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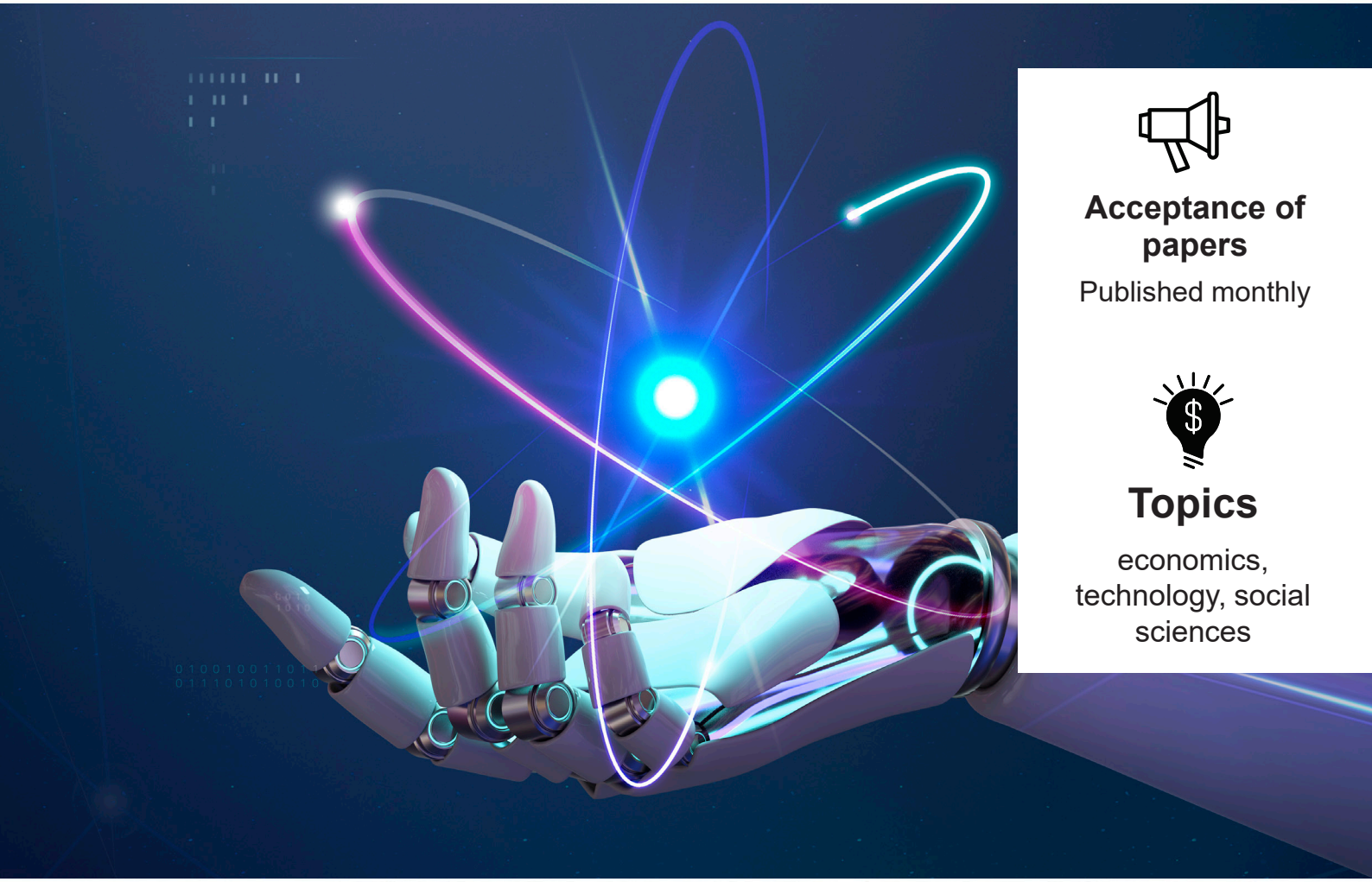

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INTEGRATION OF THE TRANSPORT SECTOR INTO THE GREEN ECONOMY AND IMPACT ON SUSTAINABLE DEVELOPMENT: ECOLOGICAL TRANSFORMATION AND INNOVATIVE SOLUTIONS

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Abstract: This article examines the contribution of the transport system to the development of the green economy and sustainable growth. Global environmental challenges, climate change, and the need for efficient resource use require the adoption of innovative and environmentally friendly approaches in the transport sector. The study analyzes the concept of "green transport," including the use of electric and hybrid vehicles, modernization of public transport, digitalization of logistics processes, and mechanisms for reducing carbon emissions. It also discusses how improving the energy efficiency of transport affects economic growth, environmental protection, and the quality of life of the population. The study concludes that the contribution of transport to the green economy is a key factor not only for environmental sustainability but also for social and economic stability.

Key words: green transport, sustainable development, green economy, transport system, electric vehicles, hybrid vehicles.

INTRODUCTION

In recent decades, the concept of a green economy has become central to the global economy and all areas of social life. A green economy is a strategic approach aimed not only at the efficient and economical use of natural resources, but also at protecting the environment, reducing the negative consequences of climate change, and ensuring sustainable economic development. In this context, the transport sector stands out as an important driving force of the economy, as it is a major source of energy consumption, carbon dioxide emissions, and other pollution.

The integration of the transport system into a green economy is carried out through ecological transformation and the use of innovative solutions. This process allows not only to increase the energy efficiency of transport, but also to improve road safety, optimize intercity and intracity mobility systems, and reduce the carbon footprint. At the same time, the creation of a sustainable transport infrastructure is directly related to the introduction of new technologies, digital solutions, and environmental standards.

Studies conducted by countries and international organizations show that investments in green transport systems not only bring environmental benefits, but also increase economic efficiency. For example, through electric vehicles, the use of renewable energy sources, intelligent transport systems and other innovative solutions, it is possible not only to protect the environment, but also to improve the quality and sustainability of transport services. In this regard, the integration of the transport sector into a green economy is considered a strategic task for countries, which is of not only environmental but also socio-economic importance.

This article aims to analyze the processes of integration of the transport system into a green economy, its impact on sustainable development, the effectiveness of ecological transformation and innovative solutions. The article considers important aspects of environmental standards, innovative technologies and the creation of sustainable infrastructure in the development of the transport sector, and develops practical recommendations.

REVIEW OF LITERATURE ON THE SUBJECT

In recent years, the integration of the transport sector into the green economy and its impact on sustainable development has become one of the most widely discussed topics in the international scientific literature. Researchers emphasize that the transformation of transport systems toward environmentally sustainable models is closely related to addressing global climate change, improving resource efficiency, and ensuring long-term economic development. According to the International Energy Agency, the transport sector is responsible for approximately 24% of global carbon dioxide emissions, which makes the decarbonization of transport systems a critical element in global climate policy and environmental protection strategies (International Energy Agency, 2022).

The issue of sustainable transport development is also strongly linked to urban transport planning and infrastructure management. Banister highlights that sustainable transport policies should prioritize the development of public transport systems, cycling infrastructure, and pedestrian-friendly urban environments. According to his research, a shift toward sustainable mobility patterns not only reduces environmental pressure but also improves the overall efficiency of urban transport systems and contributes to higher quality of life in cities (Banister, 2019).

Technological innovation is another key driver of the green transformation of the transport sector. Geels analyzes transformative innovation processes in transport systems and identifies technologies such as electric vehicles, hydrogen-based energy systems, and smart logistics networks as essential components of the transition toward sustainable mobility. These innovations help increase energy efficiency, reduce greenhouse gas emissions, and improve the environmental performance of transport systems (Geels, 2020).

Empirical studies conducted in several countries demonstrate that targeted policy measures can significantly accelerate the transition toward green transport. Liu, Li, and Zhao analyze the implementation of green transport corridors in China and conclude that government subsidies for electric vehicles and the development of environmentally friendly logistics infrastructure contribute both to carbon emission reductions and to improvements in economic efficiency (Liu, Li, & Zhao, 2021). Similar policy initiatives have also been implemented in the European Union, where sustainable transport strategies aim to promote low-emission mobility and green logistics systems.

The relationship between transport systems and sustainable development is also reflected in international policy frameworks. The United Nations' "2030 Agenda for Sustainable Development" identifies sustainable transport as an important component of achieving the Sustainable Development Goals (SDGs). The agenda emphasizes the need to reduce the carbon footprint of transport systems, increase energy efficiency, and develop environmentally friendly infrastructure to support sustainable economic and social development (United Nations, 2015).

From an economic perspective, transport investments play a significant role not only in facilitating economic growth but also in addressing regional disparities. Button's research on transport economics shows that investments in transport infrastructure contribute to improved connectivity, increased productivity, and the creation of new employment opportunities, including jobs within emerging green industries (Button, 2021).

Overall, the reviewed literature demonstrates that the role of the transport sector in the green economy is dual in nature. On the one hand, transport systems act as a key driver of economic growth and global trade; on the other hand, their ecological transformation is essential for achieving environmental sustainability and supporting long-term sustainable development. Existing studies also emphasize that effective public policies, technological innovation, and international cooperation are crucial factors in accelerating the green transformation of the transport sector.

RESEARCH METHODOLOGY

This study used a comprehensive approach to study the contribution of transport to a green economy and sustainable development. The methodology includes the following stages. The philosophical foundations of the study are based on the theory of sustainable development, the concept of a green economy, and the paradigm of ecological modernization. The UN Sustainable Development Goals SDGs - 2030, the Paris Agreement, and Uzbekistan's "Strategy for Transition to a Green Economy" were taken as the main conceptual documents.

International scientific articles, World Bank, IEA, OECD, and UNCTAD reports were studied, and the interrelationship between transport and ecology was summarized from a scientific point of view. A comparative analysis of studies conducted over the past 10 years was conducted. Data on the transport sector of Uzbekistan from the State Statistics Committee, the Ministry of Transport, and the Ministry of Ecology were taken as a basis. The dynamics of investments in transport infrastructure, the expansion of road transport networks, the volume of emissions and the share of "green" technologies in 2020-2024 were analyzed.

Statistical analysis studied the relationship between the volume of transport services, CO_2 emissions, and investments in green technologies. Correlation-regression analysis was used to determine the relationship between investments in transport infrastructure and regional economic growth indicators. Comparative analysis The experience of Uzbekistan was compared with the experience of foreign countries, in particular, the European Union and Southeast Asian countries. Development of borderline cases and recommendations. Existing problems (high energy consumption, outdated transport fleet, carbon emissions) and opportunities (digital technologies, electric vehicles, green logistics corridors) were identified and promising proposals were made to enhance the contribution of transport to the green economy.

ANALYSIS AND RESULTS

Within the framework of the theory of sustainable development, transport infrastructure integrates the production, trade and service sectors as a driver of economic growth. At the same time, it strengthens the harmony between the three main elements of sustainable development: economic efficiency, social justice and ecological balance by ensuring environmental safety. Green vehicles and ecological logistics systems increase energy efficiency and contribute to the economical use of natural resources.

Based on the concept of a green economy, the main goal of a green economy is to ensure economic growth while protecting the natural environment. The “green transformation” in transport – that is, the introduction of electric vehicles, gas and hydrogen vehicles, and digital logistics technologies – is a practical manifestation of this concept. Also, the widespread introduction of green technologies in transport reduces the “carbon footprint” and helps to fulfill international environmental obligations (Figure 1).

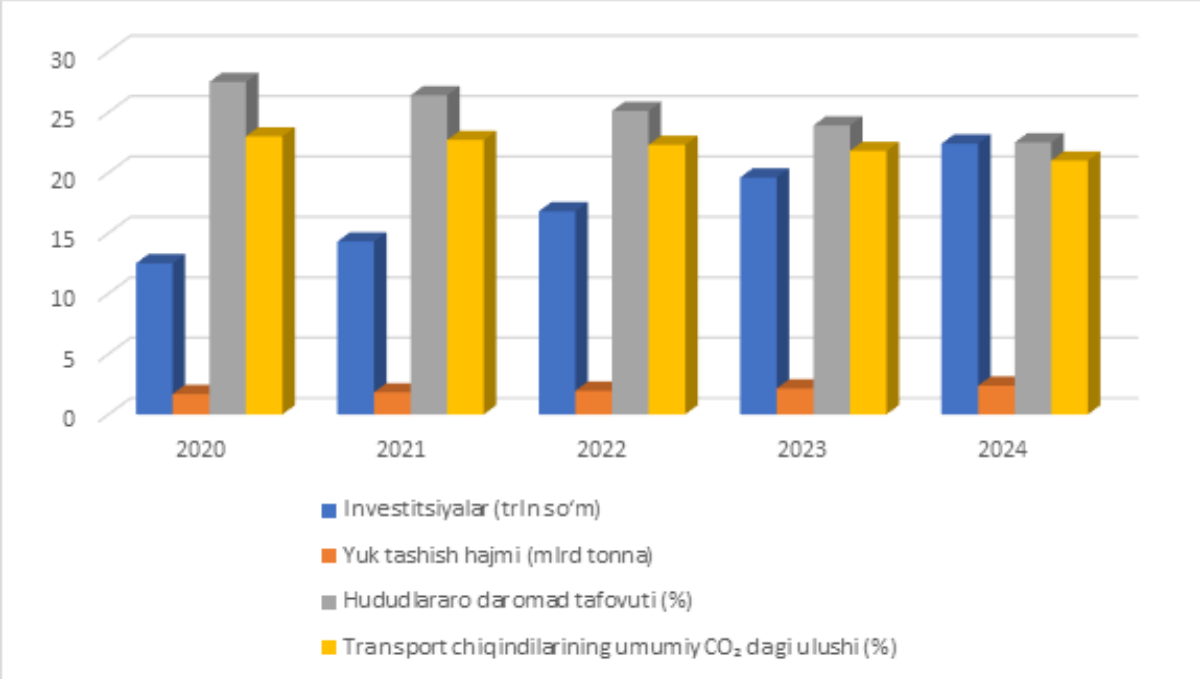

Figure 1. Transport infrastructure and sustainable development indicators[1]

Investments in transport infrastructure and economic growth During 2020–2024, the volume of investments in transport infrastructure in Uzbekistan increased from 12.5 trillion soums to 22.4 trillion soums. During this period, the volume of cargo transportation increased from 1.68 billion tons to 2.37 billion tons, which indicates an increase in the volume of logistics services and economic activity.

Reduction of interregional inequality As a result of increased funds allocated to transport infrastructure, the income gap between regions decreased from 27.5 percent to 22.5 percent. This indicates that transport is a factor that strengthens economic integration and ensures territorial equality. Transport and environmental sustainability The share of “green” technologies is gradually increasing: the use of electric buses, gas-powered vehicles, and public transport is increasing. At the same time, the share of transport in total CO_2 emissions is expected to decrease from 23% in 2020 to 21% in 2024. Comparison with international experience shows that in the European Union, the reduction of transport emissions and green logistics corridors have had a significant

1 Source: Author’s elaboration.

impact on sustainable development. Although reforms in this direction have begun in Uzbekistan, their potential has not yet been fully realized.

As can be seen from the table, investments in transport infrastructure have a significant impact on economic growth. At the same time, sustainable transport policies also help reduce regional disparities. Environmental indicators are also gradually improving, and the role of transport in the green economy is increasing.

From the point of view of the theory of economic integration, transport infrastructure is considered a key tool for reducing interregional economic inequality. An efficient transport system enhances the integration of production and consumption markets between regions, which ultimately ensures sustainable regional development. This process expands economic activity and creates new green jobs for the population. Based on the theory of innovative development, digital technologies in transport, such as “smart logistics” systems, artificial intelligence and IoT solutions, serve to reduce fuel consumption and emissions. This not only increases environmental efficiency, but also leads to a reduction in production costs in the national economy through the optimization of logistics chains.

The role of transport in a green economy is twofold: on the one hand, it stimulates economic growth and integration, and on the other hand, it directly contributes to sustainable development by solving environmental problems. Therefore, the “green transformation” of transport is a theoretical and practical basis for ensuring economic, social and environmental sustainability.

CONCLUSIONS AND SUGGESTIONS

The above analysis shows that the transport sector is not only a driver of economic growth, but also an integral part of the green economy and sustainable development. Increased investment in transport infrastructure expands production and trade links, reduces interregional economic inequality, and creates new employment opportunities. At the same time, the introduction of environmentally friendly technologies and the use of digital logistics systems reduce the negative impact of transport on the environment and reduce carbon emissions. International experience shows that the consistent implementation of green transport policies increases economic efficiency and ensures environmental safety. In the conditions of Uzbekistan, accelerating the “green transformation” of transport, widely introducing innovative technologies, and developing mechanisms for public-private cooperation remain urgent tasks.

The contribution of transport to the green economy is manifested in two directions: on the one hand, it increases economic integration and efficiency, and on the other hand, it ensures environmental sustainability and creates a healthy environment for future generations.

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