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GREEN INNOVATION AND INTERNATIONAL ECONOMIC COOPERATION IN ADDRESSING CLIMATE CHANGE

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Abstract: *The article considers the concept of "climate change" and "green innovation", explores the countries' ways of addressing occurring climate change issues, investigates improvements in sustainable technologies.*

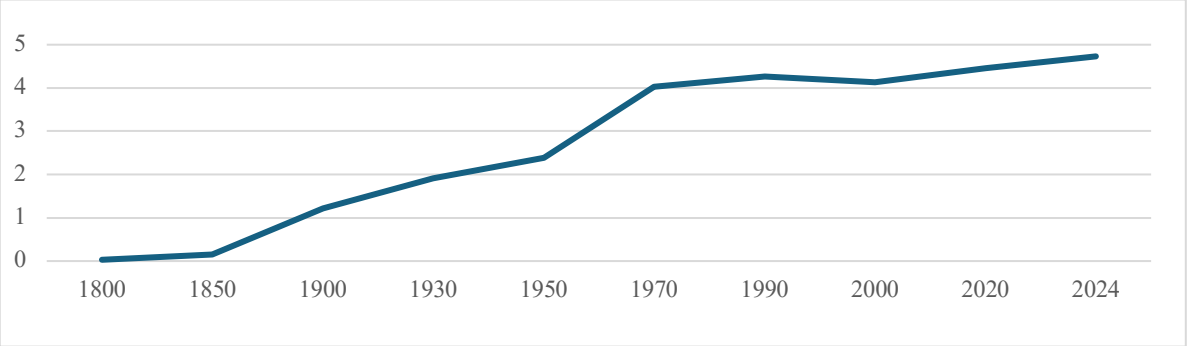
Key words: *sustainability, economics, green technologies, international relations, politics, integration, climate change, awareness.*

To develop a deeper understanding of how climate change may influence economic cooperation between states and businesses, it is first necessary to define the concept of climate change in general terms. Climate change refers to long-term alterations in temperature patterns and weather conditions. While some of these changes occur naturally due to factors such as variations in solar radiation or volcanic activity, a significant portion is anthropogenic, resulting from the rapid expansion of human industrial activity since the nineteenth century [1]. In particular, the large-scale combustion of fossil fuels and deforestation have substantially altered the composition of the Earth's atmosphere.

Until relatively recently, climate change did not receive widespread scientific or public attention. However, contemporary research has firmly established its significance. Scholars such as Mark Lynas argue that current climatic transformations are predominantly driven by human activity, emphasizing the unprecedented rate and scale of these changes [2]. This growing scientific consensus is supported by extensive empirical evidence collected over recent decades.

The origins of anthropogenic climate change can be traced back to the Industrial Revolution, which marked a transition from manual labor to mechanized production. This shift led to a dramatic increase in greenhouse gas emissions, particularly carbon dioxide (CO_2), which have continued to rise steadily since the nineteenth century [3]. These emissions enhance the greenhouse effect, trapping heat within the Earth's atmosphere and contributing to global warming.

Although the effects of climate change were not immediately apparent to the general population in the early twentieth century, scientists had already begun to identify its underlying mechanisms. Notably, in 1856, the American scientist Eunice Foote conducted pioneering experiments demonstrating the heat-absorbing properties of carbon dioxide. She concluded that higher concentrations of this gas in the atmosphere would lead to increased air temperatures, thereby laying the groundwork for the modern understanding of the greenhouse effect [4]. Subsequent research has expanded on these early findings, confirming the critical role of greenhouse gases in shaping the Earth's climate system.



Data source: Global Carbon Budget (2025); Population based on various sources (2024) [3]

By the early twentieth century, the effects of climate change were not yet widely perceived by the general public; however, the scientific community had already begun to identify its underlying mechanisms. One of the earliest contributors to this field was the American scientist Eunice Foote, who in 1856 demonstrated the heat-absorbing properties of carbon dioxide, concluding that higher concentrations of this gas in the atmosphere would lead to increased air temperatures [4]. Building on this foundation, the Swedish scientist Svante Arrhenius, later awarded the Nobel Prize, conducted the first quantitative assessment of the relationship between carbon dioxide concentrations and global temperature. In 1896, he estimated that a significant increase in atmospheric CO_2 could lead to substantial temperature rises, particularly in Arctic regions, thereby laying the groundwork for modern climate modelling [4].

It is now widely recognized that human activity has had a considerable impact on the environment and the global climate system. Raising awareness of climate change is therefore essential, as its consequences may be severe and far-reaching. Responsibility for addressing this issue extends beyond individuals to include businesses and corporations, which play a critical role in shaping production processes and consumption patterns. The adoption of sustainable practices—such as transitioning to low-carbon technologies, improving energy efficiency, and encouraging environmentally responsible behaviour among employees—can contribute to mitigating global temperature increases [5].

A key challenge in addressing climate change is the problem of "free riding." Greenhouse gases, once emitted, disperse and mix globally in the atmosphere, making it difficult to attribute emissions to specific sources. This creates incentives for some actors to benefit from the mitigation efforts of others without contributing themselves [6, 7]. At the same time, emissions levels vary significantly across countries and firms, largely depending on their size and level of industrial activity. Despite the importance of transparency, comprehensive reporting on greenhouse gas emissions and mitigation efforts remains insufficiently widespread. Expanding such reporting practices could play a crucial role in improving accountability and informing policy decisions.

International organizations, including the Intergovernmental Panel on Climate Change (IPCC) and the Climate Action Network (CAN), rely on such data to support global initiatives aimed at strengthening emissions control and climate governance. In recent years, international cooperation has intensified, with countries increasingly working together to address climate-related challenges. For instance, the European Union has supported sustainability initiatives beyond its borders, including funding the development of a solar-powered market hall in Alexandria, Egypt, and assisting cocoa producers in Côte d'Ivoire in adapting to environmental pressures such as deforestation. These examples illustrate the growing importance of collaborative efforts in mitigating and adapting to climate change on a global scale.

In conclusion, climate change represents a complex and multifaceted global challenge, rooted in both natural processes and, increasingly, human activity since the Industrial Revolution. Early scientific contributions laid the foundation for understanding the relationship between greenhouse gas emissions and rising global temperatures, while contemporary research has confirmed the scale and urgency of the issue. Addressing climate change requires coordinated action at multiple levels, involving individuals, businesses, and governments. In particular, enhancing transparency in emissions reporting, promoting sustainable production practices, and overcoming collective action problems such as free riding are essential steps toward effective mitigation. Ultimately, strengthened international cooperation and the continued efforts of global organizations will play a decisive role in ensuring a more sustainable and resilient future.

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