

Review

Sport and the Environment: Ecological Responsibility and Sustainable Development Perspectives

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Abstract

The purpose of this study is to systematically evaluate the dual role of the modern sports industry: its negative ecological footprint (carbon emissions, waste, water consumption) and its potential for implementing and advocating sustainable development principles, taking into account both international experience and the Georgian context. The research involves identifying the environmental impacts of sporting events and infrastructure, their effects on athletes' health and event organization, analyzing international "sustainable sport" policies, and examining successful case studies. Furthermore, the work explores the potential of the sports industry to serve as a platform for raising public awareness and strengthening ecological responsibility, subsequently offering strategic recommendations for the effective implementation of sustainability and ecological standards within the Georgian sports system.

Keywords: sustainable sport, ecological footprint, carbon emissions, global warming, Olympic Charter, UNEP.

Introduction

Climate change, atmospheric pollution, and ecosystem degradation represent some of the most critical global challenges of the XXI century. Data indicates the direct impact of these issues on human health: for example, studies by American scientists suggest that air pollution causes approximately 5.5 million premature deaths annually, significantly exceeding mortality rates caused by other risk factors (Smith et al., 2017). On the other hand, according to the World Health Organization (WHO), environmental risk

factors are responsible for 24% of global morbidity and 23% of mortality (WHO, 2016).

According to the United Nations Environment Programme (UNEP) report, in 2023, the planet's average temperature was 1.2°C higher than pre-industrial levels, while carbon dioxide levels reached an all-time high of 419 ppm. Air pollution, waste accumulation, deforestation, and biodiversity loss create new social and health challenges.



Sport, which today has transcended the boundaries of physical activity to become a powerful global industry of culture, business, and social influence (accounting for approximately 5% of the world economy), cannot remain isolated from these processes. It unites hundreds of millions of people and possesses immense potential for social impact. It is simultaneously a contributor to ecological problems and a potential tool for their solution.

The sporting movement's capacity to mobilize millions of people makes it a prospective platform for raising awareness and stimulating responsible behavior.

The purpose of this article is to systematically assess the dual role of the sports industry: its negative ecological footprint and its potential to implement sustainability principles.

Although sport is traditionally associated with health and well-being, mass sporting events and infrastructure exert a significant negative impact on the environment. The International Olympic Committee (IOC) and the United Nations (UN) have long recognized the interaction between sport and the environment as a key priority issue.

Sport, by its very nature, is an energy-intensive and resource-consuming field. Large-scale sporting events require massive infrastructure, transportation, technological resources, and energy. At the same time, sport serves as an effective platform for raising ecological awareness.

Research Aim

To systematically evaluate the dual role of the modern sports industry—its negative ecological footprint (carbon emissions, waste, water consumption and its

potential for advocating and implementing sustainable development principles, taking into account international experience and the Georgian context.

Research Objectives

1. To identify and analyze the primary negative environmental impacts of sporting events and infrastructure (specifically: carbon emissions, solid waste generation, and intensive water consumption) based on existing international statistical data.
2. To determine and assess the direct impact of environmental degradation on athletes' health and the viability of hosting sporting events (for instance, in the context of air pollution) through relevant case analyses.
3. To systematically review the concept of "sustainable sport," its integration at the international policy level (IOC, UNEP programs, and Olympic Charter principles), and to analyze successful case studies of mega-sporting events (e.g., the Olympic Games) regarding ecological responsibility.
4. To evaluate the potential of the sports industry to be utilized as an effective platform for advocating sustainable development principles (energy efficiency, waste management, eco-infrastructure) and raising public awareness.
5. To formulate recommendations for the Georgian sports system regarding the implementation of ecological responsibility and sustainability principles (e.g., strengthening Environmental Impact Assessment (EIA) processes, implementing energy efficiency standards).



Analysis of Environmental Impacts and Case Studies

Carbon Emissions and Energy Consumption

Numerous studies indicate that sporting events significantly increase carbon emissions. For example, during the Tokyo 2021 Olympic Games, energy consumption from accommodation, transport, and infrastructure generated approximately 2.3 million tons of CO₂—equivalent to the annual emissions of half a million passenger vehicles.

Similar to the Olympic Games, the FIFA World Cups and Formula 1 races cause not only excessive consumption of energy resources but also the artificial modification of the natural environment. Today, it is essential to implement energy-efficient technologies in sports, including LED lighting systems, solar panels, hybrid transport, and eco-friendly infrastructure.

Waste Generation

Sport is significantly linked to waste generation. Single-use bottles, packaging, plastic equipment, apparel, and other materials are often not recycled. At the 2019 London Marathon, 56,000 participants and spectators left behind 750,000 plastic bottles—approximately 7 tons of waste—in a single day. Similar examples are found in the 2018 FIFA World Cup and American baseball seasonal games, where tons of waste accumulate annually.

To address this issue, sports organizations are increasingly turning to digital ticketing, reusable containers, and the use of recycled materials.

Infrastructure and Ecosystem Degradation

The construction of sports facilities is often associated with ecological damage. During

the 2014 FIFA World Cup in Brazil, stadium construction resulted in the deforestation of 1,700 hectares.

The development of mountain sports complexes frequently alters the natural topography and causes soil erosion. A prominent example is the Sochi 2014 Winter Olympics, where the construction of roads and hotels significantly damaged the Caucasus ecosystem.

Furthermore, golf courses, ski slopes, and sports parks require massive amounts of water. On average, a 30-hectare golf course consumes 15,000–30,000 liters of water per day. In world regions already experiencing water scarcity (e.g., the Mediterranean, the Middle East, Central Asia), such trends are ecologically unsustainable. It is imperative to introduce irrigation and technological systems in sports that utilize recycled or rainwater.

Impact of Environmental Degradation on Athletes and Events

Deteriorating air quality poses a direct threat to athletes' physiological functions and performance quality. Carbon monoxide (CO) binds to blood hemoglobin, significantly restricting oxygen delivery to the body.

In 2015, six participants in the Beijing Marathon suffered heart attacks due to heavy smog (Wang et al., 2016). In 2016, air pollution in Singapore led to the cancellation of the FINA Swimming World Cup finals, and in Iran, a sharp decline in air quality halted sporting events for several days. These facts underscore the critical importance of environmental factors for the functioning of sports.

The "Sustainable Sport" Concept and International Frameworks



In response to the aforementioned challenges, the concept of "green" or "sustainable" sport emerged. This movement aims to design a sporting environment that minimizes ecological harm. Its core principles include: increasing energy efficiency, integrated waste management systems, implementing ecological standards, and fostering social responsibility toward the environment.

In 1994, the United Nations established the United Nations Environment Programme (UNEP), which began working on institutionalizing the relationship between sport and the environment. The Olympic Movement declared environmental protection as the third fundamental dimension of the Olympic Charter. This decision represents a formal recognition of ecological responsibility at the highest level of sport.

Major international events have demonstrated that the implementation of sustainability principles is practically feasible:

- **Sydney 2000 Olympic Games:** Entered history as the "Green Games"; the Olympic Park was built on a former landfill site, setting a precedent for land reclamation.
- **Tokyo 2020 Olympic Games:** Medals were manufactured from recycled electronic waste, demonstrating the effective integration of circular economy principles.
- **Paris 2024 Olympic Games:** Declared as games of "constant sustainability," aiming to use 100% renewable energy and achieve a significant reduction in carbon emissions.

The Context of Georgia: Current State and Perspectives

In Georgia, the interaction between sport and the environment is still in its developmental stages. In recent years, several key initiatives have been implemented:

- Introduction of energy efficiency standards in sports facilities;
- "Green campaigns" in schools and sports federations;
- The eco-friendly format of the Tbilisi Marathon, which incorporates waste recycling and a digital registration system.

However, the ecological management of sports requires a profound strategy and national policy, particularly when planning major infrastructural projects. In Georgia, especially for large-scale sports projects, it is necessary to tighten the Environmental Impact Assessment (EIA) process and fully comply with ecological standards.

Conclusion

Modern sport, as an essential part of the global economy and culture, carries a double responsibility: it leaves a significant ecological footprint, but at the same time, it possesses immense potential to catalyze positive environmental change. The concept of sustainable sport is no longer just an ecological objective; it is a social responsibility that synthesizes human health, economic development, and environmental protection. Sport, as a uniquely unifying force, can instill the necessity of responsible living on our planet into the consciousness of millions of people, which is critically important for preserving a healthy and sustainable environment for future generations.

სპორტი და გარემო: ეკოლოგიური პასუხისმგებლობა და მდგრადი განვითარების პერსპექტივები

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აბსტრაქტი

წინამდებარე კვლევის მიზანია სისტემურად შეფასდეს თანამედროვე სპორტის ინდუსტრიის ორმხრივი როლი: მისი ნეგატიური ეკოლოგიური კვალი (ნახშირბადის ემისიები, ნარჩენები, წყლის მოხმარება) და მისი პოტენციური მდგრადი განვითარების პრინციპების დანერგვისა და ადვოკატირების თვალსაზრისით, საერთაშორისო გამოცდილებისა და საქართველოს კონტექსტის გათვალისწინებით. კვლევა მოიცავს სპორტული ღონისძიებებისა და ინფრასტრუქტურის ეკოლოგიური ზემოქმედების გამოყოფას, მათ გავლენას სპორტსმენთა ჯანმრთელობაზე და ღონისძიებების ორგანიზებაზე, საერთაშორისო „მდგრადი სპორტის“ პოლიტიკის ანალიზს და წარმატებული ქეისების შემოწმებას. გარდა ამისა, მუშაობა იკვლევს სპორტის ინდუსტრიის პოტენციალს საზოგადოებრივი ცნობიერების ამაღლებისა და ეკოლოგიური პასუხისმგებლობის გაძლიერების პლატფორმად, ხოლო შემდგომში სტრატეგიულ რეკომენდაციებს სთავაზობს საქართველოს სპორტის სისტემისთვის მდგრადობისა და ეკოლოგიური სტანდარტების ეფექტურ დანერგვასთან დაკავშირებით.

საკვანძო სიტყვები: მდგრადი სპორტი, ეკოლოგიური კვალი, ნახშირბადის ემისიები, გლობალური დათბობა, ოლიმპიური ქარტია, UNEP.

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