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## FORMATION OF THE CONCEPT OF A CIRCULAR ECONOMY<sup>1</sup>

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### ABSTRACT

The article represents a historical survey that describes the emergence and development of the 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 author’s point of view, the circular economy concept is a general approach to promote green growth in countries’ development that allows overcoming global ecological problems and, as a result, achieving sustainable state of the planet and saving lives on Earth.

**Keywords:** industrialization, sustainable development, green economy, circular economy, social and economic development.

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## 1. INTRODUCTION

The research objective, which is based on the comparative studies methodology, is to conduct Acceleration in modern human development process, demonstrating 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 seems not to be able to transform its ideas on the interaction between human society and nature: the change of daily habits and behaviors to confirm the statements above appears in the thought of O. N. Yanitsky, who says "...biological forms (including ecosystems), that have been formed during evolution have incompatible temporalities with socially constructed forms of modern life..." (Shvab, 2017).

In the era of information accessibility, men with incredible opportunities for continued self-improvement, self-education and self-development, have chosen a different way of life, simplifying their worldview and getting lost in the vast field of information, putting incorrect emphasis on his priorities and interests. All these processes can be summarized by a well-known definition "consumer society". The paradox is that not only the wasteful lifestyle of the population in developed countries, but also the increased resource intensity of the production of the developing countries has led the climate changes and ecosystems to decline (Melnik; Hens, 2007).

In reality, a "super-consumer" model has rapidly changed into a "super-contaminator" model and caused a series of environmental disasters and catastrophes. Global environmental problems accumulated over the history of civilization's development have become clear by the beginning of the 21<sup>st</sup> century and has demanded urgent solution. Due to the need of constant application of primary resources, which has finally become a waste, the existing model of linear economy in 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 has created a trap in the form of scarcity of various types of resources, and the economies of most countries are highly dependent on their volatility (Mashukova, 2016).

The wrong perception and construction of a consumption model that evolved during the industrial revolution in the 19<sup>th</sup>-20<sup>th</sup> centuries has become the basis of the linear economic model, based on the principles of the inexhaustibility of natural resources, without concern for waste management. Nowadays resources are considered limited, and most ecosystems, having lost the ability to assimilate, have become unstable (The Ellen MacArthur Foundation, n.d.). Without changes in the developmental trajectory and the review of key approaches to production and consumption; a

production crisis and further deterioration in the quality of life are inevitable (Gureva, 2019).

The digital revolution at the beginning of the 21<sup>st</sup> century, including a number of attempts to create and develop the robotization process, the Internet of things and artificial intelligence has marked the transition to a new stage in the technological development of industrial production, called "Industry 4.0", whose main driving force 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 Kalabina E.G. (2017), 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 for maximizing the consumption of goods and services (Ivanova et al., 2018).

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 environment (Socheeva, 2017).

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 "I want to own" to "I want to use" path; 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) (Nechaeva, 2018).

## 2. METHODS

In the middle of 20<sup>th</sup> century, the world scientific community, based on the analysis of the downward course of the scientific and technical revolution, made a conclusion in terms of the 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 to raise

public awareness of the need to integrate environment and development. In June, 2012, the conference “Rio+20” has approved the nonbinding document called “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 entitled “Transforming our world: the 2030 Agenda for Sustainable Development” in 2015 (The United Nations Environment Programme, n.d.).

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 to be 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 interdependence, 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 differences only in the ways of achieving the goals and main approaches (Batova et al., 2018; Circular Economy Australia, 2000; Reike et al., 2018).

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

### 3. RESULTS

The key difference between the initially accepted concept of sustainable development and the later concept of the circular economy is the 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).

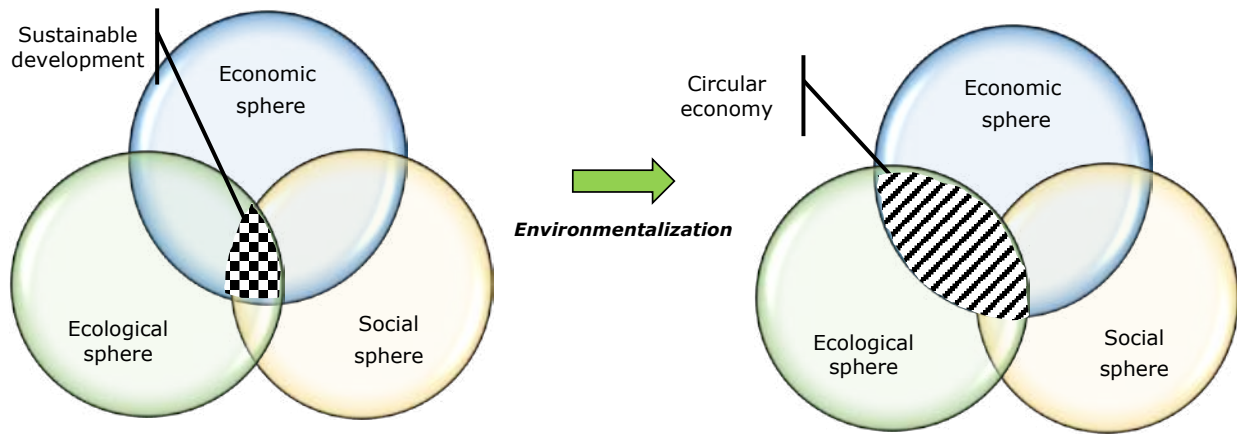


**Figure 1.** The path to the formation and popularization of the economics of environmentalism (prepared by the authors based on the works by Batova et al. (2018) and Gureva (2013)).

**Table 1.** Comparative analysis of the economics of environmentalism concepts

Comparison criterion	Sustainable development	Ecologization	Green economy	Circular economy
Peak of popularization	1992	2000	2010	2017
Main agent	A person passes from the category of “object” to the category of “subject”	An ecologically aware person	An innovative person	A 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	An economic model in which a high level of the planet’s population wellbeing is achieved simultaneously with minimizing environmental risks	An economic model based on closed loops with multiple usage of resources and high-scale waste recycling
Goal	17 Sustainable Development Goals	Maximum profitability with minimal environmental damage	Achieving social justice and 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 it	A qualitatively new economic growth (green growth), provided by innovative aspects of balanced and safe development	Waste minimization (complete reduction in the future); minimization of resources extraction
Fundamental principles	16 basic principles declared at a UN conference in Rio de Janeiro in 1992 and the United Nations General Assembly Special Session (UNGASS) in New York, in 1997	Precautionary, continuity, ubiquity, interrelatedness, and integration	Generation equality, compliance with sustainable development principles of 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)	Development of the imperatives of sustainable development R; the earlier developed 3Rs were improved, reaching 9Rs
Area of research	Improvement in the life quality for the diverse population of the planet	Maintenance of life support systems, assessment of natural capital, development of innovative assessment tools and variable environmental management models	Sustainable development, green investments, tourism, business, education, biomass, carbon pollution, and development of land resources	Sustainable development and industrialization, extension of product life-cycle, industrial symbiosis, recycling, closed-loop supply chains
Time span for implementing	Open time frames	Unlimited	Time limit	Time limit
Final global goal	Stable state of the planet and global survival			

Source: Prepared by the authors based on the following references: Batova et al. (2018); Belik et al. (2018); The Ellen MacArthur Foundation (n.d.); The United Nations Environment Programme (n.d.); Circular Economy Australia (2000); Reike et al. (2018); Rudneva & Gureva (2015).



**Figure 2.** The relationship between the concepts of sustainable development and the circular economy (prepared by the authors based on the work by Murray et al., 2017).

The transition from industrial to post-industrial society in the 1960s of 20<sup>th</sup> 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 Boulding (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 character (Homrich et al., 2018).

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 the economic theory that appeared in the 1970s of the 20<sup>th</sup> century (Gureva, 2013; 2019).

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 development (Mashukova, 2016).

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) (Gureva, 2019; D’Amato et al., 2017; Reike et al., 2018).

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

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, and philosophy. The most commonly used and generally accepted, found in the reviewed papers and the media, is the term proposed by The Ellen MacArthur Foundation in 2012. It is worth noting that at the moment there is no officially approved definition for the term (Figure 3).

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

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, aiming 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 is now a global leader in applying systems theory and complexity theory to tackling the greatest challenges of our time, as it 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 partners (Sergienko; Rohn, 2004).

Based on the academic papers analysis, the authors made the conclusion that most scientists 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 repeti-

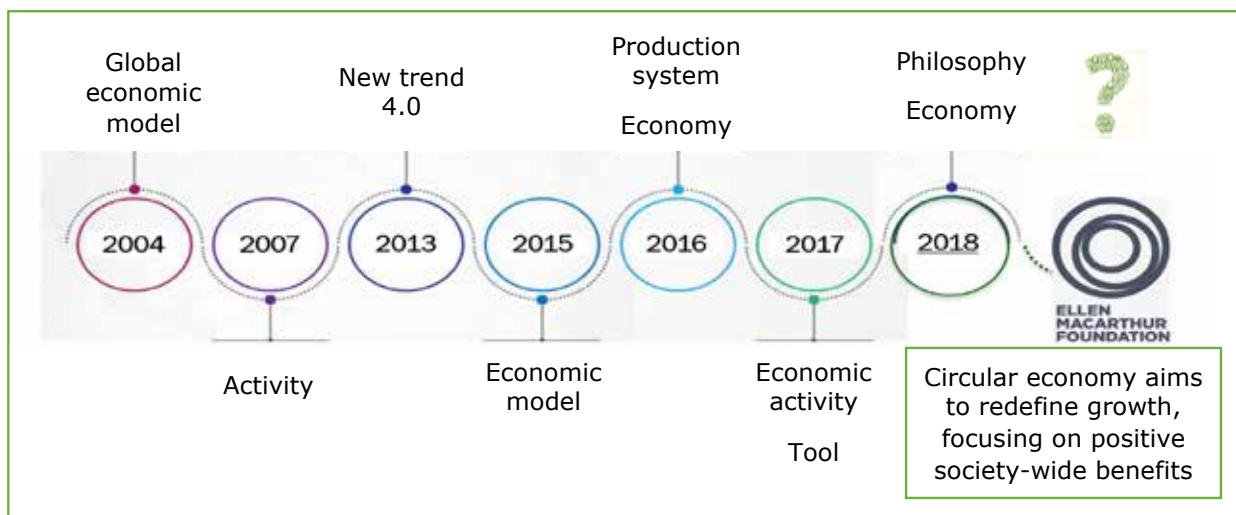
**Table 2.** Main definitions of the term “circular economy”

Year	Author	Definition
2004	The Waste and Resources Action Programme	an alternative to a traditional linear economy
2004	Sergienko; Rona	a global economic model that separates economic growth and development from consumption of non-renewable resources
2007	Wen et al.	a way to solve the problem of sustainable development
2007	Melnik; Hens	an activity for the production, distribution and consumption of goods, based on the principles of conservation of various resources and materials, “non-waste economy”
2008	Geng; Doberstein	a realization of a closed loop of material flows in the economic system
2008	Yuan et al.	a political strategy aimed to reduce resource scarcity and pollution
2009	Zhang et al.	a way to a sustainable development
2011	Zhu et al.	a way of continued economic development without creating significant environmental and resource problems
2012	The Ellen MacArthur Foundation	a 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
2013	Su et al.	It is a strategy of the sustainable development that aims to increase the material and energy efficiency
2013	Sazonova	a new trend, a basis for the fourth industrial revolution
2014	United Nations	a system that keeps the added value in products for as long as possible and eliminates 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
2014	Jiao; Boons	a holistic concept covering ‘reducing, reusing, and recycling’ activities in the process of production, circulation, and consumption”
2014	Wei et al.	a model of economic development with maximum resource utilization and environmental protection
2015	Birat	“a contemporary and popular concept that describes how materials and resources should be handled in the future”
2015	Murray A.	“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”
2015	Haas et al.	“a simple, but convincing strategy aimed at reducing both input of virgin materials and output of wastes by closing economic and ecological loops of resource flows”
2015	Tukker	a mutually-beneficial philosophy that confirms that a thriving economy and a healthy environment can coexist
2016	Ghisellini et al.	a space for solving aggravating resource problems, a concept that allows us to separate the direct use of resources from economic growth
2016	Circular Economy Australia	“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”
2016	Sauve et al.	“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)”
2016	Lieder; Rashid	“a solution to series of challenges such as waste generation, resource scarcity and sustaining economic benefits”
2016	Serbulova et al.	a recovery or regenerative production system; it is an integrated waste management process.
2016	Pilyugina	an economy that improves people’s well-being and ensures social justice, significantly reducing environmental risks
2017	Geissdoerfer et al.	“a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops”
2017	Alexandrova; Esipova	an 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 having a continuous economic growth



Year	Author	Definition
2017	Pakhomova et al.	one of the tools for solving environmental problems to accomplish sustainable environmental future
2017	Kirchherr et al.	“an economic system that is based on business models that 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“
2018	Mashukova	a philosophy of recycling and profit from what was previously considered unnecessary and sent to the utility waste as part of the traditional linear economy
2018	Nechayeva E. O.	an economy based on renewable resources, the transition to renewable energy sources and the processing of secondary raw materials
2018	Antropov et al.	- an integral part of the broader concept of a “green” economy; - the next stage of a “green” economy development
2018	Korhonen J. et al.	a 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 energy flows to the linear system

Source: Prepared by the authors based on the following references: Burger et al. (2019); Kalabina (2017); Kirchherr et al. (2018); Maier (1999); Margaryan (2018); Mishenin & Koblianska (2017); Nikulychev (2017); Prieto-Sandoval et al. (2018); Suárez-Eiroa et al. (2019); The United Nations Environment Programme. (n.d.); The Ellen MacArthur Foundation. (n.d.); United Nations. (n.d.); Murray et al. (2017); Circular Economy Australia. (2000); Sauve et al. (2016); Alexandrova (2017); Nechaeva (2018), Yanitskiy (2018).



**Figure 3.** Approaches for the definitions of “circular economy”

Source: prepared by the authors

tion, reflects the meaning of the circular economy (D’Amato et al., 2017).

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

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

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 is why a clear area of 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;

**Table 3.** Stages of the evolution of circular economy

Time period	Title	Description
1970 – 1990	Reuse activities and waste management	In the European countries and the USA, a number of 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 it was due to the lack of development in environmental culture and concern that the territories of poor countries were used for waste storage and recycling. The rapidly developing television and media were paying attention to the ongoing environmental changes. Therefore, scientific literature on recycling, collection and waste management appeared
1990 – 2010	Eco-efficiency strategies	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 the development and growth of the Internet and the increased speed of information exchange, a number of environmental problems were announced as global, such as 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, as for example, in Scopus in 2004. The idea of a closed-loop economy is gradually becoming popular
2010 till present	Maximum saving at the age of resource depletion	Around 2010, the concept of a circular economy, summarizing the most viable ideas of theoretical research, 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 will allow saving the ecosphere. Experts offer companies to plan the development based on three principles: green innovation, alternative sources, and a shift of the industrial paradigm. Currently, approximately 500 companies in the world are using a circular economy strategy.

Source: Prepared by the authors based on the work by D’Amato et al. (2017).

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

Source: prepared by the authors based on the following published works: Batova et al. (2018); Mashukova (2016); Nikitina; Zvonovskiy (2018); Sazonova (2013); Serbulova et al. (2016), Sivolapenko et al. (2017).



- 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 various R-principles in their terminology and official documents; sometimes the principles and terminology of different companies are not mutual responsive (D'Amato et al., 2017; Jiao; Boons, 2014).

According to the studies by The Ellen MacArthur Foundation (the pioneer in promoting the circular economy ideas), its several features are distinguished as follows:

- Maintenance of 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;
- Increase of the efficiency of the economic and environmental systems of industrial activity by excluding negative effects (Alexandrova, 2017; Sergienko; Rohn, 2004).

#### 4. 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 the linear model of the economy (Table 5).

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

- Cultural (companies' environmental decisions and actions, lack of interest and awareness of consumers, following linear economy principles during operational process, and interest in final value chains);
- Legislative (limited closed-loop procurement, lack of international consensus, and prohibition of laws and regulations);
- Market barrier (poor quality materials, standardization, high investment value, and limited financing of circular business models);

- Technological (the ability to deliver high-quality refurbished products, lack of presentation of project decisions, and lack of environmental impact assessment) (Kirchherr et al., 2017).

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;
- Increased environmental awareness and education (Alexandrova, 2017; Larionov, 2018).

#### 5. CONCLUSION

The circular economy has great potential for optimizing managerial and technological solutions to overcome environmental and economic problems in the resource sphere. The theoretical base of circular economy was influenced by economic theories of the 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 a tool of the green economy aimed to achieve sustainable development and fulfill the key Sustainable Development Goals (SDGs).

The concept of circular economy is a universal way of green growth, which allows taking 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.

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 in 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 consumers repair the product themselves or at a special repair company or products manufactures provide repair and maintenance service
5R	Refurbish	Restores or renovates an old product and brings it up to date without changing most part of it (especially buildings, heavy equipment)
6R	Remanufacturing	Uses parts of a discarded product in a new product with the same function to prolong its lifecycle
7R	Repurpose	Use of a discarded product for a purpose other than that for which it was originally intended, in other words "second life of thrown products. It is similar 1R, the difference is that it is not used in the manufacturing sphere but in the design sphere
8R	Recycle	Processing materials to obtain new products, sorting waste to "capture" and return "clean" resources to the production cycle.
9R	Recover	Incineration of material with energy recovery and/or biorefinery

**Figure 5.** Characteristic of the 9R principles of circular economy

Source: prepared by the authors based on the works by the following authors: D'Amato et al. (2017); Jiao; Boons (2014); Kirchherr et al. (2017); Sauvé et al. (2015).

**Table 5.** Comparative analysis of the linear and circular economy models

Comparison criterion	Circular economy	Linear economy
1	2	3
Subject	A consumer acts like an integral part of society and nature	A consumer thinks only about his benefits
System integrity	Interrelatedness, triunity of economy, ecology and society	The market acts as an entire system
Main aim	To achieve ecological balance during sustainable economic and social growth and prosperity by increasing the effectiveness of product, service and resource life cycle	To maximize profit with lack of attention to the ecological issues. The process is characterized by unbalanced economic growth and prosperity and social stratification.
Production level	Closed cycle manufacturing directed to minimize the amount of products. The manufactured goods in general are of higher quality and reusable	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 a crisis of overproduction and market saturation.
Consumption level	Development of new goods and services consumption pattern depending on its necessity and importance for consumers	Satisfaction of excessive desire for goods, peculiar to behavior of super-consumers
Type of natural resource management	Creation of resources	Consuming of resources
Society-nature interrelation	Integration of ecologization in the system of manufacturing processes. The process is characterized by the reduction of anthropogenic impact on the environment	Increasing anthropogenic impact on the environment causes planetwide environmental crisis
Resources used	Interaction of financial, informational, intellectual, labor and other resources in order to produce and use goods made of recyclable materials.	Natural resources extracted without considering environmental damage.
Amount of wastes	Gradual reduction targeted to the total disappearance of wastes by applying new approaches available from the process of technological development. Emergence of new branches	Constant industrial and consumer waste growth. Waste accumulation causes global ecological problem.
Types of manufacturing prevailing in industry	Development of knowledge-based and innovative industries.	Labor-intensive manufacturing, characterized by low level of innovative activity and involving different types of intangible asset.
Social partnership	Active socio-economic position with high level of business responsibility	Environmental illiteracy, environmentally unfriendly companies conforming to environmental laws, 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

Source: Prepared by the authors based on the following references: Belik et al. (2018); Esipova et al. (2018); Liedler; Rashid (2016).

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