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CIRCULAR ECONOMY AS AN ALTERNATIVE TO THE TRADITIONAL LINEAR ECONOMY: CASE STUDY OF THE EU

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ABSTRACT

Objective: This article aims to identify the main characteristics and trends in the development of the circular economy in EU countries and the key features of this process concerning the implementation of traditional linear economic systems.

Theoretical framework: The industrial revolution and rapid economic development over a short time have changed the state of the environment. Excessive consumption, the basis of modern society, has caused climate change and intensified countless environmental and social problems.

Method: Questionnaire survey, which was conducted by the authors of the study online to practically clarify the most critical issues related to the analysis of trends in the implementation of the circular economy.

Results and conclusion: The study identified the top, most important features of the concept and the circular economy model, the main trends in the development of the circular economy in EU countries, and the key differences between the circular and linear economies. The research authors proposed classifying circular business models, which include four main types: closed loop, circular supply chain, resource recovery, and product life extension. The study also found that implementing circular economy principles in EU countries positively impacts economic growth, job creation, and environmental protection.

Implications of the research: The authors concluded that the transition to a circular economy is a global trend that requires the joint efforts of all countries and stakeholders.

Originality/value: The originality and value of this research lie in its specific focus on the circular economy as an alternative to the traditional linear economy, using the case study of the European Union (EU).

Keywords: Implementation of the Circular Economy Model, Resource Reuse, Efficient Production, Utilization of Waste as a Resource, Renewable Raw Materials

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A ECONOMIA CIRCULAR COMO ALTERNATIVA À ECONOMIA LINEAR TRADICIONAL: ESTUDO DE CASO DA UE

RESUMO

Objetivo: Este artigo tem como objetivo identificar as principais características e tendências no desenvolvimento da economia circular nos países da UE e as principais características desse processo no que diz respeito à implementação de sistemas econômicos lineares tradicionais.

Referencial teórico: A revolução industrial e o rápido desenvolvimento econômico em um curto espaço de tempo mudaram o estado do meio ambiente. O consumo excessivo, base da sociedade moderna, tem causado mudanças climáticas e intensificado inúmeros problemas ambientais e sociais.

Método: Levantamento por questionário, que foi realizado pelos autores do estudo online para esclarecer de forma prática as questões mais críticas relacionadas à análise de tendências na implementação da economia circular.

Resultados e conclusão: O estudo identificou as características principais e mais importantes do conceito e do modelo de economia circular, as principais tendências no desenvolvimento da economia circular nos países da UE e as principais diferenças entre as economias circular e linear. Os autores da pesquisa propuseram a classificação dos modelos de negócios circulares, que incluem quatro tipos principais: circuito fechado, cadeia de suprimentos circular, recuperação de recursos e extensão da vida útil do produto. O estudo também descobriu que a implementação dos princípios da economia circular nos países da UE impacta positivamente o crescimento econômico, a criação de empregos e a proteção ambiental.

Implicações da pesquisa: Os autores concluíram que a transição para uma economia circular é uma tendência global que requer esforços conjuntos de todos os países e partes interessadas.

Originalidade/valor: A originalidade e o valor desta investigação residem no seu foco específico na economia circular como alternativa à economia linear tradicional, utilizando o estudo de caso da União Europeia (UE).

Palavras-chave: Implementação do Modelo de Economia Circular, Reutilização de Recursos, Produção Eficiente, Aproveitamento de Resíduos como Recurso, Matérias-Primas Renováveis.

1 INTRODUCTION

Climate change and the depletion of natural resources are today's two most pressing global issues. One of the main contradictions in modern economics is the conflict between economic growth and the limits of natural resource use. The solution to this task is a transition to a balanced, sustainable development of the circular economy, which equally combines economic, environmental, and social aspects of economic growth. Therefore, it is important to highlight the significant differences between circular and linear economies and analyze the first steps of European experience implementation in this area.

The theoretical part of this research provides a characterization of the concept, key trends, and features of the circular economy implementation in different world countries.

The practical part of the research includes an evaluation of the basic approaches to waste utilization as a resource, critical industrial sectors where the most intensive development of circular economic processes is currently observed, the main advantages of the circular economic model, directions of scientific research in the field of circular economy development that are most effective and in demand in practical activity, the most common trends in the

development of the circular production process in the EU countries, as well as the priority goals of the circular economy objects' development on the territory of the European Union.

Based on the study results, the authors made the following conclusions regarding the issues that need to be addressed. Specifically, it has been established that the key approaches to using waste as a resource, which are prerequisites for the development of a circular economy, include involving as many stakeholders as possible in circular transformation, positioning all waste as a source of resources that can be reused, recycled or repurposed, and establishing maintenance and technical support for existing systems. The survey has shown that the critical industrial sectors where circular economic development is currently most active in European countries are energy production and transportation (including electrochemistry and water) and the extraction and processing of minerals. The main advantages of the circular economic model are innovative and resource-efficient methods of production and consumption, protection of companies from resource shortages and unstable prices, and reduced negative environmental impact. The survey has also shown that the most demanded research directions in the field of circular economic development are "Reducing resource consumption and promoting renewable raw materials: prospects for development and world experience of state regulation," "Reuse of resources: maximum efficiency in the use of production results," and "Investigation of optimal resource utilization in various industries." According to the survey, the most common trends in circular economic development in EU countries are the reuse of raw materials in production, where used products or their components become part of new goods; the reuse of materials in consumption, where companies can extend the life cycle of a product through service optimization, as well as industrial symbiosis and processing of production waste. At the same time, the priority goals in developing circular economy practices in the EU countries are promoting industrial symbiosis, transforming by-products of one production process into raw materials for another, advancing economically viable eco-packaging, and establishing systems for restoration and recycling.

This research aims to determine the opinion of scientists and executives of industrial enterprises' departments on the specifics of circular economy development.

2 LITERATURE REVIEW

The circular economy is a model of economic development based on resource restoration and rational consumption, which is an alternative to the traditional linear economy (de Oliveira & Teixeira, 2023). First and foremost, it is a philosophy of conscious consumption, resource reuse, and efficient production (Ostapenko et. al., 2020). Today, the issue of transitioning from a linear to a circular economy is becoming increasingly relevant (Martinho & Mourão, 2020), (Brusselaers et al., 2022).

New consumption practices in the circular economy include renting equipment instead of buying new, reusing raw materials, repairing or renewing consumer goods and equipment, and sorting and processing goods (Mazur-Wierzbicka, 2021), (Ghisellini, Ripa & Ulgiati, 2018).

A linear economy is reduced to a classical approach where each product is manufactured, used, and discarded (Sulisnaningrum et. al., 2023). It is also referred to as a model of "irresponsible use and consumption". The circular economy is defined as a counterbalance to the traditional linear economy: production – use – waste (Popovych et. al., 2020). In a circular economy, goods are part of a value-creation chain, used for as long as possible (Alekseieva et. al., 2020). Then, depending on the properties of such goods, they can be reused, repaired, upgraded, or recycled (Akimova et. al., 2020). It increases efficiency, reduces operating costs, enhances profitability, and reduces environmental impact (Athanassiadis et al., 2022), (Beaussier et al., 2022).

European countries have already recognized the importance of a circular economy for sustainable development (Akimov et. al., 2020). According to preliminary forecasts, circular economy development in Europe will create 580,000 jobs and save 500 euros in electricity costs per household per year (Ksonzhyk et. al., 2021). According to EU estimates, "the implementation of resource-saving production technologies at all levels of the production chain will allow reducing industrial raw material needs by 17-24% by 2030 and companies' annual costs by 630 billion euros". This gradual transition to a sustainable economic system is part of the EU's new industrial strategy. Recent research has shown that applying circular economy principles in the EU will increase GDP by 0.5% and create up to 700,000 new jobs by 2030. Over the past century, the economy of the EU has achieved unprecedented prosperity. Part of the success comes from increased resource productivity. However, this productivity can and should be further increased as the European economy remains heavily dependent on resources. Moreover, due to the technological revolution, the circular economy will allow the EU to increase resource productivity by up to 3% per year.

The majority of scientific research on the development of the circular economy concerns the issue of measuring emissions in the EU countries, the importance of higher education related to the training of specialists who will contribute to the development of the circular economy, including the main components and economic growth, the features of the application of forms of the circular economy in Europe, challenges and opportunities circular economy, interrelationships between the goals of the circular economy and the goal of sustainable development, problems of this approach to the organization of industrial processes, the study of the CE modeling process (Guyader et al., 2022), (Schöggl, Stumpf & Baumgartner, 2020), (Giannakitsidou, Giannikos & Chondrou, 2020), (Borodin et. al., 2022).

The urgency of developing a circular economy and training professionals in this field is reinforced by the fact that complexities and uncertainties associated with climate change often paralyze government activity at national and international levels, requiring immediate action to protect society from the consequences of climate change. At the same time, it should be emphasized that consumption and production are the driving force of the global economy, based on the use of the natural environment and resources in a way that continues to have a destructive impact on the planet. Moreover, a deterioration of the environment has accompanied the socio-economic progress achieved over the past century. All of this jeopardizes our future and survival. Therefore, among the seventeen Sustainable Development Goals adopted by the UN General Assembly, a specific goal was allocated for "Responsible Consumption and Production." Implementing this goal involves effective management of common natural resources, including the economical use of drinking water and changing priorities in waste management.

Thus, the circular economy is a general term used to describe economic activity aimed at energy conservation, regenerative, environmentally friendly production, and consumption. Unlike the traditional economic development model, the circular model is the most successful way to conserve resources and materials and, therefore, a path to sustainable economic growth. The main reason why full utilization and recycling of all materials becomes an important goal for the whole world is climate change and the high consumption of natural resources (Heyes et al., 2022), (Nohra, Pereno & Barbero, 2020), (Lelyk et. al., 2022).

3 METHODS

A practical study of current trends in the circular economy development was conducted through a questionnaire survey of 238 scientists and 211 executives of industrial enterprises in Vinnytsia, Rivne, Cherkasy, Chernihiv, and Kyiv regions of Ukraine.

The regions for this study were chosen given the need to analyze the trends in the development of the circular economic system model in the areas where this approach to business organization is most concentrated, as well as the opportunity to analyze data from a significant number of industries of manufacturing enterprises, wholesalers and retailers.

While writing this article, the authors used the methods of scientific abstraction, idealization in assessing the trends in the development of the circular economy, and graphical methods to illustrate the data obtained as a survey result.

The theoretical and methodological basis for this article is the work of scholars on the development of the circular economy. The authors used the methods of theoretical generalization to combine similar approaches to the study of the circular form of organizing business processes into appropriate groups. In addition, the methods of comparative analysis are used to compare similar ones, identify their uniqueness, and determine their advantages and disadvantages.

The research team took into account the sectoral distribution of the companies based on which the survey was conducted, as well as the correspondence in the ratio of gender, age, total work experience, and professional level of the respondents who took part in the survey to the corresponding general percentage of employees of the organizations based on which the survey was conducted, according to the specified criteria.

The questionnaires used for this study were systematized, analyzed, and generalized. When organizing the survey, respondents were asked to evaluate the importance of each answer option in the questionnaire as a percentage from 0 to 100, according to the weight of each indicator. When applying the empirical method as a questionnaire, the authors identified the priority of components, factors, advantages, and trends in developing the research object. The respondents' answers were analyzed during the survey, and the arithmetic mean of the responses of all survey participants to each question was calculated. Also, the point of view of the survey participants on the issues raised was determined.

After the study's authors summarized the survey results, the respondents reviewed the data and, agreeing with the final results, they permitted to publish these results.

The study was conducted using the Survio service. The researchers utilized Survio's features to design a structured and comprehensive questionnaire tailored to the objectives of the study. The platform allowed for the customization of question types, response options, and the overall layout of the survey.

Once the questionnaire was finalized, the researchers used Survio to distribute the survey to the targeted participants. Survio offered multiple options for survey distribution, including email invitations, social media sharing, and embedding the survey on websites or online platforms.

Survio ensured the anonymity and confidentiality of respondents by providing options for anonymous participation and secure data collection. The platform also allowed for automated data gathering, organizing, and analysis, which streamlined the research process and reduced manual effort. Throughout the survey period, Survio provided real-time monitoring and tracking of response rates, allowing the researchers to assess the progress of data collection. The platform also facilitated reminders and follow-ups to encourage participation and maximize the response rate.

4 RESULTS

According to the survey participants, today, in the context of the urgent issues related to optimizing economic processes in terms of the need to increase the efficiency of resource use in production, the basic approaches to waste utilization as a resource, which are prerequisites for the development of a circular economy, are (Figure 1):

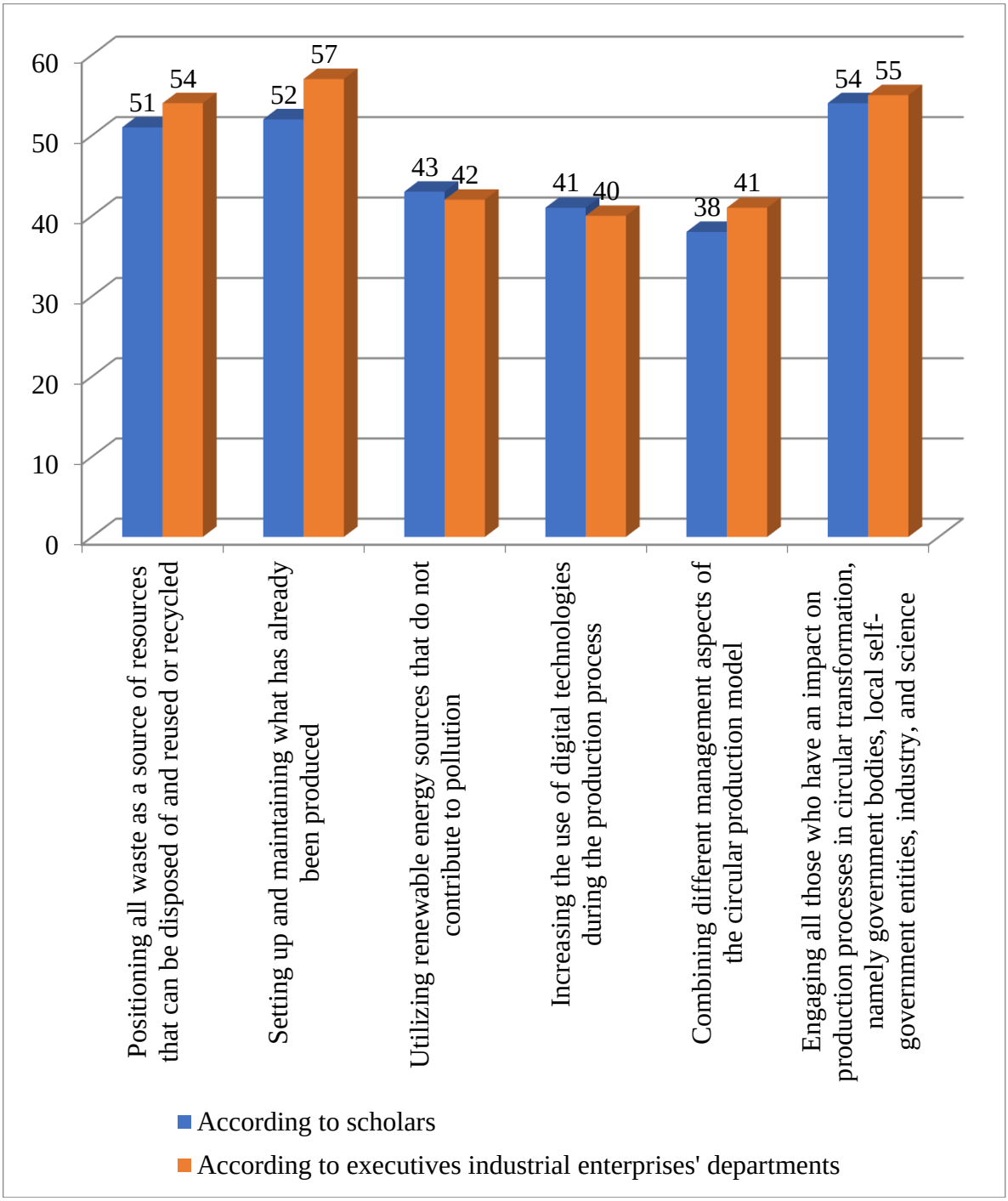

Figure 1. The basic approaches to waste utilization as a resource, which are prerequisites for the development of a circular economy, %
Source: Prepared by the authors (2023).

As shown by the analysis of survey results, the key approaches to the use of waste are:

- the involvement of as many stakeholders as possible in circular transformation;
- positioning all waste as a source of resources that can be utilized, reused, or recycled;
- maintenance and technical support for what has already been produced.
- In the survey, respondents identified the following key industry sectors where the most activation of circular economic development is currently observed in European countries (Figure 2).

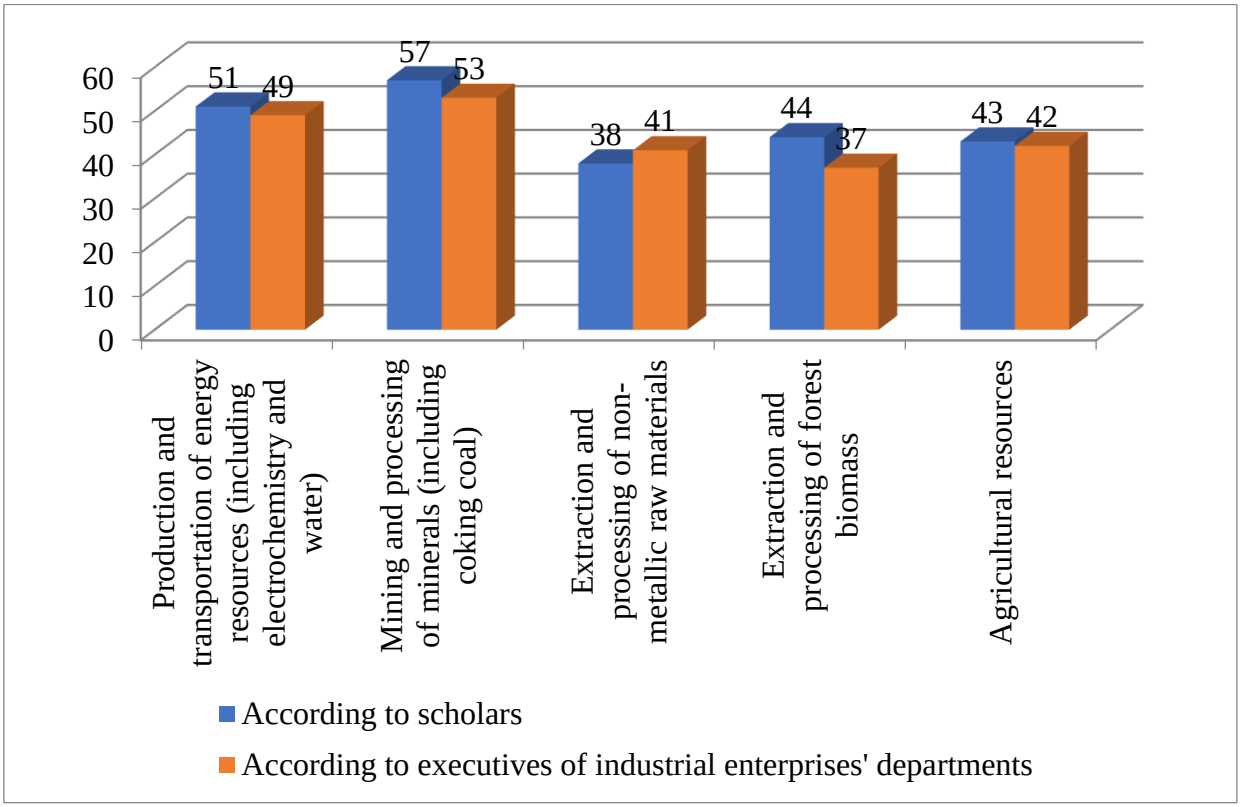

Figure 2. Key industry sectors currently showing the highest level of activation in developing circular economic processes, %
Source: Prepared by the authors (2023).

Figure 2 demonstrates the significant importance of the cycle in critical areas such as the production and transportation of energy resources, which encompasses fields like electrochemistry and water. Additionally, the cycle plays a crucial role in the extraction and processing of minerals. These sectors heavily rely on the efficient and effective management of the cycle to ensure the availability and sustainability of vital resources. By highlighting this importance, Figure 2 emphasizes the need for comprehensive and integrated approaches to address challenges and optimize processes within these sectors. During the survey, the main advantages of the circular model of economic development were identified (Figure 3):

- innovative and resource-efficient methods of production and consumption;
- protection of companies from resource shortages and unstable prices;
- reduction of negative impact on the environment.

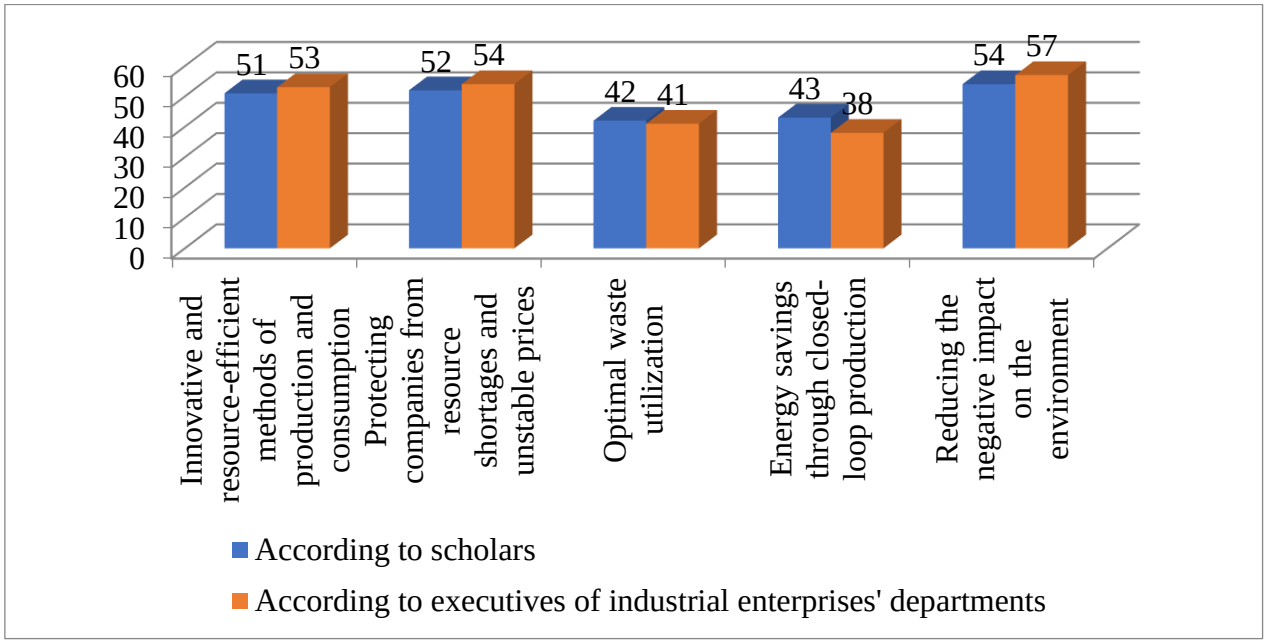

Figure 3. The main advantages of the circular model of economic development, %
Source: Prepared by the authors (2023).

During the survey, respondents were asked to name the most effective and demanded directions for scientific research in the field of circular economy development. These directions are presented in Figure 4:

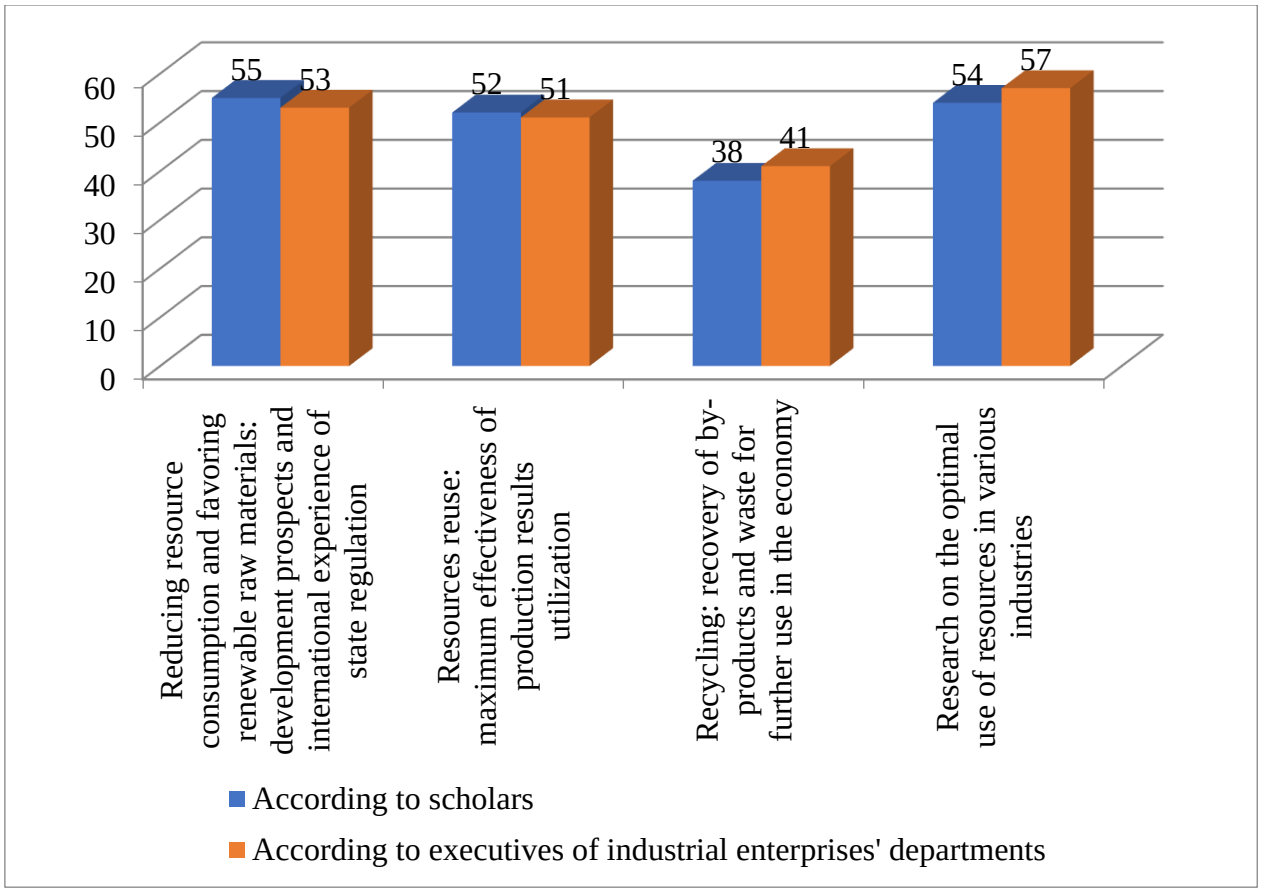

Figure 4. Directions of scientific research in the field of circular economy development that are the most effective and in demand in practice, %
Source: Prepared by the authors (2023).

As the survey showed, the following areas should be focused on: "Reducing resource consumption and promoting renewable raw materials: development prospects and global experience of state regulation", "Resource reuse: maximizing the efficiency of production results," and "Research on optimal resource utilization in different production sectors."

Regarding the most common trends in the development of the circular production process in EU countries, respondents identified (Figure 5).

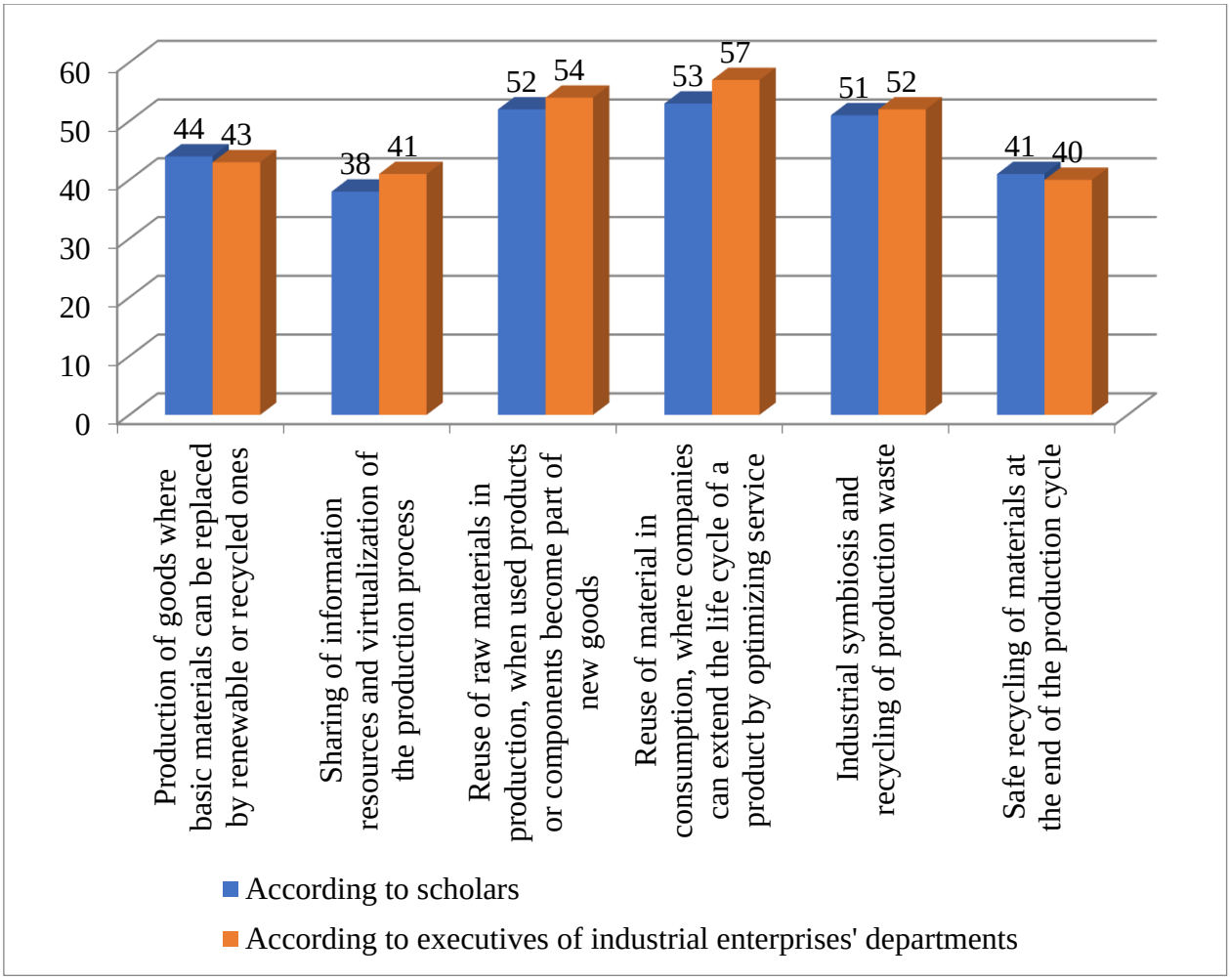

Figure 5. The most common trends in the development of the circular production process in EU countries, %
Source: Prepared by the authors (2023).

As can be seen from Figure 5, the key trends in the development of the circular economy in EU countries are the reuse of raw materials in production, where used products or their components become part of new goods, the reuse of materials in consumption, where companies can extend the product lifecycle through optimization of services, as well as industrial symbiosis and the recycling of production waste.

The survey allowed for establishing the viewpoint of survey participants on the priority goals for developing circular economy facilities in EU countries (Figure 6):

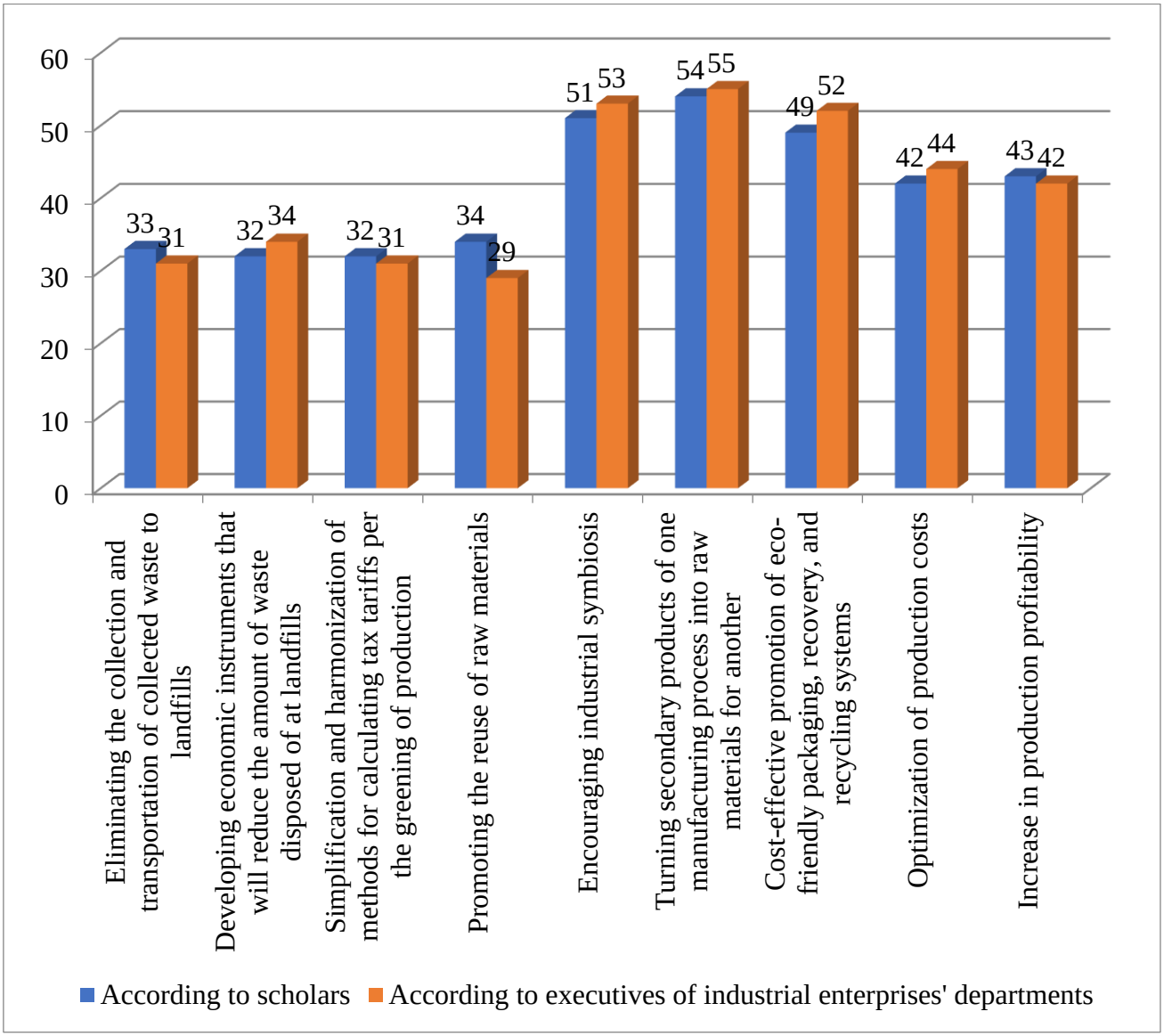

Figure 6. The priority goals for developing circular economy facilities in EU countries, %
Source: Prepared by the authors (2023).

Moving towards developing the circular economy, EU countries primarily prioritize goals and development priorities in the industry, such as promoting industrial symbiosis, transforming by-products of one production process into raw materials for another, promoting environmentally friendly packaging, and implementing systems for restoration and recycling.

5 DISCUSSION

Today, scientists and manufacturers worldwide have recognized the economic value of a circular economy as an economic system that emphasizes the reuse of products and materials to conserve natural resources and create value for people, the environment, and the economy. The circular economy has also been analyzed and highly valued from an economic perspective, emphasizing its importance for economic development and creating a basis for seeking business models that promote its implementation (Geissdoerfer et al., 2022), (Homrich et al., 2022), (Novak et. al., 2022).

Today, many countries worldwide have embarked on a circular economy path. The circular model involves using materials and waste as raw materials in the same or other

production processes. It solves problems of natural resource scarcity and high raw material prices and reduces dependence on expensive materials (Korhonen, Honkasalo & Seppälä, 2018), (Gregorio, Pié & Terceño, 2018), (Slobodianyk et. al., 2022).

The circular economy emphasizes the rational use of resources, energy conservation, and environmentally friendly production. The recycling economy includes not only the diverse use of resources and the implementation of innovative technologies in production but also the rational use of waste, which requires a clear reorientation of consumer consciousness and the formation and development of consumer and production culture (Türkeli et al., 2022), (Termeer & Metze, 2019).

It should be noted that the existing economy, which is based on extractive fuel and is inefficient in terms of resource utilization, is referred to as traditional (linear) one. However, the circular economy is gaining increasing recognition from policymakers and researchers who seek a deeper understanding of its impact on industrial development and societal functioning (Huttmanová & Valentiny, 2019), (Buşu & Busu, 2018).

The current state of the circular economy is being considered at the OECD, UN, and EU levels to accelerate society's transition to a more resource-efficient system, thereby increasing competitiveness and responding to global environmental challenges and threats (Avdiushchenko & Zając, 2019).

Looking at trends in the development of the circular economy, it should be noted that even in the European Union, despite the common framework concepts (Circular Economy Package), each country has national peculiarities in implementing this concept. Germany, for example, with its powerful industrial economy, has created a basis for the circular economy through material flows and material availability. At the same time, the Netherlands have done so through innovations in materials and business models. Finland is the first country in the world to have developed a national roadmap for transitioning to a circular economy.

Large EU countries such as Germany, the United Kingdom (formerly part of the EU), and France generally have higher levels of investment, patents, and employment in circular economy sectors, allowing them to take a leadership role in assessing the development of this approach to organizing industrial processes.

Over the past century, the EU economy has achieved unprecedented prosperity, partly due to increased resource productivity (Tantau, Maassen & Fratila, 2018).

6 CONCLUSIONS

Thus, the analysis of scientific literature on the research topic and the survey results showed that the circular economy development model is based on the efficient use of potential opportunities, balanced social development, and priority of environmental protection. The transition to a circular economy aims to consolidate global trends toward increasing people's well-being and social equality, reducing environmental risks and deficits. However, success in implementing this course must be ensured through the conscious creation of a favorable environment by each country, which requires the implementation of necessary reforms. That's why the transition to the circular economy in the EU and other countries worldwide should be systemic, requiring the cooperation of all stakeholders at all levels - local, regional, national, and international.

One limitation of the analysis and survey results is the reliance on existing scientific literature. The analysis may be limited by the availability and quality of literature on the research topic. The research may have missed relevant studies or encountered bias inherent in the selected literature. Additionally, the survey results may be subject to response bias, where respondents may have provided biased or incomplete information, affecting the accuracy and generalizability of the findings. Further research can explore the economic implications of

transitioning to a circular economy. This includes assessing the costs, benefits, and potential economic impacts on different sectors and stakeholders. Quantitative analysis can help policymakers make informed decisions and develop strategies that align economic growth with circular principles.

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