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# AI's contribution to combating climate change and achieving environmental justice in the global economy

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**AI, climate change, fight against climate change, environmental justice, global environmental economics, climate inequality**

## Introduction

This article focuses on the category of environmental justice, the achievement of which involves reducing the inequality of the world's countries in the state of the environment and climate. Although climate change is a global problem, it manifests itself, to varying degrees, in the countries of the world. In the existing literature, in particular, in the works of Filho et al. (2022), Martín-Arias et al. (2022), Peng and Huang (2022), and Tu et al. (2022), much attention is paid to the problem of climate change and combating it (the implementation of SDG 13).

The concept of environmental justice was formed in the era of colonialism and was supplemented in the subsequent period in connection with the division of the countries of the world into developed and developing countries. At that time, environmental inequality was evident in the limited capacity of developing countries and colonies to protect the environment. The most harmful industries were located on their territory. They also acted as exporters of resources for the developed countries, depleting their mineral wealth. This implied high environmental costs of economic growth in developing countries.

In this regard, the concept of environmental justice has taken shape as equal opportunities for countries to protect the environment (Budolfson et al., 2021; Cappelli et al., 2021; Dagdeviren et al., 2021; Gazzotti et al., 2021; Pérez-Peña et al., 2021; Yang and Tang, 2022). Based on this concept, an approach to ensuring environmental justice through responsible production (corporate social responsibility) and consumption has developed (Ali et al., 2016; Anantharajah and Setyowati, 2022; Furlan and Mariano, 2022; He et al., 2022; Islam, 2022). The problem is that the concept and approach to ensuring environmental justice based on experience do not correspond to the new realities.

Over the past decades, all countries have received equal opportunities to protect the environment thanks to the coordinated efforts of the entire world community to implement the Millennium Development Goals, and then their successor, the Sustainable Development Goals (SDGs), under the auspices of the UN. Social progress and the strengthening of priorities of environmental values have contributed

to the formation of sustainable communities and territories in each country and the achievement of a high level of development of responsible production and consumption. Nevertheless, there remains a noticeable gap in the "green" economy and the implementation of SDG 13 between developed and developing countries and between countries within these categories.

Thus, the new essence of environmental justice in the "Decade of Action" is not revealed in modern scientific literature, which is a research gap. Another gap is connected with the fact that the potential of scientific and technological progress, in particular, artificial intelligence (AI) as advanced technology of Industry 4.0 in terms of combating climate change, is insufficiently studied. This article is intended to fill the noted gaps in the literature and aims to analyze AI's contribution to the fight against climate change and the achievement of environmental justice in the global economy. The goal is achieved with the help of a set of the following fundamental and applied tasks:

– To rethink the meaning of environmental justice in the "Decade of Action."
– To study the current level, trends, and causes of inequality in countries in the state of the environment and climate.
– To identify the prospects for achieving environmental justice in the global economy based on the most optimal use of the potential of artificial intelligence in contributing to the fight against climate change.

The originality of the article lies in developing a new approach to achieving environmental justice in the global economy through the use of artificial intelligence as a tool to combat climate change.

## Literature review

The problem of country inequality is well recognized and reflected in SDG10 and disclosed in detail in the existing literature (Goyal et al., 2021; Chia et al., 2022; Cojocaru et al., 2022). In the available publications, the difference in natural and climatic conditions is mainly considered from the standpoint of the country's wealth in natural resources for economic growth and the standpoint of the favorable climate for the development of certain sectors of the economy (e.g., agriculture) (Rahman et al., 2022; Shimada, 2022).

Thus, by now, the economic perspective of studying the environmental inequality of countries has developed and prevails (Adom and Amoani, 2021; Duan et al., 2022; Sahin and Ayyildiz, 2022). Decarbonization carried out in support of sustainable development in the current interpretation is considered a factor that limits (slows down) economic growth (Sisodia et al., 2020; Zhao et al., 2022).

The exacerbation of climate change phenomena in the "Decade of Action" highlighted a new, much less studied component of the environmental inequality of countries from the standpoint of differences in the favorable climatic conditions for human life and health (Mupedziswa and Kubanga, 2017; Štreimikienė et al., 2022).

The COVID-19 pandemic has demonstrated the dangers of climate change as a factor in disrupting ecosystems, reducing biodiversity, and spreading zoonotic diseases (Harjoto et al., 2021; Sergi et al., 2021; Popkova et al., 2022; Stuart et al., 2022). Climate anomalies (abnormal frosts and droughts) that have become more frequent during the "Decade of Action" have focused attention on climate change as a factor in the quality of life and sustainable development of society (Mocuta, 2017; Ptak-Wojciechowska et al., 2021).

The review of the literature revealed the insufficient development of the social perspective of the environmental inequality of countries. In particular, the theoretical and methodological basis for assessing climate inequality has not been formed, which is a gap in the literature. The prospects for reducing environmental inequality and achieving environmental justice in the global economy are also unclear, which is another gap in the literature.

This raises a research question (RQ) about how to achieve environmental justice in the global economy. This study hypothesizes that the fight against climate change based on artificial intelligence (AI) will achieve environmental justice in the global economy. In order to fill in the identified gaps, search for an answer to the set RQ and test the hypothesis put forward, this article conducts a quantitative and qualitative study: based on quantitative methodology (method of analysis of variation), environmental inequality of countries is monitored, and based on qualitative analysis (method of a case study), it defines the contribution of AI to the fight against climate change and the achievement of environmental justice in the global economy.

## Environmental justice: A new meaning in the "decade of action"

The theoretical foundation of this research is the concept of social justice. Forsyth and McDermott (2022) identified the effects of alienation and deep co-production in transformative environmental science and policy, through which they described the signs of a violation of climate justice and justified ways to restore it. Zeng et al. (2022) showed a strong relationship between environmental justice and health risks (using the example of Shanghai, China).

Du and Sun (2022a) developed a benefit-sharing model for cooperative air pollution prevention and control in China and also offered recommendations for using this model to achieve environmental justice. Smith and Wodajo (2022) substantiated the relationship between climate justice and environmental

TABLE 1 Climate index in the G7 and the BRICS countries in 2018–2022.

| Category | Country | Climate index, score 0-200 | | | | |
|---|---|---|---|---|---|---|
| | | 2018 | 2019 | 2020 | 2021 | 2022 |
| The G7 countries | Canada | 52.82 | 52.55 | 50.57 | 56.75 | 55.98 |
| | France | 89.80 | 88.25 | 90.25 | 89.94 | 89.70 |
| | Germany | 82.53 | 82.51 | 83.00 | 82.97 | 82.44 |
| | Italy | 91.38 | 91.25 | 92.27 | 91.48 | 91.45 |
| | Japan | 84.82 | 84.79 | 84.79 | 85.27 | 85.27 |
| | United Kingdom | 87.92 | 87.82 | 87.62 | 88.04 | 88.06 |
| | United States | 78.23 | 77.51 | 77.54 | 77.28 | 76.78 |
| The BRICS countries | Brazil | 94.23 | 95.35 | 97.16 | 92.39 | 97.15 |
| | China | 78.81 | 78.91 | 79.19 | 80.15 | 78.41 |
| | India | 65.68 | 65.74 | 64.87 | 65.30 | 65.13 |
| | Russia | 44.70 | 46.53 | 40.36 | 38.46 | 48.95 |
| | South Africa | 95.98 | 95.97 | 95.25 | 95.25 | 95.25 |
| Analytics | Average for the G7 countries (points) | 81.07 | 80.67 | 80.86 | 81.68 | 81.38 |
| | Variation on the G7 countries (%) | 16.33 | 16.33 | 17.58 | 14.66 | 15.03 |
| | Average for the BRICS countries (points) | 75.88 | 76.50 | 75.37 | 74.31 | 76.98 |
| | Variation on the BRICS countries (%) | 28.15 | 27.37 | 31.26 | 31.31 | 26.53 |
| | The percentage ratio of the average for the G7 countries to the average for the BRICS countries | 6.84 | 5.45 | 7.29 | 9.91 | 5.72 |
| | Variation across the entire sample of 12 countries | 20.77 | 20.38 | 22.77 | 21.64 | 19.41 |

justice. Martín (2022) identified the evolution of climate action in the environmental justice movement, 2010–2020.

Medina et al. (2022) proved the need for an environmental justice approach to wastewater epidemiology for rural and disadvantaged communities (California, United States). Reeder et al. (2022) argued for the key role of environmental justice organizations and the spread of conflict over mining in Latin America. In turn, Gouveia et al. (2022) proved the connection between air pollution and environmental justice in Latin America.

Du and Sun (2022b) argued the need for collaborative air pollution prevention and control from a global community environmental justice perspective (based on a two-stage dynamic game model). Hope (2022) identified the phenomenon of globalization of sustainable development using the example of decolonial destruction and environmental justice in Bolivia. Jiang and Yang (2022) argued for the significant impact of spatial and ethnic factors on the socioeconomic status, health of residents, and environmental justice in Greater Los Angeles. Carvalho et al. (2022) proposed inequality scales to determine the role of spatial extent in environmental justice analysis.

In the 21st century, the world has entered the era of global equality of opportunities and freedoms, supported by globalization. This requires a revision of the concept of environmental justice because, despite the same opportunities for countries in the fight against climate change, they achieve significantly different results in implementing SDG 13. Therefore, equality of opportunity does not guarantee the same progress for countries in the fight against climate change and, therefore, is not identical to environmental justice.

In the "Decade of Action," results come to the fore—it is in the light of the results of the implementation of the SDGs that the sustainability of each country and the world economy as a global system is assessed. Therefore, a new interpretation of environmental justice is proposed as the degree of environmental inequality (i.e., uniformity of results in the fight against climate change). Clarification of this concept makes it possible to reliably quantify environmental justice in the global economy.

## Inequality of countries in the state of the environment and climate: current level, trends, and reasons

In order to quantify the inequality of countries in the state of the environment and climate, the authors used the Numbeo (2022) statistics for 2018–2022 in developed countries (using the example of the G7) and in developing countries (using the example of the BRICS), as shown in Table 1.

Source: calculated and compiled by the authors based on the materials of Numbeo (2022).

As calculated in Table 1, global environmental inequality (variation across the entire sample) is quite large: in 2018, it was 20.77%; in 2020, against the background of the COVID-19 pandemic, it increased to 22.77%; and in 2022, it decreased to 19.41%. Overall, it remained at a high level. Among the BRICS countries (26.53% in 2022), environmental inequality is higher than among the G7 countries (15.03% in 2022). The percentage ratio of the average for the G7 countries (81.38 points in 2022) to the average for the BRICS countries (76.98 points in 2022) is also very high –26.53% in 2022, although it has decreased compared to 2021, when it was 31.31%. The causes of environmental inequality are the following:

– Limited opportunities for climate change forecasting;
– Insufficient awareness of climate change risks and opportunities to reduce them;
– The complexity of introducing innovations (e.g., "clean" energy and "green" transport) in the fight against climate change.

Responsible production and consumption cannot fully eliminate the above reasons. Consequently, ensuring environmental justice in the "Decade of Action" lies beyond social progress. In this regard, it is advisable to determine whether technological progress (AI) can overcome this limitation and provide instrumental support for environmental justice.

## Prospects for achieving environmental justice in the global economy based on the optimal use of the potential of artificial intelligence to contribute to the fight against climate change

To determine AI's contribution to the fight against climate change, which was partially considered only in separate works by Bartmann (2022), Gooroochurn et al. (2022), and Popkova et al. (2020), a review of international experience was conducted. This made it possible to identify the prospects for achieving environmental justice in the global economy based on the optimal use of the potential of artificial intelligence to contribute to the fight against climate change.

These prospects are connected, firstly, with high-precision forecasting (short-, medium-, and long-term) and scenario analysis of climate change using AI. As demonstrated by the best experience of the American startup "Terrafuse AI," the advantages of using AI in the fight against climate change can be the detection of climatic anomalies (forest fires, changes in the natural habitat of various species on land and the sea) and predicting their occurrence (Share America, 2022).

Secondly, AI can provide automated information support to the broad masses of the population (and business) on climate change issues, measures taken to slow down this process, and practical climate solutions available to everyone. This will involve the whole society in the fight against climate change. A successful example is the AI system "LaMDA," launched by Google as a chatbot for users (Davis, 2022).

Thirdly, AI can generate applied innovations, considering the sectoral characteristics of the economy. For example, the World Meteorological Organization uses AI to prevent natural disasters, reduce greenhouse gas emissions, and develop "clean" energy and "green" transport in the international fight against climate change (Federal Service for Hydrometeorology and Environmental Monitoring(Roshydromet), 2022).

## Discussion

The contribution of the article to the literature consists of clarifying the essence of environmental justice as a criterion and target of environmental economics and management. The scientific novelty of the research and the results obtained in the article consist of rethinking the concept and essence of environmental justice, considering the new, modern realities of the "Decade of Action." In contrast to existing works (Budolfson et al., 2021; Cappelli et al., 2021; Dagdeviren et al., 2021; Gazzotti et al., 2021; Pérez-Peña et al., 2021; Yang and Tang, 2022), the authors proposed to define environmental justice not from the standpoint of equality of opportunities, but equality of results in protecting the environment and combating climate change. The author's definition provides new opportunities for determining (in particular, for quantitative measurement) and studying changes in environmental justice.

According to the updated definition, a new approach to ensuring environmental justice using high technologies of industry 4.0, and first of all AI, has been proposed. In contrast to the existing publications (Ali et al., 2016; Anantharajah and Setyowati, 2022; Furlan and Mariano, 2022; He et al., 2022; Islam, 2022), the article proposes to combat climate change based not on social but technological progress. In addition, the article determines the causes of climate change and demonstrates that social factors only indirectly affect them, while technological factors make it possible to eliminate these causes. The proposed new approach is based on international best practices and therefore opens up wide opportunities for highly effective practical use of AI in the integrated fight against climate change.

## Conclusion

Rethinking the meaning of environmental justice in the "Decade of Action" and comparing the results in the field of environmental protection and combating climate change to

measure environmental inequality are the results of the study. Guided by the new meaning of environmental justice, its assessment was made, which revealed that the degree of environmental inequality is high (climate variation: 19.41%), it increased in the conditions of the COVID-19 pandemic in 2020–2021; and in 2022, it began to decrease but remained high.

Quantitative analysis of ecological inequality in the state of the environment and climate in the dynamics of 2018–2022 in developed (on the example of the G7) and in developing (on the example of the BRICS) countries is supplemented by a qualitative analysis showing that the way to achieve environmental justice lies not in the field of social progress but the field of technological progress.

Prospects have been identified, and recommendations have been proposed to achieve environmental justice in the global economy based on the most optimal use of the potential of artificial intelligence to contribute to the fight against climate change. In particular, 1) high-precision forecasting, 2) automated increase in environmental awareness of the population, and 3) the creation of applied innovations specific to each sector of the economy using AI are proposed.

The theoretical significance of the article (the contribution of the article to the literature) is to clarify the essence of environmental justice in the global economy and reveal the potential of artificial intelligence to help combat climate change in the interests of ensuring environmental justice in the global economy. The practical significance of the results obtained in the article is that they have formed an instrumental apparatus for achieving environmental justice in the world economy.

The authors' recommendations are of interest and value to the state and supranational (e.g., the UN) environmental regulators, as they offer a new promising solution to the problem of achieving environmental justice in the global economy. The social significance of the article is that its results make it possible to increase the effectiveness of the fight against climate change and accelerate the achievement of environmental justice in the global economy.

The novelty of the article and its contribution to the existing literature is that the results obtained have strengthened the theory and methodology for assessing and analyzing environmental justice in the global economy. The concept of environmental justice is rethought in the article from the standpoint of sustainable development in the "Decade of Action." In the updated concept, environmental justice has received a more accurate and reliable measurement from the standpoint of the results of SDG13 in the field of combating climate change.

The consequences of the results for practice are related to the fact that clarifying the cause-and-effect relationships of environmental inequality, achieved in the article, opens up opportunities for its identification, systematic monitoring, and overcoming. The author's theoretical interpretation and improved methodology for assessing environmental inequality make it possible to monitor environmental inequality based on annual reports on the SDGs, in particular, complete, transparent, and open UN reports on sustainable development.

The practical value and significance of the results obtained in the article also lie in the fact that they proved the limitations of existing technologies in measuring and overcoming environmental inequality. AI is proposed as a promising technology for combating climate change and achieving environmental justice in the global economy, as well as the current directions for its use.

As a result, the article has formed a clear vision and offered practical recommendations for improving the current practice of combating environmental inequality in the global economy. The practical management implications of the article are to substantiate the need for systematic implementation of SDG10 and SDG13, reveal the prospects, and develop applied recommendations for achieving this based on combating climate change based on AI.

The limitation of the research is the isolated consideration of technological progress in the AI era as a source of environmental justice in the global economy. While this allowed for the most accurate and reliable characterization of the potential of this source, it left other sources unconsidered. As shown in the article, social progress alone is insufficient to fully achieve environmental justice in the global economy.

Nevertheless, a combination of social and technological progress may help achieve more significant results due to the synergistic effect of socioeconomic development. In this regard, the role of social progress in the fight against climate change, if it is systematically achieved, together with technological progress, deserves to be studied. The prospects for future academic pursuits are related to the systematic study of the sources of environmental justice in the global economy, in particular, technological and social progress.

## Author contributions

Idea: VO and TS. Abstract: VO and TS. Keywords: TS. Introduction: TV. Methodology: VO and TS. Research: VO and TS. Discussion: VO and TS. Conclusion: VO and TS. References: TS.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note



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