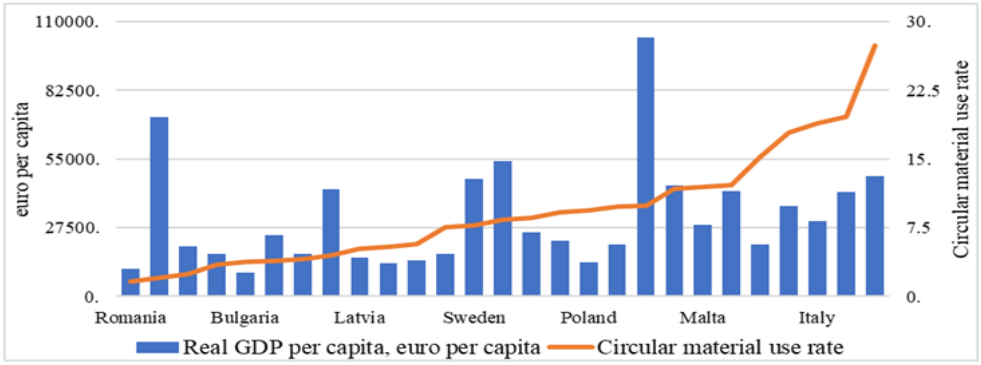

Figure 2. Circular material use ratio and real GDP per capita in EU countries, average data for 2014–2023

Source compiled from data (EC, 2024a; EC, 2024b; EC, 2025a; EC, 2025b; EC, 2025c; EC, 2025d)/

The highest rate of circular material use is observed in Italy, Belgium, and the Netherlands (19-27%) with an average annual real GDP per capita of €30-48 thousand. Correlation analysis has made it possible to establish the degree of dependence of real GDP per capita on various macroeconomic factors of circular economy development: employment rate by 21.9%; resource productivity by 75.1%; private investment and gross value added related to circular economy sectors by 18.6%; circular material utilization rate by 24.6%; waste generation per capita by 28.8% (Table 1).

Table 1. Correlation between real GDP per capita and various macroeconomic factors of circular economy development in EU countries, average data for 2014–2023.

	Real GDP per capita, €	Employment rate, %	Chain linked volumes, €/kg	Gross value added, Million €	Circular material use rate	Waste generation per capita, kg
Real GDP per capita, €	1					
Employment rate, %	0,2188	1				
Chain linked volumes, €/kg	0,7513	-0,0086	1			
Gross value added, Million €	0,1867	0,0229	0,4502	1		
Circular material use rate	0,2465	0,1667	0,6608	0,3948	1	
Waste generation per capita, kg	0,2882	0,1882	-0,0634	-0,1392	0,0400	1

Source: authors' calculations

Using cluster analysis, EU member states were grouped according to the results of an analysis of the effectiveness of circular economy implementation and various macroeconomic indicators for the period 2014–2023 (Table 2).

Table 2. Grouping of EU member states based on the results of an analysis of the effectiveness of circular economy implementation and various macroeconomic indicators for the period 2014-2023.

	Real GDP per capita, €	Employment rate, %	Chain linked volumes, €/kg	Gross value added, Million €	Circular material use rate	Waste generation per capita, kg
Cluster 1	16649	72,8	1,02	2146	5,51	4330
Cluster 2	37344	72,1	3,19	32154	17,42	4740
Cluster 3	87770	73,8	3,56	7522	5,95	9010
Cluster 4	39586	77,8	1,68	4073	9,93	11376

Source: authors' calculations.

The first cluster includes countries with an average GDP per capita of €16,649, the second – €37,344, the third – €87,770, and the fourth – €39,586 (Figure 3).

Figure 3. Grouping of EU member states by circular economy performance.
Source: compiled by the authors.

An analysis of Ukraine's macroeconomic indicators over the last decade shows the gradual positive impact of circular practices on the economy. According to the State Statistics Service of Ukraine, green investment also showed positive dynamics, growing from USD 13.1 billion in 2010 to USD 3.7 billion in 2023, which has allowed the share of renewable energy sources in electricity production to increase by 12–13% (SSSU, 2024a) (Figure 4).

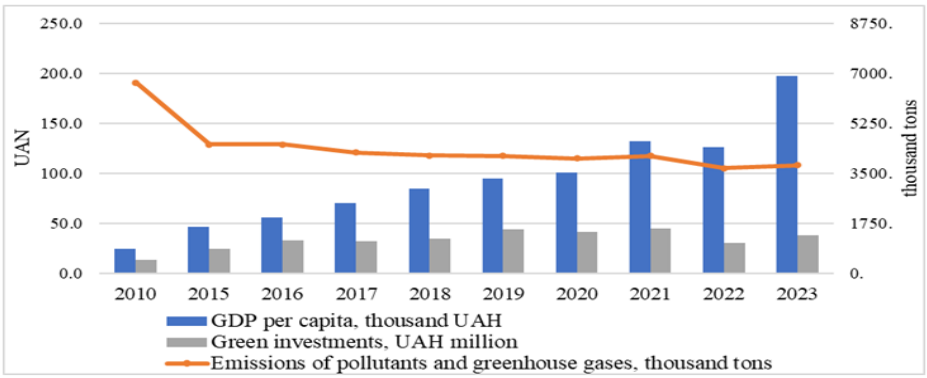

Figure 4. Macroeconomic efficiency of the circular economy in Ukraine, 2010–2023.
Source: compiled based on data (SSSU, 2024a; SSSU, 2024b).

From a macroeconomic perspective, in 2023 the country's GDP per capita increased eightfold compared to 2010 and 4.2 times compared to 2015, with experts attributing about 0.5–1% of the growth to the effects of modernization and improvements in energy and material efficiency (SSSU, 2024a). According to the World Bank (WBG, 2024), as part of post-war recovery, the government and international partners estimated the need for environmentally oriented investments at USD 486 billion, which demonstrates the scale of the potential impact of the circular economy on Ukraine's overall economic strategy. A correlation analysis of macroeconomic indicators showed a high degree of correlation (Table 3).

Table 3. Correlation indices of the circular economy's impact on Ukraine's macroeconomic indicators, 2010–2023

	GDP per capita, thousand UAH	Emissions of pollutants and greenhouse gases, thousand tons	Green investments, UAH million
GDP per capita, thousand UAH	1		
Emissions of pollutants and greenhouse gases, thousand tons	-0,685575618	1	
Green investments, UAH million	0,637660967	-0,7804694	1

Source: authors' own calculations

According to an analysis for 2015–2023, the 64% increase in green investments in Ukraine's economy contributes to GDP growth per capita and a 78% reduction in pollutant emissions. Thus, official statistics confirm the positive impact of circular practices on Ukraine's macroeconomic stability and identify it as the basis for sustainable development in the long term.

First, the introduction of circular practices has a positive impact on GDP through increased resource efficiency, the development of new markets (in particular, secondary raw materials and environmental services), and the stimulation of innovation. European Commission studies show that by 2030, a full transition to a circular economy could increase EU GDP by 0.5–1%, thanks to resource savings, productivity gains, and the development of circular business models.

Second, the circular economy promotes employment growth, especially in sectors related to recycling, repair, product upgrading, logistics, and eco-design. It is estimated that the full implementation of a circular economy in the EU could create around 700,000 new jobs, offsetting potential losses in traditional industries through structural shifts. However, to realize this potential, systemic investments in education, retraining, and skills development related to circular sectors are needed.

Thirdly, the circular economy strengthens the foreign trade balance of EU countries by reducing dependence on imports of primary resources (raw materials, energy resources) and at the same time promoting the export of high-tech products and environmental services. This is particularly relevant for the EU, which is a net importer of many critical raw materials such as lithium, cobalt, and rare earth elements. Thanks to the development of secondary raw materials and more efficient production cycles, EU countries gain strategic advantages in the global market.

The innovative aspect of the circular economy is also important: the development of new materials, digital platforms for resource sharing, and service economy models (e.g., "product as a service") that stimulate investment in research and development. This increases the overall level of technological competitiveness of the EU and helps strengthen the position of European companies in global markets.

The effectiveness of the formation of a circular economy is based on three main postulates: macroeconomic policy, environmental safety, innovative industry. The development of international or regional regulatory acts will contribute to the popularization of circular practices. The EU circular economy policy uses developed standards for the development of the secondary market, ecological design, and strict waste control requirements. Circularity in the EU taps is supported by the Horizon Europe and InvestEU programs. In general, circular policy is aimed at increasing macroeconomic efficiency, which is reflected in the growth of GDP per capita, the growth of investment in innovative activities, the increase in foreign trade turnover, and the reduction of unemployment.

An analytical study of international practices in implementing the circular economy in the macroeconomic policies of selected countries in recent years shows positive results, but also has its shortcomings and challenges (Table 4).

Table 4. Strengths and weaknesses of international experience in integrating the circular economy into macroeconomic policy

Region (country)	Main activities	Strengths	Weaknesses
European Union	Circular Economy Action Plan, mandatory eco-design requirements, waste reduction, regulatory pressure on businesses	Systematic approach, support for innovation, legislative consistency	High implementation costs, resistance from certain sectors
China	Circular industrial parks, national programs, waste laws	Scale of implementation, centralized management	Uneven regional implementation, emphasis on production
Japan	3R society (Reduce, Reuse, Recycle), citizen engagement, education	High level of public involvement, resource efficiency	High dependence on imports of raw materials
South Korea	Digitalization, investment in clean technologies, government subsidies	Innovation, rapid introduction of high technologies	The need for adaptation at the small business level
Canada	Local initiatives, private sector, municipal programs	Flexibility, startup incentives	Lack of a unified national strategy

Source: compiled based on data (Salvatori et al., 2019; Pinyol Alberich & Hartley, 2023; Fan & Fang, 2020; Vlieger de Oliveira & Mahut, 2023; Arai et al., 2023; CE, 2024; Herrador et al., 2020; Dowhaniuk, 2022)

The analytical study found that highly developed countries have clear long-term strategies and integrate the circular economy into their macroeconomic policies. However, effective implementation requires a combination of legislative, financial, technological, and educational tools, and a global strategy must take into account the principles of sustainable development, modern challenges (climate change, resource crises, geopolitical risks), and be adapted to local conditions.

Discussion

In the context of the global transition to sustainable development, the circular economy emerges as a key strategy for optimizing resources, reducing environmental pressures, and stimulating economic growth. However, the economic efficiency of circular models depends significantly on a set of interrelated factors operating at the macro level. An analysis of these factors allows identifying the critical conditions under which circular transformation can have the most significant socio-economic impact (Table 5).

Table 5. Key factors of economic efficiency of circular models at the national level.

Factors	Characteristics	Key factors
Institutional	Shape the legal and administrative environment for the implementation of circular policies.	Political will, regulatory framework, interagency coordination, state support programs
Economic and financial	Determine the investment attractiveness and economic feasibility of circular projects.	Tax incentives, available sources of financing, state tax mechanisms, cost of raw materials, economic diversification
Technological	Ensure technical capability for the implementation of circular processes.	Innovation transfer, R&D in circularity, digital accounting systems, Industry 4.0 integration
Social and educational	Determine the level of public support and human resource readiness for circular transformations.	Environmental education, training of specialists, formation of circular values, consumer behavior models
International	Exert influence through global initiatives, trade commitments, and technological interaction.	Participation in international agreements, technology transfer, foreign economic standards, geo-economic integration

Source: compiled by the authors

Effective implementation of circular strategies requires political will, a clear regulatory framework, and coordination between government agencies. The development of government programs to promote circular initiatives, the introduction of green tax instruments and financial incentives, and the harmonization of environmental standards are

prerequisites for creating a favorable institutional climate (Halunko et al., 2024; Chaher et al., 2025). The first step towards the successful integration of the circular economy is institutional and strategic anchoring. Countries need to clearly identify the circular economy as one of the key priorities in their sustainable development strategies, industrial policies, and investment plans. National roadmaps for circular transformation with targets for 2030–2050 need to be developed to ensure a systematic transition, avoid fragmented measures, and create long-term incentives for business and society.

Economic and financial factors play a key role in determining the attractiveness of circular models for business (Aamer & Al-Awlaqi, 2022). These include access to finance for environmentally oriented projects, the existence of effective public-private partnership mechanisms, and the level of economic diversification, which allows for a flexible response to changes in global production and consumption chains. The cost of primary raw materials also significantly influences the motivation to implement reuse and recycling. Without adequate funding, the circular transformation will be difficult. It is therefore critical to redirect financial flows from subsidising linear models to supporting circular technologies, as well as to attract green capital and ESG investors. Green bonds, blended finance instruments and risk guarantee schemes are becoming effective tools for mobilising resources.

Access to innovative technologies, the development of research and development in the field of eco-design, digital platforms for resource accounting, and the integration of Industry 4.0 elements provide the necessary technical basis for the functioning of a circular economy (Ghobakhloo et al., 2021). Therefore, the second important prerequisite is the transition from linear to circular value chains. This involves encouraging eco-design, developing highly modular products, repairing and extending the life cycle of goods. Countries can introduce fiscal incentives for companies that implement reuse, closed production cycles, or product-as-a-service models. This approach shifts the focus from sales volume to long-term value for the consumer. Local and regional recycling centers, material exchange platforms, and secondary resource banks create the physical conditions necessary for closed cycles to function. At the same time, digitalization—for example, the use of blockchain technologies, the Internet of Things (IoT), and digital product passports—opens up opportunities for transparent tracking of resource flows, increased efficiency, and reduced transaction costs.
At the same time, the social and educational component is also essential. Public awareness of environmental issues, the availability of skilled personnel ready to work in new sectors of the economy, and changing consumption patterns in favor of responsible practices are shaping social demand for circular transformation (Abu-Bakar & Almutairi, 2024). Training personnel – entrepreneurs, managers, engineers – is the foundation for implementing circular solutions. It is also important to encourage scientific research, international exchanges, and pilot projects that allow innovative models to be tested in practice and successful cases to be scaled up.

Finally, effective monitoring and international cooperation systems are needed. Participation of states in global environmental initiatives, access to technology transfer, and external economic imperatives (export restrictions, certification requirements) act as catalysts or barriers to the implementation of circular policies at the national level (Moïsé & Tresa, 2023). The creation of national circular economy indicator systems with open data will ensure transparency and accountability, while participation in global initiatives such as the Circular Economy Coalition or UNEP 10YFP SCP will enable the exchange of experiences and best practices. Regional cooperation is particularly important: North-South and South-South partnerships will facilitate the transfer of knowledge and technology between countries with different levels of development. Foreign economic and trade policy should also take circular aspects into account. This means including circular criteria in trade agreements, standards, and customs policy, as well as promoting trade in resources, components, and recycled products. Such a strategy contributes to increasing the competitiveness of different countries of the world, ensures the diversification of product markets and forms new business models.

The effectiveness of circular business models at the national level is formed due to the active interaction between institutional, economic, technological, social and international factors. For such a transformation to be successful, a comprehensive approach is needed that will allow combining these elements into a single strategy for sustainable development. It is important to think at multiple levels – combining strategies, infrastructure, innovation, finance, politics and partnerships. Just by working together at the national and international levels, the good stuff can happen, like real change that's good for the global economy, the environment, and future generations.

CONCLUSION

- The circular economy is becoming more than just an economic strategy, but a path to a more sustainable and just future. It helps to use resources rationally, reduce dependence on imports and open up new employment opportunities, creating markets where innovation and environmental care are closely intertwined. Thanks to the circular approach, countries not only save raw materials, but also improve the environmental situation, become stronger on the world stage and have prospects for exports. However, real success depends on a coordinated policy – supporting innovation, developing scientific research, modernizing infrastructure and creating conditions that motivate business. Cooperation between countries is also important, because the exchange of knowledge and experience helps everyone move forward, regardless of the level of development. On the path to effective circular transformation, the following factors remain key: increasing resource efficiency, government regulation, international cooperation, flexibility in the face of the challenges of time, developing human capital, financial support and raising environmental awareness in society.
- Sustainable supply chains, digitalization, resource stewardship, and active engagement of business and the public are equally important. Only by combining these efforts it is possible to strengthen the competitiveness of the economy, increase its resilience to global challenges, and create a solid foundation for the lives of future generations.

Conflict of Interest. The authors declare that they have no conflict of interest.

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