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Vs sustainable development: scenarios for the future

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Issues of sustainable development began to concern mankind starting from the 20th century, when mass industrialization and the depletion of natural resource potential contributed to the formulation of environmental issues at one of the leading places in scientific discourse. However, what if the goals of sustainable development would not be achieved to 2030? What other way we can identify for humanity to survive? So, the study is about the problems of studying the understanding of the term "sustainable development", considering the evolution of the formation of the concept of sustainable development and analyzing the modern goals of sustainable development for attainability. From an analysis of domestic and foreign experience, possible scenarios of the development of mankind are identified (such as 1. Creating an environmental framework, 2. Implementation of sustainable nature management practices in the conditions of natural and man-made objects, 3. Implementation of "geoengineering projects", 4. Construction of autonomous ecosystems, 5. Space exploration in search of a new planet for life, provided that the goals of sustainable development would not be achieved. It has been established that today probability of achieving all the sustainable development goals by 2030 is too small, and the indicated scenarios require, firstly, the development of science and technology, and secondly, a competent assessment of the value of nature and solving the issue of specifying property rights for natural goods.

***Key words*:** scenario approach; ecological framework; geoengineering projects; autonomous ecosystems; sustainable nature management; space exploration; sustainable development goals

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Introduction. Issues of sustainable development began to concern mankind starting from the 20th century, when mass industrialization and the depletion of natural resource potential contributed to the formulation of environmental issues at one of the leading places in scientific discourse. The basic principles of sustainable development were presented in the reports of the Club of Rome, as well as various international legal documents, such as decisions of conferences, summits, various UN documents, etc. The essential characteristics of "sustainable development" were formally enshrined in 1987 in the report of the Brundtland Commission "Our Common Future". According to this report, sustainable development is such a development that provides a balance of interests of generations within the framework of the ecological paradigm. It is rather "streamlined" definition, but with the emphasis on the need to introduce resource limitations. Nevertheless, this definition, although it was enshrined in an international act, is not the only one. Approaches to understanding sustainable development have evolved significantly, it is associated with the development of an understanding of the interaction within the system of "man (society) – nature" and is directly related to the use of natural resources. According to the study [8], the understanding of sustainable development has undergone three stages. The first characterizes scientific thought from the 50s to the 70s of the 20th century, where sustainable development is achieved with a balance of the extraction and reproduction of natural resources, i.e. the balance of nature management within the framework of the economic subsystem alone. The second stage (from the 70s to the 90s of the 20th century) was determined by the understanding of the balance of the nature intensity of the technosphere and the ecological technology intensity of the territories, i.e. two subsystems have already been considered: economic and environmental. And, finally, the third stage, the periodization of which begins from the 90s of the 20th century and continues to this day. This last stage postulates an actual definition of sustainable development, in which a balance of economic, environmental and social subsystems is achieved, i.e. environmentally sustainable, cost-effective environmental management, which involves achieving a balance in meeting the dynamic interests of an economic and social nature.

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Thus, the foundation of the sustainable development concept is the comprehensive harmonization of the interaction of nature and society. But the question is how to evaluate this development?

Criticism of GDP has a long history [19, 21]. Robert F. Kennedy expressed the phrase that GDP takes into account "everything except which makes life worthwhile" [23, p. 283]. But the main drawback of GDP, as one of the main indicators of the theory of economic growth, is that it very superficially reflects the environmental aspects of economic development [20]. As a result, the scientific community has proposed various options for assessing sustainable development, while discussions are still ongoing on how to measure development in general and sustainable development in particular. Nevertheless, the leading concepts in this area should be recognized as the System for Integrated Environmental and Economic Accounting developed by the statistical department of the UN secretariat and various Indices of sustainable development. If the System for Integrated Environmental and Economic Accounting is methodologically unified and represents the adjustment of standard economic indicators with environmental aspects, such as the valuation of depletion of natural resource potential and damage from environmental pollution, then Indices of sustainable development are represented by a wide range of methodological and methodical foundations. Nevertheless, it should be noted that the System for Integrated Environmental and Economic Accounting, despite its theoretical and methodological elaboration, is not widely used. This is because the adjustment of GDP is hampered by the complexity of the cost estimation of environmental data and the lack of necessary statistical information. While Indices of sustainable development are quite successfully applied at present. The most widely used are: the Genuine Domestic Savings, the Human Development Index, the Living Planet Index, The Ecological Footprint and The Happy Planet Index. However, despite the positive aspects of evaluating these indices (the ability to visually interpret changes across countries; identify weaknesses that reduce ratings; and improve the management at the macro level), it should be noted that the calculations of such indices often include qualitative characteristics, which, if desired easily manipulated and, accordingly, promoted in ratings.

Summing up we can conclude that the understanding of "sustainable development" has undergone significant changes before reaching the point of balancing the benefits of three types of subsystems: economic, environmental and social. With regard to assessments of the level of sustainable development, two concepts have been developed: the System for Integrated Environmental and Economic Accounting and Indices of sustainable development. Moreover, 2015 was marked by the adoption of 17 Sustainable Development Goals, which should be achieved by all countries from 2016 to 2030. In turn, the origins of Sustainable Development Goals concept dates back to 2012, during the 20th anniversary of the Earth Summit, sometimes called the Rio Earth Summit, because in 1992 in Rio de Janeiro, Brazil, world leaders first gathered together to discuss environmental issues and develop a new concept for sustainable development. The Earth Summit in Rio de Janeiro was also a kind of 20th anniversary of the Stockholm Conference (1972). Well, when world leaders in June 2012 came together to take stock of their activities, they came to the conclusion that the goals of the Earth Summit in Rio were not achieved. Key agreements on climate change, biodiversity and desert control have not been properly implemented. Nevertheless, the conference participants (representatives of 193 Member States of the United Nations) still had one important and positive result. It was a success in the implementation of the Millennium Development Goals, which were adopted in September 2000 and whose main goal was to combat poverty on a global scale. Thus, in 2012, world leaders inspired by the success in achieving the Millennium Development Goals decided to develop new goals, the goals of sustainable development, which are the receivers of the Millennium Development Goals, which should be achieved by 2030.

Moreover, a group of proactive researchers at a conference in Scotland in 2017 laid the foundation for the Sustainable Wellbeing Economy as a continuation of sustainable development goals. The fundamental goal of such an economy is the achievement of sustainable wellbeing, built on the principles of nobility and honesty in relation to humanity and nature. According to the authors [24], wellbeing is the benefit obtained from the influence of such factors as mental and physical health of humanity, equality and honesty, favorable social interactions and a prosperous nature. Some Russian researchers also support the idea of wellbeing economy [12]. Such high aspirations can only cause admiration, and undoubtedly, we should strive for this, but the humanity of developing coun-

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tries and countries with economies in transition are forced to face more pressing and "down to earth" problems, as well as tight budget constraints.

Statement of the problem. But on the threshold of 2019, the question arises as to the feasibility of achieving the sustainable development goals at this stage. For instance, the study [17] is quite critical of the realism of achieving these goals, arguing that development is a change, the direction of which is determined by a specific given goal or system of goals. In turn, goals are always formulated by resource holders, and goals of sustainable development are formulated by the global elite, which "imposes" relevant "environmental problems on society, the choice of which often comes from the economic and political situation" [17, p. 33]. Thus, the author concludes that the discrepancy between the sustainable development goals set by global elites and the real interests of countries and regions is the main reason for the lack of real progress in this area, which is impossible to disagree with. Moreover, such a dispersion into 17 goals – more than was indicated at the Stockholm Conference, the implementation of which turned out to be a failure – does not improve forecast for achieving such a significant number of sustainable development goals by 2030. Nevertheless, the environmental crisis is gaining momentum and the 9 planetary boundaries identified in the study [18] are approaching more and more rapidly, and some are long gone in 2009, such as: atmospheric carbon dioxide concentration, change in radiative forcing, extinction rate and amount of N_2 removed from the atmosphere for human use. As a result, the question arises: what are the forecast for the survival of mankind if the achievement of the sustainable development goals is doomed to failure?

Methodology (scenario approach). According to the results of the analysis of scientific literature, five scenarios of the development of the mankind can be isolated in conditions of failure to achieve the goals of sustainable development:

- creation of an ecological framework;
- introduction of sustainable nature management practices in the conditions of natural and man-made objects;
- implementation of "geoengineering projects";
- construction of atonomous ecosystems;
- space exploration in the search of a new planet for life.

Results. *Creating an environmental framework.* The idea of creating an environmental framework is based on the biosphere concept principles; this concept is built on the idea of "biological stabilization of the environment".

Developing ideas of biotic regulation laid down by V.I.Vernadsky and N.V.Timofeev-Resovsky, V.G.Gorshkov proved that biota is the only mechanism providing the conditions necessary for life. The recognition of the biotic regulation mechanism contributed to the possibility of identifying an acceptable threshold for the consumption of living primary biota production. Based on the data that 90 % of the organic flora is consumed by fungi, bacteria and protozoa, more than 9 % by small invertebrates, the consumption of organic flora by vertebrates, including person is estimated at 1 % [3, 4]. The same results were obtained by foreign environmental researchers [26]. If at the dawn of the mankind development the removal of biota from the natural environment by humans did not go beyond 1 %, then in modern conditions, the permissible "threshold is exceeded by at least 10 times, which leads to destabilization of life on Earth" [8]. Thus, the concept of "biotic regulation", which set a limit of 1 %, actually imposed restrictions on economic growth in the form of an allowable economic capacity of ecosystems. This concept has formed a kind of range, within which economic activity is allowed, and at the same time it has formed the conditions for the biota; these conditions help the biota to provide regulating and supporting functions [11].

One of the main threats to environmental safety is the territory reduction of natural objects untouched by humans. The relevance of the conservation of undisturbed natural ecosystems predetermined the need to establish criteria ratio between 1) territories developed and transformed by humans and 2) territories occupied by undisturbed biota, i.e. it is about the ecosystem integrity issue at the regional and global levels. Russian Federation in comparison with other countries has a more favorable indicator of the ratio "natural objects vs natural-anthropogenic and anthropogenic objects". However, environmental policy requires directing efforts to maintain and increase the area of

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natural objects – natural ecosystems undisturbed by humans. According to the structure of the land categories of the Russian Federation in 2016, the forest area was 51.8 %, the area of reserves – 2.0, the area of wildlife sanctuary – 3.1 [13, p. 88].

Based on the analysis presented in the study [9], we can identify the following options for the criterion ratio at which the survival of mankind is possible:

• According to the recommendations of the FAO UN, forests on the earth's surface should occupy 50 %, agricultural land – 45, built-up – 5.

• K.Doksiadis gives approximately the same structure, according to which the whole land is divided into twelve types of zones, it makes possible to obtain the following ratio: 57 % untouched by humans, 40 converted, 3 urban areas [2, p. 92].

• To the conclusion that "... one third of the entire environment of human society should be ... occupied by various protected areas of spontaneous nature" – comes E.Odum [22]. He recognizes equilibrium nature management as one, whose combined anthropogenic load on the environment does not exceed the self-healing potential of natural systems. The recommended percentage of the territories allocation for maintaining the ecological balance is determined by 50 % in the research [14]. At the same time, the authors consider it possible to include in the ecological network of undisturbed ecosystems, in addition to specially protected natural areas (SPNA), the reserve territories of historical and cultural purpose, traditional nature management, and nature conservation as well as reserve territories of resource use.

• A.D.Sakharov [7, p. 181] also believed that in the future it is necessary to divide land into populated and non-populated parts in a ratio of 3:8, which very closely coincides with the results arising from the theory of biotic regulation of the environment.

• The authors [5, 6] believe that the area of used forests should be reduced by 30 %, which will allow expanding the territory of undisturbed natural ecosystems. In addition, it is recommended to stop the expanding use of the oceans.

Thus, this scenario, focusing on maintaining the integrity of regional and global ecosystems, is directly associated with the creation of ecological networks – an ecological framework that ensures the sustainability of natural ecosystems [1]. Nevertheless, the modern policies of the USA, Mexico, for example, and also Russia are at variance with the principles of the current scenario.

Implementation of sustainable nature management practices in the conditions of natural and man-made objects. One of the main ways to overcome the contradiction between the goals of obtaining products that are useful for humans and preserving the regulatory functions of nature today is considered to be various agricultural and forestry technologies that provide for the partial conservation or imitation of natural processes – sustainable forestry, organic agriculture, adaptive agriculture and other practices. We are talking about the proper organization of the territory and about the ecological and economic balance, which is according to B.I.Kochurov "the ratio of the different uses of the territory and the maintenance of the equilibrium state of the flows of matter and energy, which ensures the stability of landscapes and the reproduction of natural (renewable) resources and does not cause negative environmental changes in nature" [10]. However, for the time being it cannot be considered proven that the strategy of combining the functions of production and environmental regulation better ensures the achievement of the goals for providing the sustainability of global and regional ecosystems than the strategy of dividing these functions between undisturbed natural ecosystems and high-tech closed/circular industries. Until this issue is resolved, "environmentally friendly" farming options can be a priori welcomed only on territories already developed by humans (for example, the development of sustainable forestry in old forestry regions), but cannot be considered as the basis for the economic development of undisturbed natural ecosystems.

Implementation of "*geoengineering projects*". Nowadays various "geoengineering" projects are becoming a new rapidly developing form of ecosystem transformation in order to maintain their sustainability. The most of these projects aimed primarily at combating global warming (fertilizing the oceans and planting fast-growing trees in order to absorb carbon, sheltering glaciers with reflective materials, increasing the albedo of the Earth's surface by growing certain plants or cutting down trees and shrubs in snowy regions and others) [16, p. 192]. The large-scale implementation of "geoengineering" projects in the absence of knowledge about the interaction of biota and climate

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and in the absence of reliable forecasts of changes in all the regulating and supporting functions of ecosystems is unacceptable, since it can only lead to new environmental problems.

Construction of autonomous ecosystems. This scenario has a long history of experimentation, but research has not yet reached the goal of building a 100 % autonomous ecosystem. So, back in the 1960s, the USSR tried to develop an autonomous ecosystem, a model of the artificial biosphere in the Krasnoyarsk Institute of Biophysics. In 1964, in the BIOS-1 system, a gas exchange closed two-link life-support system "human-chlorella" was implemented. Algae absorbed carbon dioxide and produced oxygen, but it was not possible to use chlorella for food. In 1965, in addition to algae, higher plants were also used in BIOS-2: wheat, vegetables. In 1968, the first experiments were conducted in the three-link system "man – microalgae – higher plants". An 85 % level of water reuse was achieved. Based on these experiments, BIOS-3 was created, simulating a closed ecological human life support system with autonomous control. In BIOS-3, 10 experiments were conducted with crews of 1 to 3 people. The longest experiment lasted 180 days (1972-1973), but it was not possible to make this system completely autonomous.

Following Russian research, there was an attempt to build the American model of the artificial biosphere "Biosphere-2". Biosphere-2 is a structure simulating a closed ecological system built by Space Biosphere Ventures and billionaire Edward Bass in the Arizona desert (USA). The number "2" in the title is intended to emphasize that the "Biosphere-1" is the Earth. The main task of "Biosphere-2" was to find out whether a person can live and work in a closed environment. In the distant future, such systems can be useful both as autonomous settlements in space and in the situation of extreme deterioration of living conditions on Earth. The laboratory is a network of sealed buildings with a total area of 1.5 hectares of light materials, divided into several independent ecosystems and covered with a glass dome that transmits about 50 % of sunlight. The interior space is divided into 7 blocks, among which – tropical forest, miniature ocean with an unusual chemical composition, desert, savannah and mangrove estuary. The experiment was carried out in two stages: the first was conducted from September 26, 1991 to September 26, 1993 and the second in 1994. The experiment did not bring the expected results.

Space exploration in search of a new planet for life. Despite the fact that such a scenario seems to be from the world of science fiction, nevertheless, the first steps have already been taken in the development of legal norms regarding mining in space bowels and asteroids. It was the small Duchy of Luxembourg that made a first step. Modern space law describes the 1967 Treaty. It states that no country has the right to claim resources located on the moon or other planets, since this is the property of all mankind. Luxembourg is trying to start working with other countries to develop multilateral agreements regulating the rights on asteroids. If one country adopts its own legislation, this can be regarded as an attempt to seize territories, as in the days of the "Wild West". Russian Deputy of Prime Minister Tatyana Golikova said that Russia offered Luxembourg a cooperation in the field of mining in space [15].

One more example of this scenario can be considered the project of Elon Mask. The project is about the colonization of Mars and the settling a human colony on this planet, etc.

Discussion. Thus, today probability of achieving all the sustainable development goals by 2030 is too small, and the indicated scenarios (such as 1. Creating an environmental framework, 2. Implementation of sustainable nature management practices in the conditions of natural and man-made objects, 3. Implementation of "geoengineering projects", 4. Construction of autonomous ecosystems, 5. Space exploration in search of a new planet for life, as directions of human development if the achievement of the sustainable development goals lacked or as a parallel alternative to solve the environmental crisis) require, firstly, the development of science and technology, and secondly, a competent assessment of the value of nature and solving the issue of specifying property rights for natural goods.

It should be noted that innovations are not only the key to enriching countries, but also a key for the survival of nations and preserving the gene pool. So, the current sanctions for Russia are extremely dangerous as an attempt to isolate Russian society from advanced technological solutions. It is also noteworthy that after two years of awarding the Nobel Prize for Behavioral Economics, 2018 was marked by a prize for traditional economic theory. However, as claimed in the Nobel

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Committee statement, the prize was awarded for the methodological contribution of Paul Michael Romer and William D. Nordhaus, which gave a fundamental understanding of the causes and consequences of technological innovation and climate change, that is, innovation and ecology again.

In conclusion, we would like to emphasize the importance of achieving one of the priority goals of sustainable development, such as the formation of a new behavioral culture of the Earth's population with the aim of changing consumer expectations, generating demand for environmentally friendly technologies and the widespread introduction of recycling principles in industry and everyday life, including the framework of the 3R concept (reduce, reuse, recycle). Achieving this goal in the future of 2030 is impossible, but moving along this path to the goal is uncontested.

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