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Klimatska nepravda u eri globalizacije i tehnološkog napretka

Danijela Slavnić[1], Milena Cvjetković[2], Sunčica Vještica[3]

[1]ElixirEngineering, Elixir Group, Novi Sad, Serbia, danijela.slavnic@elixirengineering.rs
[2]NCSDK - National Center for Certification of Additional Qualifications, Belgrade, Serbia, cvjetkovicm@gmail.com
[3]Faculty of Economics and Engineering Management, University Business Academy, Novi Sad, suncica.vjestica@fimek.edu.rs

Apstrakt: Ovaj rad istražuje preseke između ciljeva održivog razvoja (SDG) i Zelene agende, fokusirajući se na ekološke, socijalne i ekonomske izazove i prilike u globalnom kontekstu. Naglašava ulogu međunarodne saradnje, tehnoloških inovacija i ublažavanja klimatskih promena u postizanju održivog rasta i rešavanju ekoloških problema kao što su zagađenje vazduha, gubitak biodiverziteta i upravljanje otpadom. Studija analizira uticaj klimatskih promena, tehnoloških razvoja i energetske tranzicije, sa akcentom na potrebu za pravednijim pristupom u kontekstu globalnih razlika. Dok tehnološke inovacije kao što su veštačka inteligencija (AI) i blokčejn (*eng. Blockchain*) nude potencijalna rešenja za održivi razvoj, one takođe predstavljaju nove izazove u pogledu potrošnje energije i ekološkog uticaja. Rad tvrdi da je potreban uravnotežen pristup koji integriše tehnološke napretke sa sveobuhvatnim ekološkim politikama kako bi se obezbedio pravičan i efikasan zeleni prelaz, naročito u zemljama u razvoju. Takođe, poziva na veću odgovornost i saradnju između zemalja, uz naglasak na klimatsku pravdu kako bi se osiguralo da ranjive populacije ne budu nesrazmerno pogođene ekološkim propastima.

Ključne reči: Održivi razvoj, Zelena agenda, Klimatske promene, Tehnološki razvoj.

Climate Injustice in the Era of Globalization and Technological Advancement

Abstract: This paper explores the intersections between the Sustainable Development Goals (SDGs) and the Green Agenda, focusing on ecological, social, and economic challenges and opportunities in a global context. It emphasizes the role of international cooperation, technological innovations, and climate change mitigation in achieving sustainable growth and addressing environmental issues such as air pollution, biodiversity loss, and waste management. The study analyzes the impact of climate change, technological development, and energy transition, with a focus on the need for a fairer approach in the context of global disparities. While technological innovations such as artificial intelligence (AI) and blockchain offer potential solutions for sustainable development, they also present new challenges regarding energy consumption and environmental impact. The paper argues that a balanced approach is needed, integrating technological advancements with comprehensive ecological policies to ensure a fair and efficient green transition, especially in developing countries. It also calls for greater accountability and cooperation among nations, emphasizing climate justice to ensure that vulnerable populations are not disproportionately affected by environmental disasters.

Keywords: Sustainable development, Green agenda, Climate change, Technological development.

1. Introduction

At the United Nations Conference on Sustainable Development held in 2015, one of the main outcomes was the adoption of 17 Sustainable Development Goals for the period up to 2030 by Member States (Bolyssov et al., 2019). The Green Agenda focuses on global efforts to achieve sustainable development through economic, social and environmental dimensions, with the aim of reducing negative environmental impacts, combating poverty, reducing inequalities, conserving natural resources and promoting inclusive economic growth.

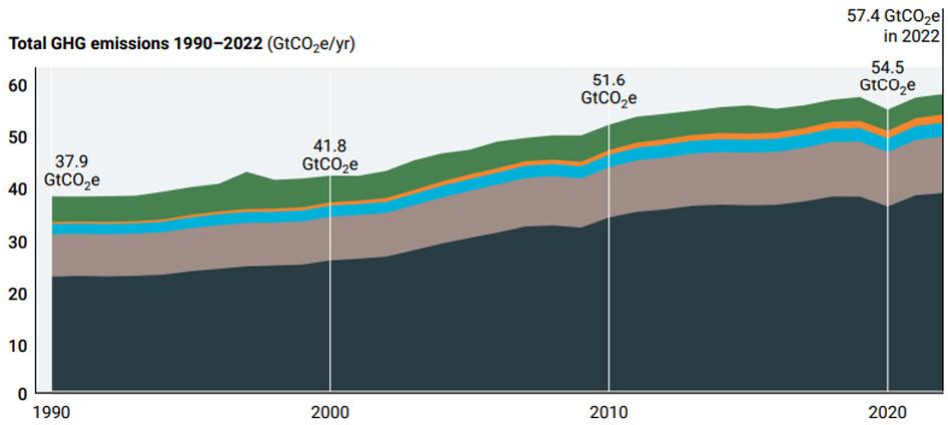
The key principles of sustainable development include respect for human rights, equality, environmental responsibility, integrated solutions and international cooperation, taking into account the different capacities and specificities of each country. The Green Agenda for the Western Balkans provides guidelines, priorities and objectives to be achieved in the areas of : decarbonisation, circular economy, protection and restoration of biodiversity, sustainable agriculture and combating air, water and land pollution (Vasilkov et al., 2021). In order to establish a framework for regional and international cooperation and in line with the priorities set out in the EU Green Deal, the Western Balkan countries are adopting strategies for the development of energy from RES. The project "EU for a Green Agenda in Serbia" aims at the effective implementation of the Green Agenda by improving the legislative framework, co-financing innovative pilot projects and mobilising additional funding. Key results include innovative solutions for cleaner air, reducing industrial emissions, enhancing natural values through green infrastructure, and supporting sustainable food systems and rural development. The Republic of Serbia has demonstrated numerous measures in the domain of climate transition in an effort to promote sustainable production and consumption that protect existing resources and natural capital. The energy system of our country tends to rely more on renewable energy sources, namely the use of wind energy and hydropower, and less on exhaustible resources (Martin, 2023).

The misleading practices of the Green Agenda can be reflected in the unequal distribution of responsibility for emissions of harmful gases, where developed countries often transfer the burden to developing countries, while they themselves do not take appropriate measures to reduce emissions. Technological developments and the application of artificial intelligence (AI) can have a detrimental impact on climate change, as they often lead to increased consumption of energy and resources, as well as emissions from industry and transport, while automation and digitalization can increase production capacities without adequate environmental protection. These negative effects of technology and globalization make it difficult to achieve a just green transition, as they often do not take into account the ecological and social dimensions of sustainable development.

2. Trends, causes and consequences of dealing with climatic changes

Climate change, caused by anthropogenic (human) activity, is one of the biggest global problems, in which greenhouse gas emissions, especially from fossil fuels, play a key role. Greenhouse gas (GHG) emissions trap heat in the atmosphere, and the planet is already 1.2°C warmer than in the 19th century, at the beginning of the Industrial Revolution. In some parts of the world, including the Western Balkans, to which the Republic of Serbia belongs, the average global temperature is 1.5°C higher than in the pre-industrial period. The latest UN Climate Change Report suggests that if the average global temperature increases by 2°C before the end of the century compared to the temperature at the end of the 19th century, life on the planet as it is now will not be possible. If the current trend of greenhouse gas emissions continues, according to this report, we are rapidly approaching this scenario – within the next 20 years the average temperature increase will reach or exceed 1.5°C. On the other hand, with zero global net greenhouse gas emissions, by 2100, global warming is unlikely to be below 2°C. In order to achieve net zero emissions, it is necessary to significantly reduce greenhouse gas emissions, so that they are equal to the amount of carbon dioxide that can be absorbed by the atmosphere (The Emission Gap Report 2022, 2023) .

Figure 1: Global GHG emissions from 1990 to 2022



Source: https://wedocs.unep.org/

Figure 1 shows greenhouse gas emissions in the period from 1990 to 2022 worldwide. As can be seen in this figure, a constant increase in emissions was recorded in the aforementioned period, with a significant increase in greenhouse gas emissions from 2000 to 2010. In the last 10 years, a weaker increase in greenhouse gas emissions was recorded, which is a consequence of the development of awareness about the harmful effects of GHG emissions.

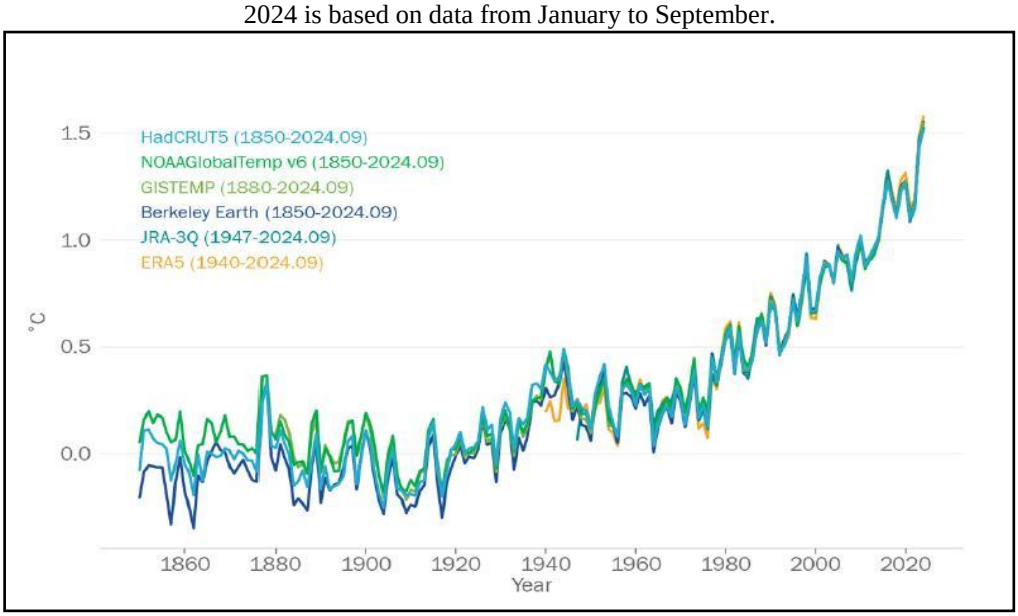
In order to limit global warming to below 2°C, countries have committed to international agreements and a transition to renewable energy sources such as wind, solar and hydropower, known as the "energy transition". Key environmental issues in the world are air pollution and climate change. According to the World Health Organization (WHO), there are six main air pollutants: particulate matter (PM), ozone (O_3), carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx) and lead. The greenhouse gases, according to the Intergovernmental Panel on Climate Change (IPCC), are: carbon dioxide (CO_2), methane (CH_4), fluorocarbons (HFCx), fluorocarbons (organic compounds in which all hydrogen atoms are replaced by fluorine, CxFy) and sulfur hexafluoride. Ozone is considered an indirect greenhouse gas. Climate change is caused by emissions of pollutants such as CO, NO, NO_2, greenhouse gases (H_2O, CH_4, O_3) and aerosols, which are interconnected due to common sources and processes. Carbon dioxide is the most important anthropogenic greenhouse gas. The rise in CO_2 levels, which contributes to global warming, is the greatest environmental challenge, requiring urgent mitigation measures, such as reducing emissions and implementing CO_2 capture and utilization (CCU) technologies. These technologies, especially CCU, offer cost-effective solutions because they enable the recycling of CO_2 into useful products, thereby reducing transportation and storage costs (Singh and Yadav, 2021).

The world is facing a serious problem of air pollution that is driven by climate change, and conversely, climate change further worsens air pollution. Air pollution and climate change are closely linked (Sonwani et al., 2022b). Matyssek et al. (2012) stated that air pollution is an integral element of climate change. Human-caused emissions contribute significantly to both processes, air pollution and climate change. Ozone is another gas that, in addition to directly affecting the climate, is indirectly affected by the lifetime of other greenhouse gases, such as methane, causing additional climate effects (Singh and Yadav, 2021). On the other hand, climate change affects ozone concentrations through dynamic and chemical changes in the atmosphere. Climate change is a global challenge with far-reaching consequences for the entire world (Haibach and Schneider, 2013). A comprehensive interdisciplinary approach is necessary to reduce the consequences of climate change and combat air pollution. Achieving SDG 13 requires, the implementation of effective strategies to reduce greenhouse gas emissions, introduce smart agricultural practices, promote renewable energy sources and improve energy efficiency. Also, the implementation of climate change adaptation strategies, the development of green infrastructure, sustainable cities and communities, as well as effective waste management, are key to achieving SDG 11 and reducing the impacts of climate change (Zakaria et al., 2020). Also, sustainable water management (Xiang et al., 2021), air quality and watershed management, as well as improving disaster preparedness systems, with the development of early warning systems, can also be useful in combating climate change (Saxena and Sonwani, 2020; Hussain and Hoque, 2022a).

Concentrations of three key greenhouse gases in the atmosphere – carbon dioxide, methane and nitrous oxide – reached record levels in 2023, the latest year for which global data are available. Carbon dioxide (CO_2) concentrations rose from about 278 ppm in 1750 to 420 ppm today, an increase of 51%. The average annual rate of increase in CO_2 over the past decade has been 2.4 ppm. Fossil fuel emissions have been the largest source of human emissions since the 1950s. The global average concentration of methane (CH_4) rose from 729 ppb in the pre-industrial period to 1934 ppb in 2023, an increase of 165%. The concentration of nitrogen oxides (N_2O) increased from 270 ppb in 1750 to 336.9 ppb in 2023, which represents an increase of 24%. The fact that some years recorded a temperature increase of more than 1.5°C does not necessarily mean that the goal of the Paris Agreement, which aims to limit the temperature increase to 1.5°C above the pre-industrial level, is unattainable (Kennedy et al., 2024).

Figure 2 shows the increase in global temperature for the period from 1850 to 2024. As can be seen in the figure, the increase in global temperature is not constant. A significant increase in global temperature was recorded in the period from 1920 to 1940. A constant and largest increase in temperature was recorded in the period from 1970 to the present.

Figure 2: Annual global temperature anomalies from 1850 to 2024 from six datasets. The average for 2024 is based on data from January to September.



Source: Kennedy et al., 2024

Climate change acts as a risk multiplier, linking global warming to problems such as the loss of key resources, supply disruptions, increased insecurity and social instability, which can lead to migration and conflict. Key questions in climate policy are who should be protected from climate impacts and who should bear the costs. Climate policy will only be successful if the Global North takes greater responsibility for addressing the problems and implements stricter limits than the Global South (Scheffran, 2023). Despite scientific warnings, the global trend towards climate stabilisation is still not visible, and reducing greenhouse gas emissions by half by 2030 and achieving climate neutrality by 2050 is necessary to meet climate security limits (Engels et al., 2023). The issue of climate justice is not adequately regulated in international climate agreements, including the Paris Agreement, and disagreements regarding greenhouse gas emission reduction targets represent an obstacle to a consistent comparative review of the state and progress. Serbia has a larger difference in emissions compared to Greece and Romania, while compared to Albania it has a larger difference in emissions per capita. Serbia's emission reduction targets are more modest than those of neighboring countries, including North Macedonia, while the EU's targets are significantly more ambitious (Todić, 2020).

3. Fair participation of states in climate change

Climate justice links climate change to social inequalities, emphasizing that the most vulnerable populations, who contribute the least to emissions, suffer the most from its consequences. Developed countries often shift the burden of climate change to the poorer, leading to global imbalances in the distribution of damages. Climate justice demands a fair distribution of these burdens and protections for all communities (Porter et al., 2020). It highlights two main groups of people differently affected by climate change: the first, the privileged, who have benefited from fossil fuels and colonial development and are now in a better position to adapt to climate change, and the second, the more numerous group, who have long been exploited and now bear the greatest burden of climate change, although they have not significantly contributed to its occurrence.

This issue is becoming increasingly important for researchers and practitioners, especially in the context of urban planning, as climate injustice is increasingly recognized as a key obstacle to an equitable response to climate challenges (Rickards & Watson, 2020).

The IPCC (Intergovernmental Panel on Climate Change) is a key UN body that assesses the scientific, technical and socio-economic aspects of climate change. Its work helps governments make informed decisions on climate issues, focusing on identifying the most vulnerable groups and understanding their needs. Recent IPCC reports clearly show that delays in reducing emissions will further exacerbate the effects of climate change and increase climate injustices.

For example, the 1.5° C Report highlights climate change as an ethical issue and calls for the protection of the human rights of those at risk, including the rights to water, food, health and life (Masson-Delmotte et al., 2018). The Climate Change and Land Report warns that failure to reduce carbon dioxide could exacerbate climate injustice at the local and regional levels, if appropriate measures are not taken (Shukla et al., 2019).

The issue of "fair share" arises in legal challenges related to the adequacy of countries' efforts to mitigate climate change, as there is a global "carbon budget" that must be respected in order to maintain the 1.5°C temperature increase target. The problem arises because it is unclear when emissions become illegal, as the Paris Agreement does not define clear principles for distributing emissions among countries. This ambiguity complicates legal proceedings aimed at holding responsible countries accountable for their emissions (Liston, 2020). In the context of the climate crisis, the ISDS mechanism for settling disputes between investors and states is considered an obstacle to effectively addressing climate change. Although a reevaluation of international investment treaties is needed, the process of modernization is complex, as balancing the interests of investors and climate objectives creates uncertainty and increases the risk of ISDS claims. Therefore, tribunals should recognize the right of states to regulate as an exception to the standards of fair and equitable treatment, guided by the principles of proportionality and good faith, in order to protect climate objectives without violating investors' rights (Holder, 2024).

Green criminology studies how human activities affect the environment, taking into account not only criminal acts, but also other harmful actions, including irresponsible behavior of companies, governments and citizens, who are motivated by the race for profit and consumerism. This discipline also points to the need for sincere action in protecting nature, instead of creating the illusion of efficient action, while in reality environmental problems are often minimized or dramatically distorted, with the aim of preserving the economic dominance of developed countries (Ignjatović, 2023). Scientific research indicates that reducing consumption in developed countries, while maintaining sustainable changes, can contribute to mitigating unjust environmental damage caused by the dynamics of ecologically unequal exchange (EUE) between the Global North and the South. Activists and scholars emphasize the importance of a global environmental justice movement that uses a multidimensional and intersectional approach to confront social and environmental injustices, restoring agency to communities affected by environmental problems and strengthening their resilience to powerful global and local structures (Jennifer et al., 2018).

4. Climate changes in the light of technological development

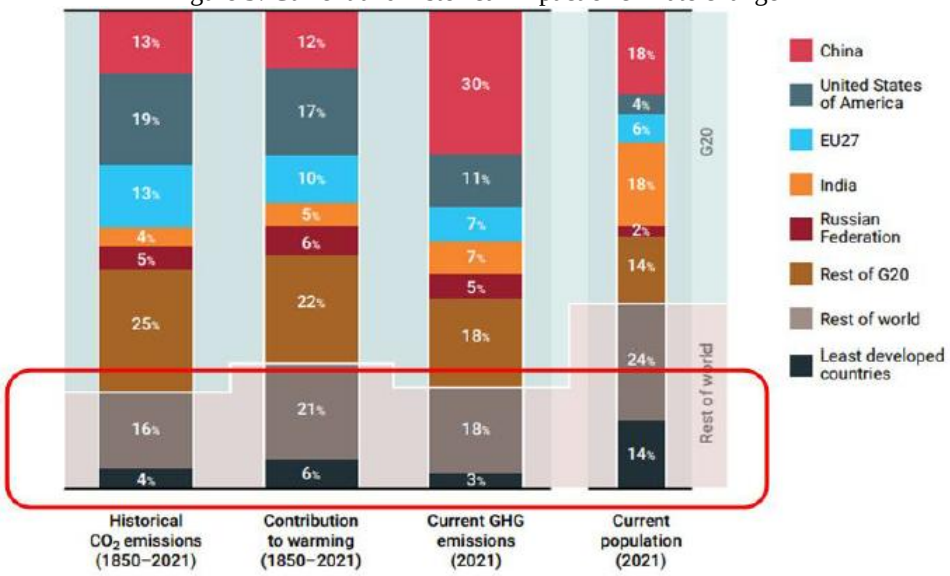
In recent decades, the dramatic increase in global industrial activity has led to a significant increase in the use of fossil fuels, while technological progress has increased carbon footprints and thus global warming (Sharma et al., 2020). Research (Tao et al., 2023) has shown the impact of climate change and technological innovation on economic growth, energy consumption and carbon dioxide emissions in Asian and European countries, revealing significant regional differences in the effects of innovation, with European countries benefiting more. The study highlights the need for targeted technological innovation in Asian countries to improve energy efficiency and reduce emissions, while technology transfer from Europe increases emissions in Asia.

The richest countries in the world are accelerating their emission reductions, while poor countries are increasing them intensively. Figure 3 shows the current and historical impact of climate change on different countries. As can be seen in the aforementioned figure, the populous developing countries are disproportionately newly established. These countries are increasing their emissions because they are relying on the cheapest energy sources (for example, coal) due to their ever-increasing energy needs.

In recent years, modern technologies such as Blockchain technology and Artificial Intelligence (AI) have been increasingly applied in the fight against climate change. Blockchain technology is a disruptive technology that advances information technology and the act of sharing information. Blockchain technology functions as a ledger in which data used in transactions or communication is stored, and which is accessible online or in digital blocks (Parmentola et al., 2022).

This technology is now applied in various fields (Centobelli et al., 2021), and recently it has often been applied with the aim of improving environmental sustainability (Glavanits, 2020).

Figure 3: Current and historical impact of climate change



Source: https://wedocs.unep.org/

The presented research (Thalhammer, et al., 2022) points to the application of blockchain technology in the fight against climate change, focusing on areas such as emissions trading, sustainable energy, mobility and the green finance sector, where blockchain improves transparency and data tracking. Although blockchain can significantly contribute to climate action, challenges such as legal framework, data privacy and energy efficiency indicate the need for further research and development of more efficient and environmentally friendly solutions for using this technology in the fight against climate change. Blockchain technology has the potential to transform the economy by harmonizing transparency and efficiency with the goal of achieving a more sustainable world, but it is important to balance its positive and negative effects on the environment (Parmentola et al., 2022).

AI plays a key role in optimizing energy consumption, forecasting demand and reducing the load on energy systems, contributing to sustainability and reducing the carbon footprint. However, the rapid development of AI, especially in training large language models, leads to increased energy consumption, which poses a challenge to achieving carbon neutrality, as high energy costs and increasing energy consumption increase the carbon footprint. Therefore, scientific efforts are focused on improving the energy efficiency of AI systems and reducing their negative impact on the environment (Pimenow et al., 2024). Research results (Zhang et al., 2023) indicate that Bitcoin mining has a significant environmental impact, with an asymmetric relationship between cryptocurrency energy consumption and CO 2 emissions, which requires the implementation of appropriate policy reforms to reduce its negative impact on climate change. Research (Huynh et al., 2021) calls for the design and implementation of regulations and strategic plans that would encourage the transformation towards sustainable cryptocurrency mining, thereby reducing carbon footprints and alleviating environmental concerns related to the cryptocurrency ecosystem. In order to mitigate the environmental consequences of cryptocurrencies, it is necessary to promote technological innovations in renewable energy and their application in the cryptocurrency market (Wang et al., 2018).

5. Conclusion

The Green Agenda and the pursuit of the Sustainable Development Goals (SDGs) represent both challenges and opportunities at the global level. While the transition to a green economy, based on renewable energy sources and sustainable practices, is crucial for long-term environmental and economic stability, there are significant obstacles that need to be overcome. These include the uneven distribution of responsibility for greenhouse gas emissions, the negative effects of certain technologies, and economic disparities between countries. A more inclusive and equitable strategy is needed in the future to ensure that all countries, regardless of their economic status, can participate in the global efforts to combat climate change.

Legislative frameworks need to be strengthened, investments in green technologies increased and international cooperation enhanced.

The role of new technologies, such as artificial intelligence (AI) and blockchain, also needs to be carefully assessed to ensure that their environmental impact is minimized while maximizing their potential for sustainable development. The global community must strive for a just transition that recognizes the historical responsibilities of industrialized countries and ensures that developing countries are not left behind in the pursuit of climate justice. This includes addressing the needs of the most vulnerable communities affected by environmental disasters and promoting international cooperation to ensure a fairer sharing of the costs and benefits of climate action.

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