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FORMATION OF THE CONCEPT OF A CIRCULAR ECONOMY¹

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Abstract

The article represents a historical survey describing appearing and development of circular economy as an independent concept and its interconnection to the phenomenon of new industrialization. The variety of definitions of the concept “circular economy” given by Russian and foreign scientists are provided in the article, basic approaches to the concept formation are determined. The comparative analysis of basic concepts related to the environmentalism (sustainable development, ecologization, green economy, circular economy) was carried out. The evolutionary development of ecological imperatives that take part in the concept formation is studied; the characteristics of the concept, current state and general development prospects are described. The article is concluded by the clarified definition of “circular economy”. From the point of the author’s view, the circular economy concept is a general approach to promote green growth in countries’ development that allows to overcome global ecological problems and, as a result, to achieve sustainable state of the planet and to save living on the Earth.

Keywords

Industrialization – Sustainable development – Green economy – Circular economy

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Introduction

The research objective, which is based on the comparative studies methodology, is to conduct a Acceleration in modern human development process demonstrates that the world is speeding up and there is much less time needed for new scientific and technical revolution. This phenomenon has dire consequences. Humanity appeared not to be able to transform its ideas about the interaction between human society and nature: change habits and everyday behavior, to confirm the statements above, the thought of O. N. Yanitsky that "...biological forms (including ecosystems) that have been formed during evolution have incompatible temporacies with socially constructed forms of modern life..." seems interesting².

A man in the era of information accessibility with incredible opportunities for continued self-improvement, self-education and self-development has chosen the other way of life, simplifying his worldview and getting lost in the vast information field, putting incorrect accents on his priorities and interests. All these processes can be summarized by a well-known definition "consumer society". The paradox is that not only wasteful lifestyle of the population in developed countries, but also the increased resource intensity of the production of developing has caused the climate changes and ecosystems' decline³.

In reality a "super-consumer" model has rapidly changed to a "super-contaminator" model and caused a series of environmental disasters and catastrophes. Global environmental problems accumulated over the history of civilization's development has become clear by the beginning of XXI century and demanded an urgent solution. Due to the need of constantly appliance of primary resources, which, finally become wastes, the existing model of linear economics at the terms of industrialization development and the planet population growth appeared to be ineffective, unable to provide the necessary quality of life. Gradually, sometimes without realizing it, society itself created a trap in the form of scarcity of various types of resources, and the economies of most countries have a pronounced dependence on their volatility⁴.

Wrong perception and construction of a consumption model that developed during the industrial revolution in the XIX-XX centuries that became the basis of the linear economic model, based on the principles of the inexhaustibility of natural resources without waste management concern. Nowadays resources are considered limited, and most ecosystems, having lost the ability to assimilate, have become unstable⁵. Without changes in developmental trajectory and review of key approaches to production and consumption a production crisis and further deterioration in the life quality are inevitable⁶.

The digital revolution at the beginning of the XXI century including a number of attempts to create and develop robotization process, the Internet of things and artificial intelligence has marked the transition to a new stage in the technological development of

² K. Shvab, *Chetvertaya promyshlennaya revolyutsiya* (Moscow: EKSMO, 2017).

³ L. Melnik and L. Hens, eds., *Social-Economic Potential of Sustainable Development: Manual* (Sumy: University Book, 2007).

⁴ B. Mashukova, "Osnovnyye printsipy tsiklichnoy ekonomiki (ekonomika zamknutogo tsikla)" *European Science*, Vol: 7 num 17 (2016): 14–16.

⁵ Ellen MacArthur Foundation, "Official Site of The Ellen MacArthur Foundation", Ellen MacArthur Foundation, <https://www.ellenmacarthurfoundation.org/>.

⁶ M. A. Gureva, "Teoreticheskiye Osnovy Kontsepta Tsirkulyarnoy Ekonomiki", *Journal of International Economic Affairs*, Vol: 9 num 3 (2019): 2311–2336.

industrial production, called “Industry 4.0”, the main driving force of which is the Internet of things. At the same time, the organization of the production process is characterized by a sharp reduction of energy and material consumption, the design of materials and organisms with predetermined properties. According to E. G. Calabina, consumer demand serves as the main driver of Industry 4.0, and the general concept is based on the perception of sustainable development as a process of maximizing the consumption of goods and services⁷.

The transition to Industry 4.0 will create a world of virtual and physical unity of production with erased industry boundaries, significantly reducing the technological impact on the environment⁸. When considering digitalization as a transformational technology, on the one hand, an increase in public awareness is observed, and on the other, the effect of a certain “transparency” of society appears. There is a shift in consumer preferences from the path “I want to own” towards “I want to use”; the boundaries of understanding in the field of individual professional and everyday skills, personal concepts of work, leisure and education as a whole are changing. The new industrial era has a distinctive feature in the perception of labor from the point of social efficiency, when the workplace is considered as a tool for self-realization (the development of E. Toffler's concept of prosumerism)⁹.

Methods

In the middle of 20th century world scientific community, based on the analysis of the downward course of the scientific and technical revolution, made a conclusion about limits for growth opportunities set by linear (industrial) model exploration at a global scale that led to the concept of circular economy as an alternative solution. In 1972 the United Nations Conference on the Environment was held in Stockholm (Sweden), the United Nations Environment Programme (UNEP) was established as the main UN body in the field of environment. The United Nations Conference on Environment and Development (UNCED), also known as the Rio de Janeiro Earth Summit, was a major United Nations conference held in Rio de Janeiro in 1992. The primary result of the conference was the raise of public awareness of the need to integrate environment and development. In June, 2012 the conference “Rio+20” has approved the nonbinding document, “The Future We Want”, a 49-page work paper, including Millennium Development Goals. In it, the heads of state of the 192 governments renewed their political commitment to sustainable development and declared their commitment to the promotion of a sustainable future. The document largely reaffirms previous action plans. The 17 Sustainable Development Goals and 169 targets were announced at the UN document “Transforming our world: the 2030 Agenda for Sustainable Development” in 2015¹⁰.

⁷ M. V. Ivanova; N. G. Dyachenko y and Yu L. Gilyarova, “Circular economy: opportunities for development of the Murmansk region,” in Proceedings of the all-Russian Scientific and Practical Conference “Multifactor Challenges and Risks in the Context of the Implementation of the Strategy of Scientific, Technological and Economic Development of the Macro-Region North-West,” ed. S. Kuznetsov and Ivaniov S.V. A. (St. Petersburg: Saint Petersburg State University of Aerospace Instrumentation, 2018), 270–277.

⁸ V. E. Socheeva, “Tsirkulyarnaya model' ekonomiki kak novyy podkhod k probleme ustoychivogo razvitiya”, Economics and Business: Theory and Practice, Vol: 7 (2017): 122–124.

⁹ E. Nechaeva, “Rol sotsialnoy laboratorii i Quadruple Helix modeli v perekhode Samary na tsirkulyarnuyu ekonomiku”, Vestnik sovremennyh issledovaniy Vol: 8 num 23 (2018): 60–62.

¹⁰ United Nations, “United Nations Environment Programme”, UNEP - United Nations Environment Programme, <http://www.unenvironment.org/node>.

Over the past decade, special attention has been paid to the new concept of an economic model development, called the “circular economy”, which is considered as a new path for the development of society along the path of sustainability (Figure 1).

A study of the considered areas of the economy of environmentalism showed their interdependence and interdetermination, the similarity of the formation approach, confirming that their final global goals are the same - the stable state of the planet and global survival, with difference only in ways of goals achievement and main approaches¹¹.

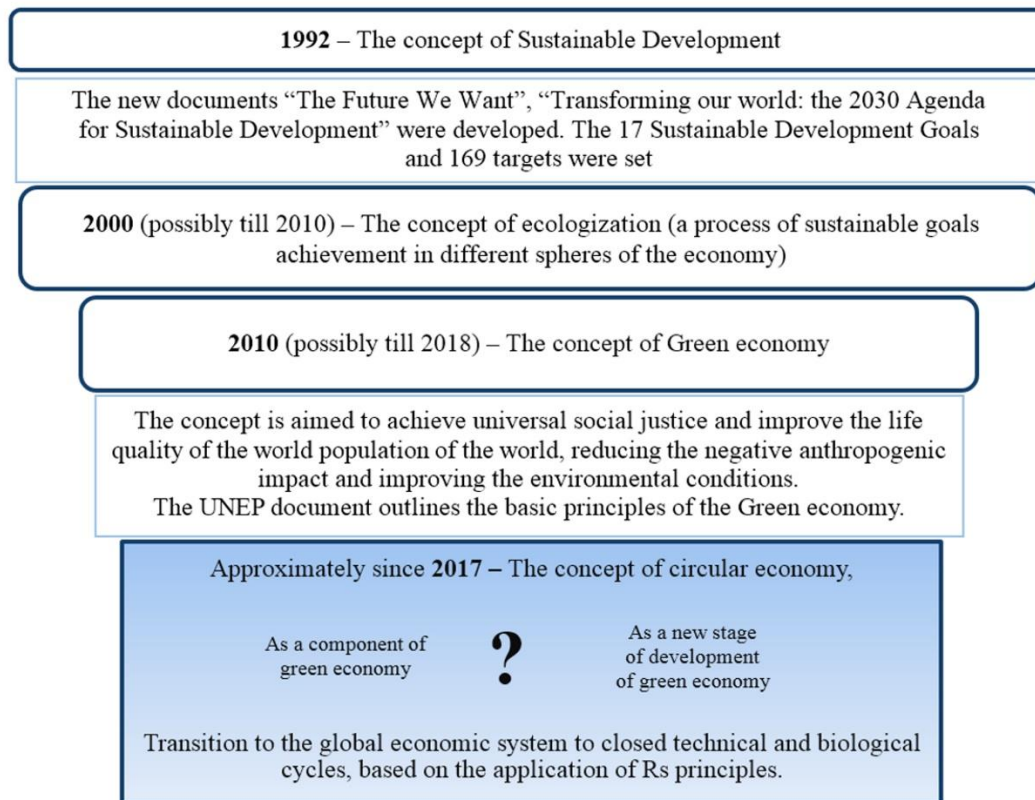


Figure 1

The path to the formation and popularization of the economics of environmentalism
(prepared by the authors based on the works by Batova, Sachek, Tochitskaya¹² and Gureva¹³)

¹¹ CEA, “Circular Economy in Australia,” Circular Economy Australia, <http://www.circulareconomyaustralia.com>; Denise Reike, Walter J.V. Vermeulen, and Sjors Witjes, “The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options,” *Resources, Conservation and Recycling*, Vol: 135 (2018): 246–264; N. Batova, P. Sachek, and I. Tochitskaya, “On the way to Green Growth: window opportunities of circular economy,” BEROG Green Economy Policy Paper Series, PP GE num 1 (2018), http://eng.beroc.by/research/policy_papers/ge-01-eng/.

¹² N. Batova; P. Sachek and I. Tochitskaya, “Circular economy in action: forms of organization and best practices”, BEROG Green Economy Policy Paper Series, PP GE num 5 (2018), http://eng.beroc.by/research/policy_papers/ge-5/.

¹³ M. A. Gureva, *Metodicheskiy instrumentariy otsenki ekologizatsii territorii* (PhD thesis, Ural Federal University named after the first President of Russia B. N. Yeltsin, 2013).

The comparative analysis of the economics of environmentalism concepts based on main criteria is shown in Table 1.

Comparison criterion	Sustainable development	Ecologization	Green economy	Circular economy
• Peak of popularisation	• 1992	• 2000	• 2010	• 2017
• Main agent	• person passes from the category of "object" to the category of "subject"	• environmentally aware person	• innovative person	• man is integral with nature and society
• Main concept	• achieving the needs of the current generation during development does not negatively affect the ability of the future generation to satisfy their own	• economic development that meets environmental requirements	• economic model in which a high level of planet's population wellbeing is achieved simultaneously with minimizing environmental risks	• economic model based on closed loops with multiply usage of resources and high-scale waste recycling
• Goal	• 7 Sustainable Development Goals	• maximum profitability with minimal environmental damage	• achieving social justice, improving wellbeing simultaneously with reducing environmental risks	• achieving ecological balance with a steady economic and social growth in the well-being of the world's population while maximizing the life cycle efficiency of various resources, goods and services
• Mainstream	• the trinity of social, economic and environmental systems	• much attention is paid to the problem of the distribution of various goods among the population, decoupling	• qualitatively new economic growth (green growth), provided by innovative aspects of balanced and	• waste minimization (complete reduction in the future); minimization of resources extraction

Comparison criterion	Sustainable development	Ecologization	Green economy	Circular economy
			safe development	
<ul style="list-style-type: none"> • fundamental principles 	<ul style="list-style-type: none"> • 6 basic principles declared at a UN conference in Rio de Janeiro, 1992 and the United Nations General Assembly Special Session (UNGASS) in New York, 1997 	<ul style="list-style-type: none"> • precautionary, continuity, ubiquity, interrelatedness, integration 	<ul style="list-style-type: none"> • generation equality, compliance with sustainable development principles • reasonable natural and social capital accounting, sustainable and efficient use of resources, creation of “green” jobs, poverty eradication, improvement of competitiveness and increasing growth in the main sectors of the economy (European Environment Agency) 	<ul style="list-style-type: none"> • developing imperatives of sustainable development R, earlier developed 3Rs were improved to 9Rs
<ul style="list-style-type: none"> • area of research 	<ul style="list-style-type: none"> • improvement in the life quality for the diverse population of the planet 	<ul style="list-style-type: none"> • maintenance of life support systems, assessment of natural capital, development of innovative assessment tools and variable environmental management models 	<ul style="list-style-type: none"> • sustainable development, green investments, tourism, business, education, biomass, carbon pollution, development of land resources 	<ul style="list-style-type: none"> • sustainable development and industrialization, extension of product life-cycle, industrial symbiosis, recycling, closed-loop supply chains
<ul style="list-style-type: none"> • time span of implementing 	<ul style="list-style-type: none"> • open time frames 	<ul style="list-style-type: none"> • unlimited 	<ul style="list-style-type: none"> • time limit 	<ul style="list-style-type: none"> • time limit
<ul style="list-style-type: none"> • final global goal 	<ul style="list-style-type: none"> • Stable state of the planet and global survival 			

Note: The table is prepared by the authors based on the published works¹⁴.

Table 1

Comparative analysis of the economics of environmentalism concepts

¹⁴ N. Batova; P. Sachek and I. Tochitskaya, “Circular economy in action: forms of ...”; I. S. Belik et al., “Formation of the Investment Portfolio in Accordance with the Criteria of Circular Economy”, Bulletin

Result

The key difference between the initially accepted concept of sustainable development and the later concept of the circular economy is expansion of its sphere of concepts, because in the interconnection of environmental and economic spheres, a greater merger occurs through the necessary interaction (Figure 2).

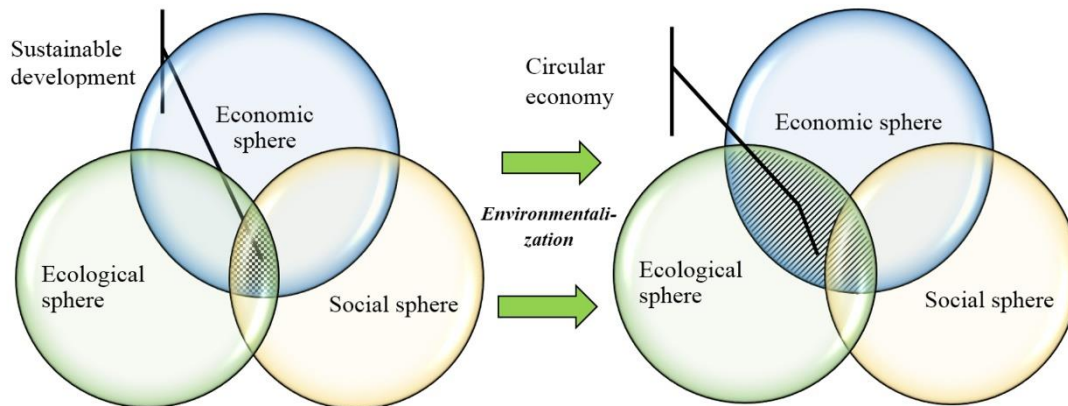


Figure 2

The relationship between the concepts of sustainable development and the circular economy (prepared by the authors based on the work by Murray, Skene, and Haynes¹⁵)

The transition from industrial to post-industrial society in the 60s of XX century based on the technological and further innovative progress caused the appearance of the concept of circular economy in the scientific literature. The circular economy concept was introduced in 1966 by Kenneth Ewart Boulding¹⁶ (an American economist). The concept was mainly rooted in ecological and environmental issues: “a man should find his own place in circular environmental system”. Later the concept has gained more economic character¹⁷. There are several opinions on the origin of the term “circular economy”, a number of scientists believe that the circular economy is a new stage in the development of the concept of sustainable development and the green economy; on the other hand, much less often, it is considered as an independent direction of economic theory, appeared in the 1970s of the XX century¹⁸.

of Ural Federal University. Series Economics and Management, Vol: 17 num 6 (2018): 986–1004; Ellen MacArthur Foundation, “Official Site of The Ellen MacArthur Foundation”; United Nations, “United Nations Environment Programme”; CEA, “Circular Economy in Australia”; Denise Reike, Walter J.V. Vermeulen, and Sjors Witjes, “The circular economy ...

¹⁵ Alan Murray; Keith Skene and Kathryn Haynes, “The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context”, *Journal of Business Ethics*, Vol: 140 num 3 (2017): 369–380.

¹⁶ K. Boulding, “The Economics of the Coming Spaceship Earth,” in *Environmental Quality in a Growing Economy*, ed. H. Jarrett (Baltimore: Hopkins University Press, 1966), 3–14, http://arachnid.biosci.utexas.edu/courses/THOC/Readings/Boulding_SpaceshipEarth.pdf.

¹⁷ Aline Sacchi Homrich et al., “The circular economy umbrella: Trends and gaps on integrating pathways”, *Journal of Cleaner Production*, Vol: 175 (2018): 525–543.

¹⁸ M. A. Gureva, “Metodicheskiy instrumentariy otsenki ...”; M. A. Gureva, “Teoreticheskiye Osnovy Kontseptya Tsirkulyarnoy Ekonomiki...”

The literature search has been performed in Scopus, Elsevier, Elibrary, WOS databases and Google Scholar using “circular economy” as a keyword in the title, keywords or abstract of the document. The term is widely spread in foreign scientific literature while in Russian academic literature it is much less common. Nevertheless, a number of scientists emphasize that the circular economy is not an analogue of the “green” economy, but acts as an integral part of it, a way to achieve sustainable development¹⁹.

The earliest reference to the circular economy belongs to Walter Stahel. In his 1976 research report, he offered the idea of transition from the linear model of resource-dependent economy to an economy in loops (or circular economy)²⁰.

The main definitions of the term “circular economy” given by different researches are represented in Table 2.

Year	Author	Definition
• 004	• The Waste and Resources Action Programme ²¹	• An alternative to a traditional linear economy
• 004	• Sergienko O. and Rona X. ²²	• A global economic model that separates economic growth and development from consumption of non-renewable resources
• 007	• Wen C. F. <i>et al.</i> ²³	• A way to solve the problem of sustainable development
• 007	• Melnik L. G. and Hens L. ²⁴	• An activity for the production, distribution and consumption of goods, based on the principles of conservation of various resources and materials, “non-waste economy”
• 008	• Yong G. and Doberstein B. ²⁵	• The realisation of a closed loop of

¹⁹ B. Mashukova, “Osnovnyye printsipy tsiklichnoy ekonomiki...”

²⁰ M. A. Gureva, “Teoreticheskiye Osnovy Kontsepta Tsirkulyarnoy Ekonomiki ...”; D. D’Amato et al., “Green, circular, bio economy: A comparative analysis of sustainability avenues”, *Journal of Cleaner Production*, Vol: 168 (2017): 716–734; H. Majer, “Wachstum aus der Sicht der ökologischen Ökonomie”, in *Jahrbuch Ökologische Ökonomik Band 1: Zwei Sichtweisen auf das Umweltproblem: Neoklassische Umweltökonomik versus Ökologische Ökonomik* (Marburg: Metropolis, 1999), 319–1349.

²¹ United Nations, “United Nations Environment Programme”.

²² O. Sergienko and H. Rohn, eds., *Osnovy teorii eko-effektivnosti: Monografiya [Basics of the eco-efficiency theory: Monograph]* (St. Petersburg: STPbSUR&FT, 2004), https://wupperinst.org/uploads/tx_wupperinst/Basics_EcoEfficiency_ru.pdf.

²³ C. F. Wen; Y. L. Zhao and R. Z. Liang, “Recycle of low chemical potential substance”, *Resources, Conservation and Recycling*, Vol: 51 num 2 (2007): 475–486.

²⁴ L. Melnik and L. Hens, eds., *Social-Economic Potential of...*

²⁵ Yong Geng and Brent Doberstein, “Developing the circular economy in China: Challenges and opportunities for achieving ‘leapfrog development,’” *International Journal of Sustainable Development*

Year	Author	Definition
		material flows in the economic system
• 008	• Yuan Z. <i>et al.</i> ²⁶	• political strategy aimed to reduce resource scarcity and pollution
• 009	• Zhang H. <i>et al.</i> ²⁷	• new way to a sustainable development
• 011	• Zhu Q. <i>et al.</i> ²⁸	• way of continued economic development without creating significant environmental and resource problems
• 012	• The Ellen MacArthur Foundation ²⁹	• new way to design, make, and use things within planetary boundaries. A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems
• 013	• Su B. <i>et al.</i> ³⁰	• It is a strategy of sustainable development that aims to increase the material and energy efficiency
• 013	• Sazonova T.Yu. ³¹	• new trend, a basis for The fourth industrial revolution
• 014	• United Nations ³²	• circular economy system that keeps the added value in products for as long

& World Ecology, Vol: 15 num 3 (2008): 231–239, <https://www.tandfonline.com/doi/full/10.3843/SusDev.15.3%3A6>.

²⁶ Zengwei Yuan; Jun Bi and Yuichi Moriguchi, “The Circular Economy: A New Development Strategy in China”, *Journal of Industrial Ecology*, Vol: 10 num 1–2 (2008): 4–8.

²⁷ Haiyan Zhang et al., “Comparative analysis of socio-economic and environmental performances for Chinese EIPs: case studies in Baotou, Suzhou, and Shanghai”, *Sustainability Science*, Vol: 4 num 2 (2009): 263–279.

²⁸ Qinghua Zhu et al., “Evaluating green supply chain management among Chinese manufacturers from the ecological modernization perspective”, *Transportation Research Part E: Logistics and Transportation Review*, Vol: 47 num 6 (2011): 808–821.

²⁹ Ellen MacArthur Foundation, “Official Site of The Ellen MacArthur Foundation”; Ellen MacArthur Foundation, “Circular Economy - UK, USA, Europe, Asia & South America - The Ellen MacArthur Foundation,” Ellen MacArthur Foundation, 2017, <https://www.ellenmacarthurfoundation.org/>.

³⁰ Biwei Su et al., “A review of the circular economy in China: moving from rhetoric to implementation”, *Journal of Cleaner Production*, Vol: 42 (2013): 215–227.

³¹ T. Sazonova, “Volny internatsionalizatsii i perspektivy globalizatsii”, *Scientific Works of the Free Economic Society of Russia*, Vol: 176 (2013): 495–502.

³² United Nations, “United Nations,” Official site of the United Nations (United Nations, n.d.), <http://www.un.org>.

Year	Author	Definition
		as possible and eliminate waste. It keeps resources within the economy when a product has reached the end of its life, so that it can be productively used again and again and hence creates further value
• 014	• Jiao W. and Boons F. ³³	• holistic concept covering the activities of 'reduce, reuse, and recycle' in the process of production, circulation, and consumption"
• 014	• Wei F. <i>et al.</i> ³⁴	• model of economic development with maximum resource utilization and environmental protection
• 015	• Murray A. ³⁵	• a contemporary and popular concept that describes how materials and resources should be handled in the future"
• 015	• Murray A. ³⁶	• an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being"
• 015	• Haas W. <i>et al.</i> ³⁷	• a simple, but convincing, strategy, which aims at reducing both input of virgin materials and output of wastes by closing economic and ecological loops of resource flows"

³³ Wenting Jiao and Frank Boons, "Toward a research agenda for policy intervention and facilitation to enhance industrial symbiosis based on a comprehensive literature review", *Journal of Cleaner Production*, Vol: 67 (2014): 14–25.

³⁴ Feng Wei', Sifeng Liu, and Lijun Yin WeizhaoLi, "Research on Performance Evaluation System for Green Supply Chain Management Based on the Context of Recycled Economy" (2014).

³⁵ Martijn Burger et al., "The heterogeneous skill-base of circular economy employment", *Research Policy*, Vol: 48 num 1 (2019): 248–261.

³⁶ Alan Murray, Keith Skene, and Kathryn Haynes, "The Circular Economy..."

³⁷ Willi Haas et al., "How Circular is the Global Economy?: An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005: How Circular is the Global Economy?", *Journal of Industrial Ecology*, Vol: 19 num 5 (2015): 765–777.

Year	Author	Definition
• 015	• Tukker A. ³⁸	• mutually-beneficial philosophy that confirms that a thriving economy and a healthy environment can coexist
• 016	• Ghisellini <i>et al.</i> ³⁹	• space for solving aggravating resource problems, a concept that allows us to separate the direct use of resources from economic growth
• 016	• Circular Economy in Australia ⁴⁰	• an alternative model that anticipates and designs for resources to be either safely returned to nature or back into systems where they can be reused or renewed”
• 016	• Sauvé S., Bernard S., and Sloan P. ⁴¹	• a model of production and consumption of goods through closed loop material flow that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)”
• 016	• Lieder M. and Rashid A. ⁴²	• a solution to series of challenges such as waste generation, resource scarcity and sustaining economic benefits”
• 016	• Serbulova N. M., Sivolapenko E. V., and Panosyan S. A. ⁴³	• recovery or regenerative production system; is an integrated waste management process.

³⁸ A. Tukker, “Product Services for a Resource-Efficient and Circular Economy – a Review”, *Journal of Cleaner Production*, Vol: 97 (2015): 76–91.

³⁹ Patrizia Ghisellini, Catia Cialani, and Sergio Ulgiati, “A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems”, *Journal of Cleaner Production*, Vol: 114 (2016): 11–32.

⁴⁰ CEA, “Circular Economy in Australia.”

⁴¹ Sébastien Sauvé, Sophie Bernard, and Pamela Sloan, “Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research”, *Environmental Development*, Vol: 17 (2016): 48–56.

⁴² Michael Lieder and Amir Rashid, “Towards circular economy implementation: a comprehensive review in context of manufacturing industry”, *Journal of Cleaner Production*, Vol: 115 (2016): 36–51.

⁴³ N. Serbulova, E. Sivolapenko, and S. Panosyan, “Aktualnost perekhoda ot lineynoy k tsirkulyarnoy modeli ekonomiki [The relevance of the transition from a linear to a circular economic model],” in *Economist of the Year*, ed. G. Yu Gulyaev (Penza: MTsNS, 2016), 60–65.

Year	Author	Definition
• 016	• ilyugina M. A. ⁴⁴	• n economy that improves people's well-being and ensures social justice, significantly reducing environmental risks
• 018	• ashukova B. S. ⁴⁵	• philosophy of recycling and profit from what was previously considered unnecessary and sent to the utility waste as part of the traditional linear economy
• 017	• eissdoerfer M. <i>et al.</i> ⁴⁶	• a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops”
• 017	• leksandrova V.D. ⁴⁷ and Esipova O. V. ⁴⁸	• n economic activity aimed at energy conservation, regenerative environmentally friendly production, circulation and consumption. The circular model is the most successful way of saving resources and materials and continuous economic growth
• 017	• akhomova N. V., Rikhter K.K., and Vetrova M. A. ⁴⁹	• ne of the tools for solving environmental problems to accomplish sustainable environmental future

⁴⁴ M. Pilyugina, “Tsirkulyarnaya model ekonomiki kak novyy podkhod k probleme ustoychivogo razvitiya”, *Stroitelstvo - Formirovanie Sredy Zhiznedeyatelnosti* (2016): 148–149.

⁴⁵ B. Mashukova, “Osnovnyye printsipy tsiklichnoy ekonomiki ...

⁴⁶ Martin Geissdoerfer et al., “The Circular Economy – A New Sustainability Paradigm?,” *Journal of Cleaner Production*, Vol: 143 (2017): 757–768.

⁴⁷ V. Aleksandrova, “Aktual'nost' perekhoda k modeli tsirkulyarnoy ekonomiki v Rossii”, *International Journal of Humanities and Natural Sciences*, Vol: 11 (2017): 106–110.

⁴⁸ O.V. Esipova; N. M. Blazhov and I. A. Satsyuk, “Tsirkulyarnaya ekonomika” in *Proceedings of 4th International Research and Practical Conference “Modern science: topical issues, achievements and innovations”*, Part 2, ed. G. Yu Gulyaev (Penza: MTsNS “Nauka i Prosveshchenie” Publ., 2018), 107–110.

⁴⁹ Nadezda V. Pakhomova; K. Knut and Mariya A. Vetrova, “Transition to circular economy and closedloop supply chains as driver of sustainable development”, *St Petersburg University Journal of Economic Studies*, Vol: 33 num 2 (2017): 244–268.

Year	Author	Definition
<ul style="list-style-type: none"> • 017 	<ul style="list-style-type: none"> • Kirchherr J., Reike D. and Hekkert M.⁵⁰ 	<ul style="list-style-type: none"> • an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations“
<ul style="list-style-type: none"> • 018 	<ul style="list-style-type: none"> • Nechaeva E. O.⁵¹ 	<ul style="list-style-type: none"> • an economy based on renewable resources, the transition to renewable energy sources and the processing of secondary raw materials
<ul style="list-style-type: none"> • 018 	<ul style="list-style-type: none"> • Antropov V. A., Bochko V. S., and Kniss M. Yu.⁵² 	<ul style="list-style-type: none"> • an integral part of the broader concept of a “green” economy; • the next stage of a “green” economy development
<ul style="list-style-type: none"> • 018 	<ul style="list-style-type: none"> • Korhonen J. <i>et al.</i>⁵³ 	<ul style="list-style-type: none"> • sustainable development initiative with the objective of reducing the societal production-consumption systems' linear material and energy throughput flows by applying materials cycles, renewable and cascade-type

⁵⁰ Julian Kirchherr, Denise Reike, and Marko Hekkert, “Conceptualizing the circular economy: An analysis of 114 definitions”, *Resources, Conservation and Recycling*, Vol: 127 (2017): 221–232.

⁵¹ E. Nechaeva, “Rol sotsialnoy laboratorii...”

⁵² V. A. Antropov; V. S. Bochko and M. Yu. Kniss, “Development of the «green» economy in Russia”, *Herald of the Ural State University of Railway Transport* num 3 (2018): 68–83.

⁵³ Jouni Korhonen et al., “Circular economy as an essentially contested concept”, *Journal of Cleaner Production*, Vol: 175 (2018): 544–552.

Year	Author	Definition
		energy flows to the linear system

Note: The table is prepared by the authors based on the published works (mentioned above and and other⁵⁴.

Table 2
Main definitions of the term “circular economy”

In general approaches for “circular economy” definition for the 15-years long period of its development (from 2004 to 2019) may be grouped as follows: a certain model, activity, system, strategy, process, tool, economy, philosophy. The most commonly used and generally accepted, found in the reviewed papers and the media, is the term by The Ellen MacArthur Foundation proposed in 2012. It is worth noting that at the moment there is no officially approved definition for the term (Figure 3).

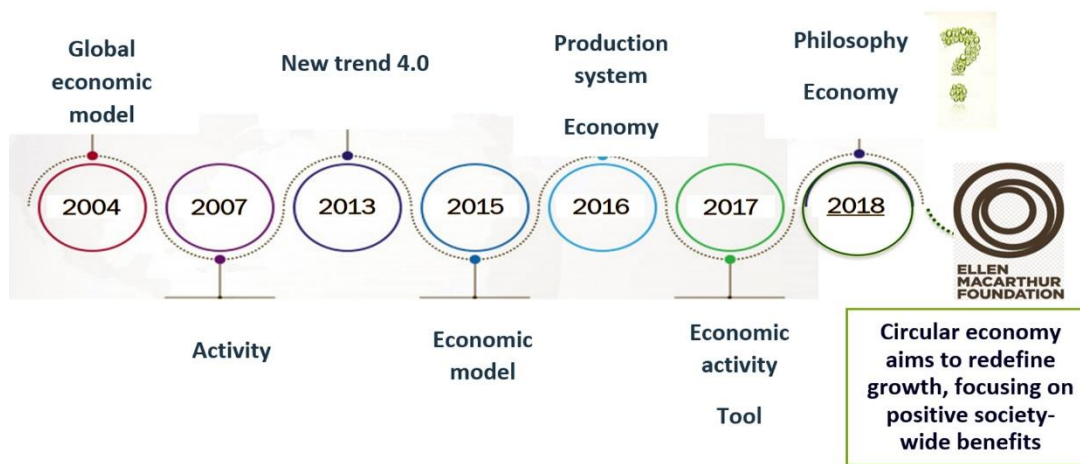


Figure 3
Approaches for the definitions of “circular economy” (prepared by the authors)

There are three stages distinguished in the evolution of the circular economy (Table 3).

Time period	Title	Description
• 1970 – 1990	• reuse activities and waste management	• in the European countries and the USA a number of

⁵⁴ Ye. V. Mishenin and I. I. Koblianska, “Perspectives and mechanisms of ‘circular’ economy global development”, Marketing and Management of Innovations num 2 (2017): 329–343; A. G. Margaryan, “Idealnaya model ekonomiki, Vol: 1 num 9 (2018): 136–137; Vanessa Prieto-Sandoval, Carmen Jaca, and Marta Ormazabal, “Towards a consensus on the circular economy”, Journal of Cleaner Production, Vol: 179 (2018): 605–615; Sébastien Sauvé; Sophie Bernard and Pamela Sloan, “Environmental sciences...; L.N. Rudneva and M.A. Gureva, Ekonomika prirodopol’zovaniya: Uchebnoye posobiye dlya VUZov (Tyumen: TSOGU, 2015); Brais Suárez-Eiroa et al., “Operational principles of circular economy for sustainable development: Linking theory and practice”, Journal of Cleaner Production, Vol: 214 (2019): 952–961, <https://linkinghub.elsevier.com/retrieve/pii/S0959652618340009>; O.N. Yanitskiy, “Novyy doklad Rimskom klubu k 50-letiyu ego osnovaniya: plyusy i minusy” Vlast’, Vol: 26 num 2 (2018): 19–25.

Time period	Title	Description
		<p>environmental legislative measures have been adopted. The 3R (reduce, reuse and recycle) concept has become more popular at governmental level. State measures were restrictive, taking into account producers' preferences The Polluter-Pays-Principle was stated. The focus was shifted at the waste management issue, but due to the lack of development in environmental culture and concern the territories of poor countries were used for waste storages and recycle. Rapidly developing television and the media were paying attention to the ongoing environmental changes. Scientific literature on recycling, collection, waste management appeared</p>
<ul style="list-style-type: none"> • 1990 – 2010 	<ul style="list-style-type: none"> • co-efficiency strategies 	<ul style="list-style-type: none"> • The idea of environmental payments (pollution charges) (the Brundtland report. 1987) had a certain influence on the evolution of the circular economy. Environmental problems were perceived by society as a kind of economic opportunity. In the early 2000s with development and growth of the Internet and the increased speed of information exchange, a number of environmental problems were announced as global (ozone layer depletion, global warming, etc). • • The academic community is actively developing possible ways of zero-waste production, but only in the industrial sphere. • • The first references to the circular economy appeared in a number of scientific literature databases, for example, in Scopus in 2004. The idea of a closed-loop

Time period	Title	Description
		economy is gradually becoming popular
<ul style="list-style-type: none"> • 010 till present 	<ul style="list-style-type: none"> • aximum saving at the age of resource depletion 	<ul style="list-style-type: none"> • early 2010, the concept of a circular economy, summarizing the most viable ideas of theoretical researches, has gained its final form. The central stated problem is the survival of mankind in terms of the reduction and a natural resources crisis, the growth of the world population and the amount of waste. In particular, ideas and investigations devoted to the circular economy created by the team of The Ellen MacArthur Foundation are widespread. It is planned that further economic growth will be independent from natural resources and thus the energy dependence will be overcome. That'll make it possible to save the ecosphere. Experts offer companies to plan the development based on three principles: green innovation, alternative sources, a shift of the industrial paradigm. Currently, about 500 companies in the world are using a circular economy strategy.

Note: Prepared by the authors based on the work by D'Amato *et al.*⁵⁵.

Table 3
Stages of the evolution of circular economy

⁵⁵ D. D'Amato et al., "Green, circular, bio economy..."

The name Ellen MacArthur is closely connected with the concept of a circular economy. She finished her single-handed circumnavigation of the globe in world record time in 2005. Following her retirement from professional sailing in 2010, Ellen MacArthur announced the launch of the Foundation named after her that aims at the acceleration of the transition to a circular economy. The Ellen MacArthur Foundation works in Education & Training, Business & Government, Insight & Analysis, Systemic Initiatives and Communications

The Foundation now is a global leader in applying systems theory and complexity theory to tackling the greatest challenges of our time that works with business, government and academia to build a framework for an economy that is restorative and regenerative by design. The Fund is an active participant in the world's leading economic forums and attracts an increasing number of founding partners⁵⁶.

Based on the academic papers analysis the authors made the conclusion that most scientist use the prefix “re” while describing the principles of the circular economy. The prefix “re”, occurring originally in loanwords from Latin, used with the meaning “again” or “again and again” to indicate repetition, reflects the meaning of the circular economy⁵⁷.

Initially there were three guiding principles of the circular economy – “3R” principles (reduce, reuse, recycle) that have been transformed to “9R” principles. It should be noted that their further development is still possible (Figure 4).

A detailed characteristic of the 9R-s principles of circular economy is presented in Figure 5.

⁵⁶ O. Sergienko and H. Rohn, Osnovy teorii eko-effektivnosti...

⁵⁷ D. D’Amato et al., “Green, circular, bio economy...”

3 R General model of the circular economy	4 R Circular economy: priorities and mechanisms	5 R Principles of the circular economy	9 R Principles of useful application of materials and products
Reduce	Material choice and design	Reduce	Refuse (stop excessive usage of raw materials)
Reuse	Cascading	Reuse	Reduce (decline volume of raw materials used)
Recycle	Lifetime extension	Recycle	Reuse (use again)
	Change of consumption pattern	Recovery	Repair (maintenance and repair)
	Resource management	Reclamation	Refurbish (renovate and redecorate)
	Infrastructure development		Remanufacture (rebuilding of a product to specifications of the original manufactured product using a combination of reused, repaired and new parts)
	Resource restoration		Repurpose (to use something for a different purpose to the one for which it was originally intended)
	Safe disposal		Recycle (treat or process (used or waste materials) so as to make suitable for reuse)
			Recover (conversion of non-recyclable waste materials into usable heat, electricity)

Figure 4
Evolution of the circular economy guiding principles
(prepared by the authors based on the published works)⁵⁸

⁵⁸ N. Batova; P. Sachek and I. Tochitskaya, "Circular economy in action: forms of ..."; B. Mashukova, "Osnovnyye printsipy tsiklichnoy ekonomiki..."; B. A. Nikitina and V. B. Zvonovskiy, "Vliyanie tsirkulyarnoy i sheringovoy ekonomiki na kachestvo zhizni naseleniya i formirovanie innovatsionnyh rabochikh mest v sovremennom obschestve", Problemy razvitiya predpriyatii: teoriya i praktika, Vol: 3 (2018): 79–85; T. Sazonova, "Volny internatsionalizatsii i..."; E. Serbulova, E. Sivolapenko and S. Panosyan, "Aktualnost perekhoda ot lineynoy ..."; Yu Nikulychev, Upravlenie otkhodami. Opyt Evropeyskogo soyuza (Moscow: INION RAN, 2017).

Legend	Title	Description
0R	Refuse	Refusal of excessive use of raw materials. Consumers are supposed to buy and consume less. Waste volume reduction (such as packaging paper, disposable tableware etc.) is emphasized in some literature sources All stages of the product life cycle are affected, including design, production processes, etc.
1R	Rethink	New thinking of product life cycle and raw material usage in order to change and improve it.
2R	Reduce	Reduction of raw material usage with further total elimination of waste production both on individual and industry level
3R	Reuse	Practice of using discarded product of good condition again by another customer. Active development of reselling especially at Amazon and eBay and other top online shopping sites.
4R	Repair	Maintenance and repair of defective product so it can be used with its original function. There are several options for implementing this principle: a consumer repairs the product themselves or at a special repair company or manufactures of products provide repair and maintenance service
5R	Refurbish	Restore or renovate an old product and bring it up to date without changing most part of it (especially buildings, heavy equipment)
6R	Remanufacturing	Use parts of a discarded product in a new product with the same function to prolong its lifecycle
7R	Repurpose	Use a discarded product for a different purpose to the one for which it was originally intended, otherwise "second life of thrown products. Looks like 1R, the difference is that it is used not in manufacture spher but at the sphere of design
8R	Recycle	Process materials to get new products, sorting of waste to "capture" and return of "clean" resources to the production cycle.
9R	Recover	Incineration of material with energy recovery and/ or biorefinery

Figure 5
 Characteristic of the 9R-s principles of circular economy (prepared by the authors based on the published works by other authors⁵⁹)

⁵⁹ D. D’Amato et al., “Green, circular, bio economy...; Julian Kirchherr et al., “Barriers to the Circular Economy: Evidence From the European Union (EU)”, Ecological Economics, Vol: 150 (2018): 264–272; Sébastien Sauvé; Sophie Bernard and Pamela Sloan, “Environmental sciences...

The lack of a clear conceptualization of the basic principles together with an increasing number of additionally emerging areas in the study of R-imperatives, can be explained by the following:

- many research papers by different authors are devoted to the circular economy concept, that's why a clear area of the knowledge can be hardly determined.;
- the circular economy is not a strictly isolated field of study; its origin took place at the intersection of different sciences;
- globalization processes taking place in the scientific environment allow us to identify and present to the world scientific community previously unknown studies, which affects the dynamic perception of the circular economy;
- international organizations use in their terminology and official documents various R-principles, sometimes the principles and terminology of different companies bear no mutual correspondence⁶⁰.

According to the researches of The Ellen MacArthur Foundation (the pioneer at the promoting of the circular economy ideas) distinguish its several features:

- maintaining a sustainable balance of natural resources and monitoring their condition and use in order to avoid the natural capital depletion;
- development, distribution and widespread implementation of optimized manufacturing processes achieve the maximum level of its reuse;
- increasing the efficiency of economic and environmental systems of industrial activity by excluding negative effects⁶¹.

Discussion

The practical application of the circular economy can be observed at all levels of the global economic activity - from an individual action to the planetary level of interaction of countries representatives, which will make possible the transition from linear model of the economy (Table 5).

Comparison criterion	Circular economy	Linear economy
•	•	•
• subject	• consumer acts like an integral part of society and nature	• consumer thinks only about his benefits
• system integrity	• interrelatedness, triunity of economy, ecology and society	• market acts like an entire system

⁶⁰ D. D'Amato et al., "Green, circular, bio economy..."; Jiao and Boons, "Toward a research agenda for policy intervention and facilitation to enhance industrial symbiosis based on a comprehensive literature review".

⁶¹ V. Aleksandrova, "Aktual'nost' perekhoda k modeli..."; O. Sergienko and H. Rohn, Osnovy teorii eko-effektivnosti...

Comparison criterion	Circular economy	Linear economy
<ul style="list-style-type: none"> • Main aim 	<ul style="list-style-type: none"> • To achieve ecological balance during sustainable economic and social growth and prosperity by increasing the effectiveness of product, service and resource life cycle 	<ul style="list-style-type: none"> • To maximize profit with lack of attention to the ecological issues. The process is characterized by unbalanced economic growth and prosperity and social stratification.
<ul style="list-style-type: none"> • Production level 	<ul style="list-style-type: none"> • Closed cycle manufacturing directed to minimize the amount of products. The manufactured goods in general are of higher quality and reusable 	<ul style="list-style-type: none"> • Constant growth of the amount of manufactured goods and services (of low quality in general), increasing of production rate at all spheres. The process is characterized by overproduction crisis and market glut.
<ul style="list-style-type: none"> • Consumption level 	<ul style="list-style-type: none"> • Developing of new goods and services consumption pattern depending on the its necessity and importance for a consumer 	<ul style="list-style-type: none"> • Satisfaction of excessive desire for goods, peculiar to behavior of super-consumer
<ul style="list-style-type: none"> • Type of natural resource management 	<ul style="list-style-type: none"> • Repeating of resources 	<ul style="list-style-type: none"> • Consuming of resources
<ul style="list-style-type: none"> • Society-nature interrelation 	<ul style="list-style-type: none"> • Integration of ecologization in the system of manufacturing processes. The process is characterized by reduction of anthropogenic impact on the environment 	<ul style="list-style-type: none"> • Increasing anthropogenic impact on the environment causes planetwide environmental crisis
<ul style="list-style-type: none"> • Resources used 	<ul style="list-style-type: none"> • Interaction of financial, informational, intellectual, labour and other resources in order to produce and use goods made of recyclable materials. 	<ul style="list-style-type: none"> • Natural resources extracted without considering environmental damage.
<ul style="list-style-type: none"> • Amount of wastes 	<ul style="list-style-type: none"> • Gradual reduction targeted to total disappearance of wastes by applying new approaches available from the process of technological development. Appearing of new branches 	<ul style="list-style-type: none"> • Constant industrial and consumer waste growth. Waste accumulation causes global ecological problem.
<ul style="list-style-type: none"> • Types of manufacturing prevailing in industry 	<ul style="list-style-type: none"> • Development of knowledge-based and innovative industries. 	<ul style="list-style-type: none"> • Labour-intensive manufacturing, characterized by low level of innovative activity and involving different types of intangible asset.
<ul style="list-style-type: none"> • Social partnership 	<ul style="list-style-type: none"> • Active socio-economic position with high level of business responsibility 	<ul style="list-style-type: none"> • Environmental illiteracy, environmentally unfriendly companies conforming to environmental laws,

Comparison criterion	Circular economy	Linear economy
		regulations, standards and other requirements only under pressure
• product lifecycle	• prolonged product (service) lifecycle with a recycle and reuse opportunity	• short product (service) lifecycle, caused by its quick moral depreciation

Note: The table is prepared by the authors based on the works⁶².

Table 5
Comparative analysis of the linear and circular economy models

There are several challenges faced during the implementation of circular economy concept:

1. cultural (companies' environmental decisions and actions, lack of interest and awareness of a consumer, following linear economy principles during operational process, interest in final value chains);
2. legislative (limited closed-loop procurement, lack of international consensus, prohibition of laws and regulations);
3. market barrier (poor quality materials, standardization, high investment value, limited financing of circular business models);
4. technological (the ability to deliver high-quality refurbished products, lack of presentation of project decisions, lack of environmental impact assessment)⁶³.

A number of authors noted similar prerequisites necessary for an effective transition to a circular economy:

- necessity to establish a strong legal and policy framework for environmental protection;
- government support measures for organizations implementing the principles of circular economy;
- support and stimulation of research activities devoted to the circular economy;
- popularization and promotion of eco-friendly and environmentally conscious business-ideas among companies;
- increasing environmental awareness and education⁶⁴.

⁶² I. S. Belik et al., "Formation of the Investment..."; O. V. Esipova; N. M. Blazhov and I. A. Satsyuk, "Tsirkulyarnaya ekonomika..."; Michael Lieder and Amir Rashid, "Towards circular economy implementation..."

⁶³ Julian Kirchherr et al., "Barriers to the Circular Economy..."

⁶⁴ V. Aleksandrova, "Aktual'nost' perekhoda k modeli..."; V.I. Larionov, "Tsirkulyarnaya ekonomika kak novyy put' razvitiya". in Actual problems and current trends in the socio-economic development of the region and the country: a collection of scientific papers based on the results of the International Scientific and Practical Conference (Saratov: Saratov Socio-Economic Institute of Plekhanov Russian University of Economics, 2018), 173–174.

Conclusion

The circular economy has great potential for optimizing managerial, technological solutions to overcome environmental and economic problems in the resource sphere. The theoretical base of circular economy was influenced by economic theories of industrialization development of socio-economic systems.

Summarizing the above, it can be assumed that the circular economy is an economic model based on the principles of closed systems of technological and biological cycles, which can be considered as a tool of the green economy aimed to achieve sustainable development and fulfill the key SDGs.

The concept of circular economy is a universal way of green growth, which allows to take the place of the linear economy model, and thereby: minimize the resource dependence of production, overcome the global social and economic inequality, solve environmental problems caused by the global crisis and, finally, overcome the crisis of environmental sustainability and save life on earth.

References

Aleksandrova, V. "Aktual'nost' perekhoda k modeli tsirkulyarnoy ekonomiki v Rossii". *International Journal of Humanities and Natural Sciences*, Vol: 11 (2017): 106–110. <http://intjournal.ru/aktualnost-perekhoda-k-modeli-tsirkulyarnoj-ekonomiki-v-rossii/>.

Antropov, V. A.; V. S. Bochko and M. Yu. Kniss. "Development of the «green» economy in Russia". *Herald of the Ural State University of Railway Transport* num 3 (2018): 68–83. <https://elibrary.ru/item.asp?id=36351458>.

Batova, N.; P. Sachek and I. Tochitskaya. "Circular economy in action: forms of organization and best practices". *BEROC Green Economy Policy Paper Series*, PP GE num 5 (2018). http://eng.beroc.by/research/policy_papers/ge-5/.

Batova, N.; P. Sachek and I. Tochitskaya. "On the way to Green Growth: window opportunities of circular economy". *BEROC Green Economy Policy Paper Series*, PP GE num 1 (2018). http://eng.beroc.by/research/policy_papers/ge-01-eng/.

Belik, I. S.; N. V. Starodubets; S. G. Ivlev and S. O. Zverev. "Formation of the Investment Portfolio in Accordance with the Criteria of Circular Economy". *Bulletin of Ural Federal University. Series Economics and Management*, Vol: 17 num 6 (2018): 986–1004. <https://vestnik.urfu.ru/ru/arkhiv/journal/101/article/1158/>.

Boulding, K. "The Economics of the Coming Spaceship Earth". In *Environmental Quality in a Growing Economy*, edited by H. Jarrett, 3–14. Baltimore: Hopkins University Press, 1966. http://arachnid.biosci.utexas.edu/courses/THOC/Readings/Boulding_SpaceshipEarth.pdf.

Burger, Martijn; Spyridon Stavropoulos; Shyaam Ramkumar; Joke Dufourmont and Frank van Oort. "The heterogeneous skill-base of circular economy employment". *Research Policy*, Vol: 48 num 1 (2019): 248–261.

CEA. “Circular Economy in Australia.” Circular Economy Australia. <http://www.circulareconomyaustralia.com>.

D’Amato, D.; N. Droste, B. Allen; M. Kettunen; K. Lahinen; J. Korhonen; P. Leskinen, B. D. Matthies and A. Toppinen. “Green, circular, bio economy: A comparative analysis of sustainability avenues”. *Journal of Cleaner Production*, Vol: 168 (2017): 716–734.

Ellen MacArthur Foundation. “Circular Economy - UK, USA, Europe, Asia & South America - The Ellen MacArthur Foundation”. Ellen MacArthur Foundation. 2017. <https://www.ellenmacarthurfoundation.org/>.

Ellen MacArthur Foundation. “Official Site of The Ellen MacArthur Foundation”. Ellen MacArthur Foundation. <https://www.ellenmacarthurfoundation.org/>.

Esipova, O. V.; N. M. Blazhov and I. A. Satsyuk. “Tsirkulyarnaya ekonomika”. In Proceedings of 4th International Research and Practical Conference “Modern science: topical issues, achievements and innovations”, Part 2, edited by G. Yu Gulyaev, 107–110. Penza: MTsNS “Nauka i Prosveshchenie” Publ. 2018.

Geissdoerfer, Martin; Paulo Savaget; Nancy M. P. Bocken and Erik Jan Hultink. “The Circular Economy – A New Sustainability Paradigm?”. *Journal of Cleaner Production*, Vol: 143 (2017): 757–768.

Geng, Yong and Brent Doberstein. “Developing the circular economy in China: Challenges and opportunities for achieving ‘leapfrog development’.” *International Journal of Sustainable Development & World Ecology*, Vol: 15 num 3 (2008): 231–239.

Ghisellini, Patrizia; Catia Cialani and Sergio Ulgiati. “A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems”. *Journal of Cleaner Production*, Vol: 114 (2016): 11–32.

Gureva, M. A. “Teoreticheskiye Osnovy Kontsepta Tsirkulyarnoy Ekonomiki”. *Journal of International Economic Affairs*, Vol: 9 num 3 (2019): 2311–2336.

Gureva, M. A. “Metodicheskiy instrumentariy otsenki ekologizatsii territorii”. PhD thesis, Ural Federal University named after the first President of Russia B. N. Yeltsin, 2013.

Haas, Willi; Fridolin Krausmann; Dominik Wiedenhofer and Markus Heinz. “How Circular is the Global Economy?: An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005: How Circular is the Global Economy?”. *Journal of Industrial Ecology*, Vol: 19 num 5 (2015): 765–777.

Homrich, Aline Sacchi; Graziela Galvao; Lorena Gamboa Abadia and Marly M. Carvalho. “The circular economy umbrella: Trends and gaps on integrating pathways”. *Journal of Cleaner Production*, Vol: 175 (2018): 525–543.

Ivanova, M. V.; N. G. Dyachenko and Yu. L. Gilyarova. “Circular economy: opportunities for development of the Murmansk region.” In Proceedings of the all-Russian Scientific and Practical Conference “Multifactor Challenges and Risks in the Context of the Implementation of the Strategy of Scientific, Technological and Economic Development of the Macro-Region North-West”, edited by S. Kuznetsov and Ivaniov S.V. A., 270–277. St. Petersburg: Saint Petersburg State University of Aerospace Instrumentation. 2018.

Jiao, Wenting, and Frank Boons. "Toward a research agenda for policy intervention and facilitation to enhance industrial symbiosis based on a comprehensive literature review." *Journal of Cleaner Production*, Vol: 67 (2014): 14–25.

Kirchherr, Julian, Laura Piscicelli, Ruben Bour, Erica Kostense-Smit, Jennifer Muller, Anne Huibrechtse-Truijens, and Marko Hekkert. "Barriers to the Circular Economy: Evidence From the European Union (EU)." *Ecological Economics*, Vol: 150 (2018): 264–272.

Kirchherr, Julian, Denise Reike, and Marko Hekkert. "Conceptualizing the circular economy: An analysis of 114 definitions." *Resources, Conservation and Recycling*, Vol: 127 (2017): 221–232.

Korhonen, Jouni, Cali Nuur, Andreas Feldmann, and Seyoum Eshetu Birkie. "Circular economy as an essentially contested concept." *Journal of Cleaner Production*, Vol: 175 (2018): 544–552.

Larionov, V.I. "Tsirkulyarnaya ekonomika kak novyy put' razvitiya [Circular economy as a new way of development]." In *Actual problems and current trends in the socio-economic development of the region and the country: a collection of scientific papers based on the results of the International Scientific and Practical Conference*, 173–174. Saratov: Saratov Socio-Economic Institute of Plekhanov Russian University of Economics, 2018.

Lieder, Michael, and Amir Rashid. "Towards circular economy implementation: a comprehensive review in context of manufacturing industry." *Journal of Cleaner Production*, Vol: 115 (2016): 36–51.

Majer, H. "Wachstum aus der Sicht der ökologischen Ökonomie [Growth from the perspective of the ecological economy]." In *Jahrbuch Ökologische Ökonomie Band 1: Zwei Sichtweisen auf das Umweltproblem: Neoklassische Umweltökonomik versus Ökologische Ökonomie*, 319–349. Marburg: Metropolis, 1999.

Margaryan, A.G. "Idealnaya model ekonomiki [The ideal model of the economy." *Vestnik Nauki [Herald of Science]*, Vol: 1 num 9 (2018): 136–137.

Mashukova, B. "Osnovnyye printsipy tsiklichnoy ekonomiki (ekonomika zamknutogo tsikla) [Basic principles of cyclic economy (Closed-loop economy)." *European Science*, Vol: 7 num 17 (2016): 14–16.

Melnik, L., and L. Hens, eds. *Social-Economic Potential of Sustainable Development: Manual*. Sumy: University Book, 2007.

Mishenin, Ye. V., and I. I. Koblianska. "Perspectives and mechanisms of 'circular' economy global development." *Marketing and Management of Innovations* num 2 (2017): 329–343.

Murray, Alan, Keith Skene, and Kathryn Haynes. "The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context." *Journal of Business Ethics*, Vol: 140 num 3 (2017): 369–380.

Nechaeva, E. "Rol sotsialnoy laboratorii i Quadruple Helix modeli v perekhode Samary na tsirkulyarnuyu ekonomiku". *Vestnik sovremennyh issledovaniy* Vol: 8 num 23 (2018): 60–62.

Nikitina, B. A. and V. B. Zvonovskiy. “Vliyaniye tsirkulyarnoy i sheringovoy ekonomiki na kachestvo zhizni naseleniya i formirovaniye innovatsionnykh rabochikh mest v sovremennom obschestve”. Problemy razvitiya predpriyatiy: teoriya i praktika Vol: 3 (2018): 79–85.

Nikulychev, Yu. Upravleniye otkhodami. Opyt Evropeyskogo soyuza. Moscow: INION RAN. 2017. http://inion.ru/site/assets/files/1109/nikulichev_upravlenie_otkhodami.pdf.

Pakhomova, Nadezda V.; Knut K. Richter and Mariya A. Vetrova. “Transition to circular economy and closedloop supply chains as driver of sustainable development”. St Petersburg University Journal of Economic Studies, Vol: 33 num 2 (2017): 244–268.

Pilyugina, M. “Tsirkulyarnaya model ekonomiki kak novyy podkhod k probleme ustoychivogo razvitiya”. Stroitelstvo - Formirovaniye Sredy Zhiznedeyatelnosti (2016): 148–149. <http://integross.net/cirkulyacionnaya-model-ekonomiki-kak-novyyj-podxod-k-probleme-ustojchivogo-razvitiya/>.

Prieto-Sandoval; Vanessa, Carmen Jaca and Marta Ormazabal. “Towards a consensus on the circular economy”. Journal of Cleaner Production, Vol: 179 (2018): 605–615.

Reike, Denise; Walter J. V. Vermeulen and Sjors Witjes. “The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options”. Resources, Conservation and Recycling, Vol: 135 (2018): 246–264.

Rudneva, L. N. and M. A. Gureva. Ekonomika prirodopol'zovaniya: Uchebnoye posobiye dlya VUZov. Tyumen: TSOGU. 2015.

Sauvé, Sébastien; Sophie Bernard and Pamela Sloan. “Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research”. Environmental Development, Vol: 17 (2016): 48–56.

Sazonova, T. “Volny internatsionalizatsii i perspektivy globalizatsii”. Scientific Works of the Free Economic Society of Russia, Vol: 176 (2013): 495–502.

Serbulova, N.; E. Sivolapenko and S. Panosyan. “Aktualnost perekhoda ot lineynoy k tsirkulyarnoy modeli ekonomiki”. In Economist of the Year, edited by G.Yu Gulyaev, 60–65. Penza: MTsNS. 2016.

Sergienko, O. and H. Rohn, eds. Osnovy teorii eko-effektivnosti: Monografiya. St. Petersburg: STPbSUR&FT, 2004. https://wupperinst.org/uploads/tx_wupperinst/Basics_EcoEfficiency_ru.pdf.

Shvab, K. Chetvertaya promyshlennaya revolyutsiya. Moscow: EKSMO. 2017.

Socheeva, V. E. “Tsirkulyarnaya model' ekonomiki kak novyy podkhod k probleme ustoychivogo razvitiya”. Economics and Business: Theory and Practice, Vol: 7 (2017): 122–124.

Su, Biwei; Almas Heshmati; Yong Geng and Xiaoman Yu. “A review of the circular economy in China: moving from rhetoric to implementation”. Journal of Cleaner Production, Vol: 42 (2013): 215–227.

Suárez-Eiroa, Brais; Emilio Fernández; Gonzalo Méndez-Martínez and David Soto-Oñate. "Operational principles of circular economy for sustainable development: Linking theory and practice". *Journal of Cleaner Production*, Vol: 214 (2019): 952–961.

Tukker, A. "Product Services for a Resource-Efficient and Circular Economy – a Review". *Journal of Cleaner Production*, Vol: 97 (2015): 76–91.

United Nations. "United Nations". Official site of the United Nations. United Nations, n.d. <http://www.un.org>.

United Nations. "United Nations Environment Programme". UNEP - United Nations Environment Programme. <http://www.unenvironment.org/node>.

Wei', Feng; Sifeng Liu and Lijun Yin WeizhaoLi. "Research on Performance Evaluation System for Green Supply Chain Management Based on the Context of Recycled Economy". (2014).

Wen, C. F., Y. L. Zhao and R. Z. Liang. "Recycle of low chemical potential substance". *Resources, Conservation and Recycling*, Vol: 51 num 2 (2007): 475–486.

Yanitskiy, O. N. "Novyy doklad Rimskommu klubu k 50-letiyu ego osnovaniya: plyusy i minusy". *Vlast'* Vol: 26 num 2 (2018): 19–25.

Yuan, Zengwei; Jun Bi and Yuichi Moriguchi. "The Circular Economy: A New Development Strategy in China". *Journal of Industrial Ecology*, Vol: 10 num 1–2 (2008): 4–8.

Zhang, Haiyan; Keishiro Hará; Helmut Yabar; Yohei Yamaguchi; Michinori Uwasu and Tohru Morioka. "Comparative analysis of socio-economic and environmental performances for Chinese EIPs: case studies in Baotou, Suzhou, and Shanghai". *Sustainability Science*, Vol: 4 num 2 (2009): 263–279.

Zhu, Qinghua; Yong Geng; Joseph Sarkis and Kee-hung Lai. "Evaluating green supply chain management among Chinese manufacturers from the ecological modernization perspective". *Transportation Research Part E: Logistics and Transportation Review*, Vol: 47 num 6 (2011): 808–821.

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