

Actual Aspects of Circular Economy Development

Olga Sosnovska ^{1,*} Olena Shtepa ¹

¹*Borys Grynchenko Kyiv University, 18/2 Bulvarno-Kudriavska str., Kyiv, 04053, Ukraine*

^{*}*Corresponding author. Email: o.sosnovska@kubg.edu.ua*

ABSTRACT

The rapid pace of expansion of industrial production over several decades led to an improvement in the economic well-being of society and provoked aggravation of global problems in terms of environmental degradation, depletion of natural resources and the emergence of a global environmental crisis. In this context, the main priority is the synthesis of economic development, social well-being and environmental safety – the establishment and development of a circular economy as a new economy of an inclusive type. The aim of the study is to identify relevant aspects of the development of the circular economy based on the study of world experience to identify the risks of transformation of the modern national economy to a circular economy and determine the prerequisites for its development. The methodological basis of the research is the scientific development of national and foreign scientists, the fundamental theoretical provisions of economic science in the problems of introduction and development of circular economy. The study of world experience allowed us to identify the risks of introducing a circular economy and measures for its implementation at the national level. The main provisions and results of the research can be used by the authorities in the development of regulatory support for the implementation of the circular economy model, as well as by business entities to take into account in business processes.

Keywords: *economic and environmental development, resource conservation, circular economy, 10R principles, risks of a circular economy, prerequisites for the development of a circular economy*

1. INTRODUCTION

In the modern world, the interaction of society and nature is one of the most acute problems of mankind, because at present fast economic development leads to a significant increase in the use and depletion of natural resources. According to the forecasts of leading experts, by 2050 the world economy will grow four times, and the world's population will increase from 7.3 billion to about 10-11 billion, and therefore an additional burden on material and energy resources is expected. This creates enormous challenges for sustainable economic and environmental development and efficient use of resources. So, while Ukraine is trying to produce, import and adapt the latest technologies of industrial production, to determine its place in global value chains, developed countries are faced with new challenges of global change, which they are trying to solve successfully by synthesizing continuous modernization of production technologies and reducing harmful environmental impacts.

This makes it necessary to find a new economic model, which could disrupt the link between economic growth and the depletion of natural resources, and most importantly, to ensure sustainable development of society – a development model that provides for: the development and successful implementation of advanced technologies and their organic integration into the socio-economic sphere; environmental protection as a necessary dominant of the development process; focus on improving the welfare of society and improving the quality of life; balance of social, economic and environmental institutions of the state.

Taking this into consideration, the formation of model of a circular economy as a type of management is of great relevance and aimed at resource and energy conservation, regenerative cleaner production, turnover and consumption, and the reuse of raw materials and waste, which are considered as resources for the next production cycle. That is, the circular

economy is associated with "green growth" and provides a movement from mass consumption to responsible consumption. It is based on a closed cycle of the use of resources (products) in order to reduce pressure on the environment.

2. LITERATURE REVIEW

The concept of a circular economy was introduced in 1989 by two British environmental economists David Pearce and Kerry Turner in their work "The Economics of Natural Resources and their Environment". The further spread of the concept of a circular economy in the world arose in response to the growing consumption and accumulation of a mass of waste that does not lend itself to rapid processing in the natural environment and has a harmful effect on the environment [10]. As a result, there is a need for a transition to an inclusive economy, it implies the ability of economic growth without a corresponding increase in the use of energy and resources (source borders) and environmental load (absorption border). Taking into consideration this issue, the circular economy has been studied by foreign and our scientists. In particular, the works devoted to the following problems: the development of these requisites for the formation of a circular economy were considered by Kenneth Boulding, P.M. Vitousek, Rachel Carson, J. Lubchenko, H.A. Mooney, J.M. Melillo, Walter R. Stahel; formation of the conceptual-categorical apparatus of the circular economy was highlighted by Di Wu, Chen Demin, MaKai, Ellen MacArthur, Felix Preston, Walter R. Stahel; the works of such scientists are devoted to the development of theoretical and methodological provisions of the circular economy (H. Winkler, Chen Demin), Warren Mabee, Felix Preston, G. Redey-Mulvey, John Robinson; the problem of waste management in the context of the circular economy was raised in the works of D.O. Hrytsyshen, V.V. Yevdokimov, and in general, the question of the

effectiveness of the model of the circular economy was investigated by T. K. Kvasha and L.A. Musina; studies on the circular economy, committed to public administration, belong to foreign scientists Andrew Flynn, Li Yu, Lynch Nicholas, Magdalena Nikolic, Marina Ilic, Peter Feindt, Hobson Kersty. Taking into account the achievements and significant scientific results of these scientists, it should be noted that a number of problems of the introduction and development of the circular economy are not sufficiently illuminated and require further fundamental research.

3. INTERNATIONAL EXPERIENCE

An analysis of the literature [11 - 16], [19], [20] allows us to note that the circular economy is a new economic model in which the emphasis is on the reuse of materials. That is, it is an industrial system that is reconstructive and requires consideration at the micro, meso and macro levels, covering the production, consumption and proper use of waste (Table 1).

The circular economy operates in accordance with 3R principles: Reduce, Reuse, and Recycle [2]. Such an approach can provide an increase in socio-economic well-being without excessive consumption of natural resources.

In particular, the implementation of the concept of a circular economy at the micro level involves the consideration of environmental aspects in the implementation of production processes and products (eco-design), the organization of clean production with low emissions and the introduction of waste prevention systems by manufacturers, as well as strengthening the responsibility of consumers as a result of environmental labeling and implementation of “green” public procurement. The practice of developing circular processes at the meso level includes the development of eco-industrial parks and agricultural ecological systems along with eco-design and efficient waste management. The introduction of a circular economy at the macro level is aimed at creating ecocities, eco-community and ecoregions. It is worth noting that an important condition for ensuring the effective implementation of the concept of a circular economy and leveling existing obstacles is the availability of support from initiatives of enterprises, institutions and organizations that cover all areas of production, consumption and waste management at all specified levels of aggregation.

It is common knowledge that the modernization of industry in the direction of the transition to a circular economy is one of the main challenges of our time, since it involves the creation of new business models, new economic relations and added

value chains. Industrial enterprises should go beyond the usual model of efficient use of resources and strive to increase the duration and potential reuse of materials, products and assets. Considering this, EU economic policies aimed at enterprises include reuse, processing or recycling of materials in production cycles, provide for: minimum requirements for waste sorting, reuse and recycling, as well as taxation / prohibition of landfills and incineration; developing requirements for the sharing of products, buildings or infrastructure; in the development of production technology or in the implementation of the production process – the minimum requirements or prohibitions on the product, environmental permits and taxes.

In 2017, the European Commission and the European Economic and Social Committee created a joint European platform for stakeholders in the development of the circular economy (European Circular Economy Stakeholder Platform). The purpose of creating such a platform is the exchange of best practices, strategies, knowledge and risks of the transition from a linear economic model to a circular economy by strengthening the cooperation of countries and identifying social, economic and cultural obstacles to the development of a circular economy.

In the countries of the European Union, the institutional support of the financial component is represented by the European Investment Bank, which began in 2013 with active lending to projects related to the circular economy. For the period 2013-2017 it gave loans related to the circular economy, for 2.1 billion Euros, of which 0.7 billion Euros for the industrial sector and services, 0.5 billion Euros for water resources management, 0.37 billion Euros for agriculture and the bio-economy sector; and 0.33 billion euros for waste management.

According to the European Investment Bank (2018) for the period 2013-2018 the European Investment Bank has funded 622 energy projects in the amount of 56,4 billion euros, 93 projects in the field of solid waste management in the amount of 1.8 billion euros, 234 projects in the field of water supply and sanitation in the amount of 19,6 billion euros. The Bank co-finances not only projects of the European Union, but also other countries, including Ukraine. So, in 2013, the Ukrainian project for the development of alternative energy sources received a loan in the amount of 2.5 billion euros. In 2015, the program for the development of the Ukrainian municipal infrastructure in terms of energy supply to cities, solid waste management and water supply and sanitation received 360 million euros.

Table 1 The structure of the circular economy

Levels	Micro -	Macro -	Meso -	Mega-
Production	Eco-cleaner production Eco-design	Eco-industrial park Agricultural ecosystem	Regional Industrial Network	Global circular value chains (Including global supply chain of recycled materials)
Consumption	Green acquisitions and consumption	Eco-cleaner park	Rent, service	
Waste management	Product recycling system	Waste trade, industrial parks	Symbiosis of urbanization	
Development support	Policies and laws, information platform, capacity building			

Based on the foregoing, the European Commission has already developed and adopted the Circular Economy Package [5], [17] – a set of legislative initiatives that set targets for waste processing. Some enterprises in the European Union are already implementing economically successful projects for the processing and use of solid waste in further production. Along with this, in 2018, the World Economic Forum [5], [14] expanded the three basic principles of the circular economy to ten, the so-called 10R, which include (Figure 1): refuse (refuse to produce a product on this technology and materials, alternative product offer), rethink (rethinking the direction of using the product, exchange or sharing of product), reduce (reduction in the use of natural resources with an increase in the efficiency of production or consumption), reuse (reuse by another consumer of the product), repair (repair and maintenance of a defective product with its subsequent use for its main purpose), refurbish (restoration of an old product for future consumption), remanufacture (reprocessing and application of part of an old product in a new product), repurpose (reorientation of a part of an old product in a new product to another functional purpose), recycle (processing materials to produce products of the same or lower quality), recover (burning materials with the restoration of energy spent on their production).

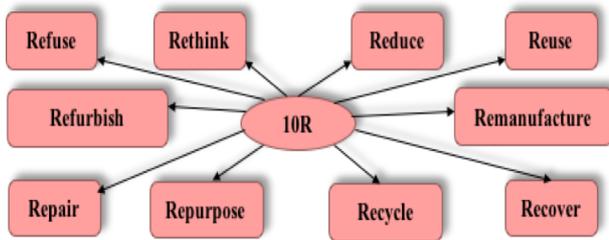


Figure 110-R Principles for Introducing a Circular Economy According to the World Economic Forum in 2018

Some European enterprises have already been able to “embed” successfully these principles during the modernization of industrial production, while ensuring a level of profitability, guaranteeing the timely return of investments and further business growth. They partially refuse to use products from materials that are difficult to process, or use the trade-in system – the exchange of goods that were already in use for new ones [10].

In view of the foregoing, at the present stage of economic development, the circular economy in European countries has already become a platform for testing various business models. Many of them have proven their effectiveness and already have positive results in the form of cost savings and reduction of negative environmental impacts. Along with this, it should be noted that the analysis of the achievements of different countries in introducing the circular economy model indicates significant differences in the perception of the need for this process and its relevance. It certainly depends on the specifics of the human, natural, physical (artificial) and institutional capital of each state, the level of its development, the socio-economic and environmental culture of society. On the one hand, the desire to implement the principles of a circular economy is primarily an initiative of states with a strong economy, highly developed technology and production culture. The development of a circular economy in the developed countries of the world will contribute to the growth

of technological advantages of their production and increase the competitiveness of such countries in world markets. On the other hand, developing countries, and have lower incomes than developed countries, can achieve more significant successes in the development of circular processes and increase the efficiency of their implementation. Indeed, the careful sorting and use of waste provides the so-called "growth points", which allows the government, the private sector and other interested parties to promote innovative models of economic growth. Considering this, we can highlight the key priorities for introducing a circular economy: in developed countries changing the structure of production and consumption, ensuring competitive positions on a national and global scale and jobs; in developing countries sustainable economic development and poverty alleviation.

An analysis of the development trends of the circular economy in different countries of the world allows us to state that even in the integration union of the European Union, taking into account the existing unity of the framework approaches (circular economy package), each country has national characteristics of the concept of a circular economy. In particular:

- Germany, as a country with a powerful industrial economy, formed the basis of a circular economy through material flows and the availability of materials. In the rating of the circular economy-2018, it ranks first in the number of patents related to the development of the circular economy; job creation in circular sectors of the economy; together with Great Britain and France, it is a leader in attracting circular investments.
- The Netherlands is focusing on financing innovation and developing new business models to support the development of a circular economy.
- Finland is the first country in the world to develop a national roadmap for a transition to a circular economy.
- Scotland was the first to join the Circular Economy 100 (CE100) club, created on the initiative of the Helen MacArthur Foundation to stimulate cooperation and innovation in the development of the circular economy. The goal of creating the global Circular Economy 100 platform is to combine the efforts of government, business entities and research institutions to accelerate the transition to a circular economy. So, taking advantage of the development of the information society, the Circular Economy 100 contributes to the creation of a mechanism for collective management decision making, gives recommendations on the implementation of world best practices and the possibility of activating circular processes at the level of individual enterprises.
- Japan has moved to a highly efficient model of the circular economy thanks to the adoption in 2000 of the innovative Law on Promoting Efficient Use of Resources. Nowadays, Japanese recycling rates are quite significant, because the country processes 98% of metals, the share of seized materials for processing electrical and electronic products is about 90%, most of the materials are reused in the production of the product in accordance with the principles of the circular economy.
- China stimulates the development of a circular economy in the framework of the industrial ecology program, provides for the use of waste from one company as resources for the production of another company's product. A powerful legislative framework for the development and maintenance of the circular economy has been formed and adopted in the country, the concepts

of environmental design and increased producer responsibility have been actively developed, indicating significant progress in enhancing and stimulating circular processes. Along with this, the China Association of Circular Economy, a national organization for regulating state policies for the conservation of resources, environmental protection and the implementation of the Law on the Development of the Circular Economy in Industries and Individual Enterprises, has been created.

- Turkey implements the concept of developing a circular economy by minimizing waste and increasing the efficiency of resource use in industry, agribusiness and the municipal sector through the introduction of the Near-Zero Waste investment program, financed by the European Bank for Reconstruction and Development (EBRD).
- Sweden uses waste-to-energy technology. 99% of the country's waste is used as fuel for power plants or raw materials for production. At the same time, the country imports garbage from Norway, the UK, and Germany, paying it extra for the use of its waste.

The experience of introducing a circular economy in European countries sets new trends in the formation of strategic priorities for national development. European practice allows us to assess the potential changes taking place in countries where the development of the circular economy is becoming one of the priorities of our time. At the same time, an analysis of current global trends allows us to note that the process of implementation and development of a circular economy in a strategic perspective will contribute to the emergence of risks of a social, technological, environmental, industrial and economic nature. The degree of manifestation and impact of these risks in different countries will depend on the level of economic development of a particular country, which makes it necessary to implement the principle of differentiated responsibility of different countries. This means that developed countries should play a leading role in the development of circular systems by changing the existing structure of production and consumption, as well as provide financial and technological support for the development of circular processes. In turn, developing countries must ensure socio-economic development based on the principles of development of a circular economy.

4. RISKS OF INTRODUCTION AND BACKGROUND OF DEVELOPMENT OF CIRCULAR ECONOMY IN UKRAINE

In November 2017, the National Strategy for Waste Management in Ukraine until 2030 was adopted, which refers to the unsatisfactory state of waste management in Ukraine and refers to the main goal of "introducing a systematic approach to waste management at the state and regional level, reducing waste generation and increasing its volume processing and reuse" [6], that is, an approximation to the basic principles of a circular economy. Indeed, in Ukraine [18], waste management mainly includes recycling, incineration and disposal in specially designated places or facilities. According to statistics, 1/7 of the entire territory of the country is littered with garbage, and only 4% goes for recycling. For the most part, it can be removed in designated areas (about 70%), a significant part is disposed of (about 30%), a small part (<0.3%) is burned.

It should be noted that the introduction of the principles of a circular economy along with the modernization of production

will provide the Ukrainian economy with double benefits. Firstly, when reusing resources already consumed once, the company saves on their purchases and reduces dependence on suppliers. At the same time, the value of the company is growing, and the cost of production and disposal of waste can be significantly reduced. Secondly, it reduces the burden on the environment, solves the problem of waste disposal and preserves the country's resource potential.

However, despite the tangible economic and environmental effects of the circular economy, for most scientists this model still remains a kind of specific national experiment, not worthy of serious scientific research and practical testing. This is due to risks that undoubtedly arise in the process of converting the traditional economic model to a circular model. They should be considered from an economic point of view. After all, the risks that will accompany the process of transformation of the economy to a circular type can turn into dangerous consequences if they are neglected. This can lead to disruption of the economic balance, environmental safety and social consensus as a whole. So, in order to avoid reorientation of risks in potential danger and prevention of possible negative consequences, a necessary condition is the correct identification of potential risks of introducing a circular economy, which are as follows (Figure 2):

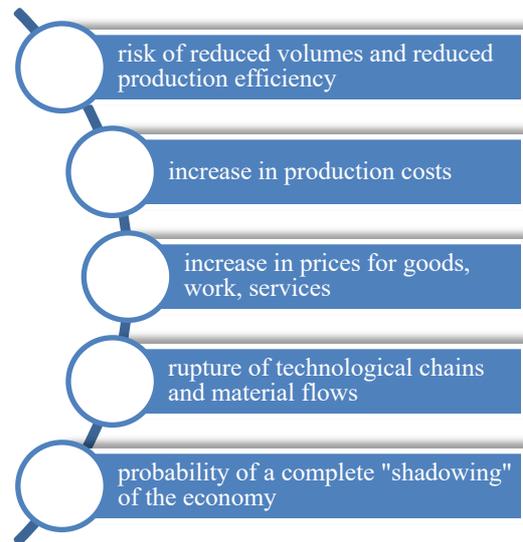


Figure 2 Risks of the development of the circular economy in Ukraine

- firstly, the risk of a decrease in volumes and a decrease in production efficiency, which is due to the inability to quickly adapt production capabilities to new requirements and standards. This will lead to a reduction in personnel potential, and, in turn, will contribute to a reduction in population incomes. At the same time, there is a risk of a partial loss of flexibility of production processes, which will lead to a slowdown in response to consumer needs in a specific period of time.
- secondly, the reorientation to new business requirements will be accompanied by significant financial costs, which will affect the increase in production costs. Since the cost is the most important general indicator of economic efficiency, its increase will have a negative impact on production in general.
- thirdly, the price level for domestic goods, work and services will increase, which in turn will affect the decrease in the competitiveness of these goods. Declining competitiveness poses a strategic threat and requires preventive actions.

- fourthly, in the short term, transformation processes in the economy will exacerbate the problems of breaking technological chains and material flows. Perhaps a violation of the continuous and rhythmic technology of the main production and supply. That is, the risk concerns the movement of materials, the distribution of the finished product between consumers and the organization of delivery to the destination.
- fifthly, high market risk, which implies the uncertainty of the final cost of a new product and its perception by consumers.
- sixthly, without effective management of the above risks, negative consequences can occur that consist not only in a decrease in economic well-being, a reduction in the country's GDP and a "complete" shadow economy, as well as in the absolute destruction of the domestic economic system.

It should be noted that for the successful implementation of the concept of a circular economy, it is necessary to create a favorable business environment. First of all, business entities and the state as a whole need to intensify the processes of investing in new technologies that would satisfy the requirements of a circular economy. Investments necessary to ensure decoupling growth in various sectors and subsectors, which during the transition phase will increase economic activity, employment and pollution levels, on the assumption that they do not completely replace other investments or consumption. Thus, financial support for the transition to a model of the circular economy should include any measures, the initiation of which will help to attract investment for financing or refinancing enterprises and projects in the development of the circular economy. The main sources of financing circular business projects may be enterprises, banking institutions, investment funds, venture and private equity, crowd funding. At the same time, the importance of each of the proposed funding sources will vary depending on the features of the Project, its cost and payback period.

Introduction of a circular economy should be based on basic market laws – in the absence of demand for recycled waste and products, it loses economic feasibility. Therefore, to justify investments, it is necessary to stimulate market demand and create new value chains within the country. This will inevitably entail the withering away of certain types of activity and enterprises, a reorientation from old types of activity to new ones or the creation of new types of business. As a result, the system of economic ties and relations on a national and global scale and the design of the country's economy will change.

Along with the foregoing, improving the business climate will attract the necessary level of investment in order to ensure the implementation of circular economy projects and the reorientation of the domestic economic system towards the manufacture of ready-made products. The need to attract investment will arise primarily in sectors of the economy that, given the development of a circular economy, gain priority, namely:

- agriculture, timber industry, woodworking and pulp and paper industry to promote the use of biofuels and the development of new products based on biotechnology;
- installation and construction / reconstruction services to achieve greater energy efficiency and the use of renewable energy sources;
- stable infrastructure, in particular with respect to the energy and transport sectors – mass transportation systems, electric vehicles and ways to determine their

value;

- maintenance and repair, development and processing to facilitate the efficient use of materials;
- engineering services and training, which will make it possible to meet the growing demand for new competencies in areas such as design, processing and updating of products, as well as new business models. Workers must be prepared to take on a whole range of new tasks that are needed for a "new" promising economy.
- improving energy efficiency of residential buildings, commercial and industrial buildings.
- education and employment services to prepare the workforce for new tasks that will be relevant in the new economy.

It is worth noting that the activation of the processes of development of the circular economy requires not only financial support and evaluation of its effectiveness, but also a high-quality information product. Indeed, the main reason for the slow pace of investment is the lack of timely, reliable, complete and relevant information. So, there is a need for targeted information programs. Information programs should be created that will directly focus on disseminating information on the need for investment for the successful implementation and development of a circular economy. A successful example of such information support is the creation in 2017 of the Platform for supporting the financing of circular economy, which combines information resources for financing the development of the circular economy by the European Investment Bank, investment funds, state banks, investors and other interested parties. The main activities of the Platform are coordination and informational work to exchange best practices and regulate financing of the circular economy, financial work to study the need for social instruments for financing projects and consulting work to develop circular economic processes and improve prospects for their implementation.

Along with this, in real life, the movement towards a circular economy requires a number of political measures – a combination of regulatory and economic instruments, as well as significant investments in infrastructure, construction and production, aimed at reducing the use of energy and materials in society. In addition, a suitable opinion [1] is that it is necessary to consider a number of new policy measures, for example, more active use of public procurement and targeted investments in the interest of efficient use of resources, various financing schemes, and adoption of resource efficiency goals for materials. In particular, where there may be a shortage, or there is a significant general effect of the extraction and use of resources on the environment. This requires the introduction of product design requirements in order to make it more convenient and easier repair, maintenance, disassembly, anti-aging and support of new business models aimed at enhancing functional sales.

It is also crucially important to revise the tax system, because the transition of society to the concept of rational use of resources and the social and environmental plan will require tax changes in the context of increasing taxes on the consumption of non-renewable resources. Such tax changes will accelerate the transition to a circular economy that is resource-efficient in nature. As part of the tax reform, a priority rethinking is required by the mechanism of levying value added tax. Goods produced using recycled materials must be exempt from value added tax. Such a reform will facilitate the use of recycled materials, that is, their recycling and reuse.

Along with the foregoing, we believe that the introduction of a circular economy in Ukraine is possible on the basis of public-private partnerships as an alternative option to accelerate the transition to sustainable models of production and consumption. In particular, a project that complies with the provisions of the circular economy on the basis of interaction between the state and business can be implemented: firstly, within one enterprise by creating a new production enterprise or modernizing, re-equipping or reconstructing an existing one; secondly, through the creation

5. CONCLUSION

The study allows us to state that, along with the existence of national characteristics of the transition to the concept of a circular economy, each country has different priority directions for its realization, primarily due to the level of economic development. Consequently, expanding the scale of development of the circular economy is impossible without a systematic complex restructuring in the direction of legislative regulation, the introduction of technologies, adequate financial support and forms of doing business to changing the mentality of society on the use of circular products and creating new opportunities for interaction between manufacturers of circular goods.

In the process of introducing a circular economy as the main model of national production, the risk management system from the position of the state is one of the key indicators of the effectiveness of such a transformation. The above risks, the list of which is not exhaustive, regardless of their separation by environment, are interrelated and interdependent. However, given the impact of introducing a circular economy in terms of the economic system, an integrated risk management system for such a transformation should be based on interdisciplinary ties involving leading experts and representatives of various fields of knowledge.

The above confirms, that the circular transformation of industrial production and the introduction of a circular economy as a whole require further steps towards the development of state economic policy, the study of the most promising sectors of the economy in terms of including waste processing links in production chains, and also in identifying possible sources of investment for financing projects with advanced recycling methods.

Herewith, the movement of the national economy in a circular direction with the potential to provide significant social benefits requires well-considered and balanced political measures along with targeted investments over a certain period of time. The main goal of this process is to reduce the utilization of energy and materials in society. It is also important to look at the circular economy as an integral part of the employment strategy and competitiveness, and not just as an environmental problem.

REFERENCES

[1] A. Flynn, L. Yu, P. Feindt et al. «Eco-cities, governance and sustainable lifestyles: The case of the Sino-Singapore Tianjin Eco-City», *Habitat International*, №53, pp. 78–86, 2016. DOI: <http://dx.doi.org/10.1016/j.habitatint.2015.11.004>

[2] A.A. Solar, O.O. Sosnovska «Current risks of circular economy development in Ukraine», *Modern financial*

of new production and / or modernization, technical re-equipment or reconstruction of existing enterprises voluntarily combined within a specific industry; thirdly, by territorial unification of the totality of entrepreneurial structures, both again and those that have undergone modernization, technical re-equipment or reconstruction.

policy of Ukraine: problems and prospects: a collection of materials of the VII Ukrainian Scientific and Practical Conference, Kyiv, 2019, December 4, pp. 176-179.

[3] A. Viykman and K. Skonberh, The circular economy and the benefits to society. Study report requested by the Club of Rome with the support of the Foundation MAVA. Available:

<https://www.clubofrome.org/wp-content/uploads/2018/02/dl-10-circular.pdf> Accessed on: February 9, 2020.

[4] A. Wijkman, K. Skånberg, Berglund M. The circular economy and benefits for society: Jobs and climate clear winners in an economy based on renewable energy and resource efficiency: A study pertaining to Finland, France, the Netherlands, Spain and Sweden, 2015. Available:

<https://www.clubofrome.org/wp-content/uploads/2016/03/The-Circular-Economy-and-Benefits-for-Society.pdf> Accessed on: February 24, 2020.

[5] Circular Economy in Cities. Evolving the model for a sustainable urban future. White paper, 2018. World Economic Forum. Available:

http://www3.weforum.org/docs/White_paper_Circular_Economy_in_Cities_report_2018.pdf Accessed on: February 7, 2020.

[6] CMU Order № 820-p (2017, Nov.8) «On approval of the National Strategy for Waste Management in Ukraine until 2030». Available:

<https://zakon.rada.gov.ua/laws/show/820-2017-p> Accessed on: February 6, 2020.

[7] D. Bourguignon, Circular economy package. Four legislative proposals on waste. Briefing. EU Legislation in Progress, 2018. Available:

[https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614766/EPRS_BRI\(2018\)614766_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614766/EPRS_BRI(2018)614766_EN.pdf) Accessed on: February 9, 2020.

[8] H. Kersty «Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world», *Futures*, №82, pp.15–25, 2016. DOI: <http://dx.doi.org/10.1016/j.futures.2016.05.012>

[9] I. Zvarych, «Circular economy, globalized management», *Journal of European Economics*, №1, P. 41–57, 2017. DOI: <https://doi.org/10.35774/jee>

[10] L.V. Deineko, O.O. Tsyplitska «The circular economy

direction of industrial modernization: European experience». Available: <https://economics.opu.ua/files/archiv/2018/No5/30.pdf> Accessed on: February 9, 2020. DOI: <https://doi.org/10.5281/zenodo.2568944>

[11] L.V. Serhiienko «The introduction of the circular economy in Ukraine: state-management aspect», the dissertation of a candidate of economic sciences: 25.00.02, Zhytomyr State Technological University, Zhytomyr, 2017.

[12] L.V. Serhiienko-Berdiukova «Circular Economics: A Review of Interpretation Approaches», Actual directions of ensuring the efficiency of the country's economy: a collection of materials of the International Scientific and Practical Conference, Zaporizhzhia, 2016, April 8-9, P. 1, pp. 101-104.

[13] L.V. Serhiienko-Berdiukova «Prerequisites for the formation and implementation of the concept of a circular economy», Problems of the theory and methodology of accounting, control and analysis. Journal: Accounting, control and analysis, Zhytomyr, 2015, Issue 3(33), pp.327-352. DOI: [https://doi.org/10.26642/pbo-2015-3\(33\)-327-352](https://doi.org/10.26642/pbo-2015-3(33)-327-352)

[14] N.D. Pilkin, O.O. Sosnovska «Experience of introducing circular economy in Ukraine and EU countries», Modern financial policy of Ukraine: problems and prospects: a collection of materials of the VII Ukrainian Scientific and Practical Conference, Kyiv, 2019, December 4, pp. 180-183.

[15] N.V. Pakhomova, K.K. Rikhter, M.A. Vitrova «The transition to a circular economy and closed supply chains as a determining factor in sustainable development», Bulletin of St. Petersburg University, Issue. 2, pp. 244-268, 2017. DOI: [10.21638/11701/spbu05.2017.203](https://doi.org/10.21638/11701/spbu05.2017.203)

[16] P. Schroeder, K. Anggraeni, U. Weber «The Relevance of Circular Economy Practices to the Sustainable Development Goals», Journal of Industrial Ecology. Available: <https://onlinelibrary.wiley.com/doi/full/10.1111/jiec.12732> Accessed on: February 24, 2020. DOI: <https://doi.org/10.1111/jiec.12732>

[17] P.T. Williams. Waste Treatment and Disposal. Chichester, John Wiley & Sons. Available: <https://www.znrfak.ni.ac.rs/serbian/010-studije/oas-3-2/PREDMETI/III%20GODINA/316-KOMUNALNI%20SISTEMI%20I%20ZIVOTNA%20SRBDINA/SEMINARSKI%20RADOVI/2014/S105%20-%20S150.pdf> Accessed on: February 6, 2020.

[18] State Statistics Service of Ukraine «Education and waste management». Available: <http://www.ukrstat.gov.ua/> Accessed on: February 9, 2020.

[19] Towards the circular economy – opportunities for the consumer goods sector. Report of the Ellen Macarthur Foundation. Available:

<http://www.ellenmacarthurfoundation.org/publications/towards-the-circular-economy-vol-2-opportunities-for-the-consumer-goods-sector> Accessed on: February 6, 2020.

[20] V.V. Yevdokymov, D.O. Hrytsyshen, L.V. Serhiienko, Circular Economics. Monograph. Zhytomyr: ZGTU, 2016.