DOI https://doi.org/10.30525/978-9934-26-677-5-36

INNOVATIVE ECOTOURISM MODELS AND THEIR ROLE IN SUSTAINABLE DEVELOPMENT IN GEORGIA

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This article assesses the role of innovative ecotourism development models–GIS and PPGIS systems, mobile applications, community-based management approaches, and artificial intelligence (AI)–in the sustainable development process (UNWTO, 2023; IUCN, 2020). The study aims to determine how the integration of these innovative tools contributes to effective visitor management, ecosystem protection, and strengthening of local economies in Georgia (UNEP & UNWTO, 2005).

The study is based on a comparative and analytical analysis of international practices, allowing for an assessment of the potential of Georgian ecotourism in a global context (GNTA, 2022; UNWTO, 2023). The study's findings demonstrate that innovative, data-driven management transforms ecotourism from a reactive to a predictive system, reduces pressure on ecosystems, and improves decision-making (IUCN, 2020; UNWTO, 2023).

Furthermore, GIS, PPGIS, and mobile applications enable spatial analysis and systematic monitoring of visitor flows (Buendía et al., 2019; Pietilä et al., 2018), while community-based management models and eco-infrastructure enhance local engagement and the development of small and medium-sized enterprises (IUCN, 2008; UNDP, 2020). The study confirms that ecotourism sustainability is achieved when technological innovation and community-based management function as a unified system, which is an important strategic prerequisite for the long-term development of ecotourism in Georgia.

An important foundation for the sustainable development of the ecotourism industry is the creation of a targeted concept of environmental education in the country and its practical implementation. (Gvinjilia Malkhaz,)

Keywords: Ecotourism; Sustainable Development; Ecology; Innovative Models; Artificial Intelligence (AI).

Materials and Methodology

The study is based on secondary data analysis and a comparative research approach. International academic literature, reports from international organizations (WTO, IUCN, UNEP, UNDP), and official strategic documents related to tourism and protected area management in Georgia (GNTA, 2022; APA, 2025) were used.

Methodologically, content analysis (Buendia et al., 2019; IUCN, 2020) was used to functionally assess innovative ecotourism models (GIS, PPGIS, mobile applications, AI, community-based management), and comparative analysis (UNDP, 2020; Pietilä et al., 2018) was used to identify opportunities for adapting international experience to the Georgian context. The results of the study were analyzed taking into account the environmental, social and economic principles of sustainable development (UNEP and WTO, 2005). At the regional level, studies using GIS analysis were conducted in the protected areas of Javakheti (Gvinjilia, 2017).

Results.

GIS and PPGIS systems enable spatial monitoring of visitor flows and infrastructure optimization (Buendía et al., 2019; Pietilä et al., 2018).

Mobile applications increase visitor awareness and improve service quality (UNWTO, 2023). Artificial intelligence technologies are used to forecast visitor flows, monitor ecosystems, and support decision-making, reducing pressure on natural resources (IUCN, 2020). Community-based management models contribute to the empowerment of local SMEs and employment growth (IUCN, 2008; UNDP, 2020). Eco-infrastructure reduces environmental impacts and improves the energy efficiency of tourism facilities (UNEP & UNWTO, 2005).

Discussion

Globally, “green tourism” is considered an effective tool for the sustainable use of natural resources and local development, which simultaneously protects ecosystems and improves the quality of life of local populations (WTO, 2023). International research confirms that integrating technological tools and community-based management significantly improves the social, economic, and environmental impacts of ecotourism (IUCN, 2020; Buendia et al., 2019).

In Georgia, ecotourism potential is particularly high in protected areas, although its full realization remains limited by insufficient infrastructure development, low international awareness, and limited local participation

(GNTA, 2022). These challenges necessitate the implementation of innovative management models that combine technological, social, and infrastructural innovations. An important foundation for the sustainable development of the ecotourism industry is the creation of a targeted concept of environmental education in the country and its practical implementation (Gvinjilia, 2016)..

Innovative models include:

1. Technological tools (GIS, mobile apps, artificial intelligence) that enable data analysis and optimize visitor flows;
2. Social and management approaches (community-based management models, eco-infrastructure) that enhance local community engagement and promote the development of small and medium-sized enterprises (SMEs);
3. Artificial intelligence (AI) as an integrated tool combining data analysis, real-time monitoring and management support, which effectively promotes the implementation of sustainable tourism (IUCN, 2020) (see Table 1).

Table 1

Innovative Models in Ecotourism

Innovations	Applications	Expected results:	Source
Artificial Intelligence (AI)	Visitor flow management, ecosystem monitoring	Protection of natural resources, improved management efficiency	UNWTO, 2023
GIS Systems	Protected areas	Protection of ecosystems	UNEP & UNWTO, 2005
Mobile Apps	Tourism management	Raising awareness, optimizing visitor flow	UNWTO, 2023
Community-Based Models	Regional tourism	Increasing employment, supporting small and medium-sized enterprises	IUCN, 2008
Eco-Infrastructure	Tourism infrastructure	Reduced environmental impact	UNEP & UNWTO, 2005

The practice of using innovative models has been implemented in many countries around the world (see Table 2).

Table 2

International Experience in Technological and Community-Based Management of Protected Areas.

Country/Location	Approach	Results achieved	Source
Spain– Ebro Delta NP	PPGIS For visitor monitoring	Spatial distribution of visitors, infrastructure optimization.	Buendía et al., 2019
Nepal– Annapurna CA	Community-based governance	Increasing incomes of local residents, developing infrastructure.	UNDP, 2020
Finland – National Parks	PPGIS + Spatial analysis	Visitor dynamics control, Improving the experience	Pietilä et al., 2018
Croatia–Plitvice Lakes NP	GIS For visitor monitoring	Traffic management, ecosystem protection	Sustainability Directory, n.d.

The presented international experience demonstrates that the effectiveness of protected area management is significantly enhanced by the integrated use of technological tools and the involvement of local communities. Sustainable ecotourism is achieved when technological innovation and community-based management function as a unified system, generating both ecological and socioeconomic benefits (Buendía et al., 2019; UNDP, 2020; IUCN, 2008).

Approaches based on GIS, public participation platforms (PPGIS), and data analysis enable spatial and temporal monitoring of visitor flows, reducing pressure on ecosystems and improving the validity of decisions. Furthermore, examples of community-based management (Nepal, Finland) demonstrate that active participation by local populations creates socioeconomic incentives for the protection of natural resources, particularly through the development of small and medium-sized enterprises.

International practice demonstrates that the integration of these models contributes not only to the achievement of ecological goals but also to the long-term socioeconomic sustainability of protected areas. This experience thus provides an important benchmark for the implementation of innovative and adaptive management models in Georgia's protected areas. (See Table 3)

Table 3

Adaptation of International Experience in Technological and Community-Based Management in Protected Areas for Georgia

International experience	Georgia – Possible Implementation	Expected results
PPGIS / GIS Visitor Monitoring (Spain, Finland)	Borjomi-Kharagauli National Park, Lagodekhi National Park: mapping of tourist routes and services, digital registration of visitor flows.	Reducing tourist congestion, optimizing infrastructure, protecting the ecosystem.
Community-based management (Nepal)– Annapurna CA)	Tusheti, Keda: Involving local communities in organizing excursions and family tourism, supporting small and medium-sized enterprises.	Increased local revenues, incentives for conservation of protected areas, economic development.
AI / Data Analysis for Visitor Forecasting (Netherlands, Italy)	Borjomi-Kharagauli, Samtskhe-Javakheti: forecasting peak visitor numbers, resource allocation (rangers, infrastructure)	Optimal management, improved service quality, reduction of unnecessary load.
Eco-infrastructure and tourism policy (Italy – Cinque Terre National Park)	Lagodekhi, Tusheti: Eco-friendly houses, renewable energy, waste management systems.	Sustainable tourism, reduced environmental impact, visitor satisfaction.

International experience shows that technological tools (GIS, AI) and community-based management in Georgia's protected areas ensure effective visitor management, community engagement, and sustainable tourism development.

Regarding international practices in the use of artificial intelligence, we present the results of AI use in different countries in a table (see Table 4).

Table 4

International Practices in the Use of Artificial Intelligence

Country/Region	AI Application Areas	Key Results
Costa Rica	Data Analysis	Biodiversity Protection
Tanzania	Prediction Models	Reduced Pressure on Natural Resources
Australia	Marine Ecosystem Monitoring	Supporting Sustainable Policy Planning
Turkey	Community-Based Platforms	Reduced Unregulated Tourism, Increased Local Engagement

International practice confirms that AI implementation improves both technological and institutional effectiveness. Country examples demonstrate AI's adaptability in various contexts, making it a versatile tool for protected areas in Georgia. (See Table 5)

Data-driven approaches are becoming increasingly important in modern ecotourism management. Innovative data-driven management transforms ecotourism from a reactive system to a predictive one, enabling pre-assessment of visitor flows, reducing pressure on ecosystems, and efficiently allocating resources (IUCN, 2020; UNWTO, 2023). This approach is particularly evident in the trifunctional integration of artificial intelligence–forecasting, monitoring, and management support (Mzarelua l., 2017).

Table 5

Trifunctional Integration of AI in Ecotourism in Georgia

Function	Technical means	Georgia – context of use	Expected effect
Forecast (Predictive analytics)	Data analysis, modeling	Borjomi-Kharagauli, Tusheti	Optimizing visitor flows, reducing pressure on ecosystems
Monitoring (Sensors, Big Data)	Sensors, remote sensing methods, data visualization.	Protected areas, national parks	Real-time assessment of ecosystem conditions, efficient use of resources.
Management Support (Decision Support)	Virtual platforms, data dashboards	Regional tourism, SME, community engagement	Improving decision-making processes, strengthening local small and medium enterprises and local communities.

The table shows that the trifunctional integration of AI provides technological, institutional, and social benefits to Georgian ecotourism, enhancing sustainability, visitor experience, and economic benefits.

Recommendations

1. Visitor flow management: quotas, pre-registration, mobile app integration, predictive analytics.
2. Modernization of protected area management: GIS, sensors, remote sensing.
3. Institutional coordination: creation of digital platforms for APA and GNTA.
4. Socioeconomic innovations: community-based management models using AI, SME support, training, and virtual education.
5. Eco-infrastructure: energy-efficient facilities, electric transport, reduced environmental impact.

Conclusion

The study demonstrated that the integration of technological tools and community-based management models is an effective mechanism for developing sustainable tourism in protected areas. An analysis of international experience confirmed that the use of GIS technologies, mobile applications, artificial intelligence, and predictive analytics significantly improves visitor flow management, reduces pressure on ecosystems, and increases the transparency of management processes.

The study also found that community-based models and social innovation play a significant role in engaging local populations and strengthening small and medium-sized enterprises (SMEs), thereby ensuring the equitable distribution of economic benefits and strengthening the foundation for the social sustainability of protected areas.

In the Georgian context, these approaches can be adapted through strengthening institutional coordination, developing digital platforms, and the phased implementation of eco-infrastructure. As a result, the study confirms that a combination of technological and community-based management models is a feasible and strategically important way to ensure sustainable tourism and local economic development in Georgia's protected areas.

Bibliography:

1. Agency of Protected Areas of Georgia. (2025). Protected areas management plans and visitor statistics. Tbilisi: Agency of Protected Areas of Georgia. https://apa.gov.ge

2. Buendía, V. P., García-Amado, L. R., & Iniesta-Arandía, I. (2019). Public participation GIS (PPGIS) and public use management in protected areas: A case study of Ebro Delta Natural Park (Spain). ISPRS International Journal of Geo-Information, 8(6), 244. https://doi.org/10.3390/ijgi8060244

3. Contingent valuation of ecotourism in Annapurna Conservation Area, Nepal. (2008). Ecological Economics, 66(2–3), 388–397. https://doi.org/10.1016/j.ecolecon.2008.03.008

4. Gvinjilia Malkhaz. Ecosystems of Samtskhe-Javakheti region and the results of its GIS analysis. Geography in a Global Context: Achievements and Challenges. Ak. Tsereteli State University. International Conference. 3-4. 06.2017 https://atsu.edu.ge/ge/conferences

5. Gvinjilia Malkhaz. Features of Environmental Education in Tourism. 1st International Scientific and Practical Conference: "Tourism Development Trends: Problems and Prospects." Tbilisi State University, May 7-8, 2016.

6. Georgian National Tourism Administration (GNTA). (2022). Georgian tourism in figures: Structural overview. Tbilisi: GNTA. https://gnta.ge/statistics/

7. Georgian National Tourism Administration (GNTA). (2023). Georgian tourism in figures: Structure and industry analysis. Tbilisi: GNTA. https://gnta.ge/statistics/

8. International Union for Conservation of Nature (IUCN). (2008). Guidelines for protected area management categories. Gland, Switzerland: IUCN. https://portals.iucn.org/library/node/9243

9. International Union for Conservation of Nature (IUCN). (2020). Artificial intelligence for nature conservation: Opportunities and challenges. Gland, Switzerland: IUCN. https://www.iucn.org/resources/publication/artificial-intelligence-nature-conservation

10. Mzarelua l. The role of Georgia's protected areas in the development of ecotourism AZƏRBAYCAN RESPUBLİKASI TƏHSİL NAZİRLİYİ BAKI DÖVLƏT UNİVERSİTETİ Ekologiya və torpaqşünaslıq fakültəsi Ümummilli lider Heydər Əliyevin anadan olmasının 97-ci ildönümünə həsr olunmuş 2021

11. Pietilä, M., Kangas, K., & Kajanus, M. (2018). A spatial perspective of visitor experiences in national parks: Public participation GIS approach. NORDIA Geographical Publications, 47(5) https://nordia.journal.fi/article/view/75161

12. United Nations Environment Program (UNEP) & United Nations World Tourism Organization (UNWTO). (2005). Making tourism more sustainable: A guide for policy makers. Paris & Madrid: UNEP/UNWTO.https://www.unwto.org/sustainable-development/making-tourism-more-sustainable

13. United Nations World Tourism Organization (UNWTO). (2023). Innovation and sustainability in tourism development. Madrid: UNWTO. https://www.unwto.org/innovation-tourism

14. United Nations World Tourism Organization (UNWTO). (2023). Digital transformation and smart tourism destinations. Madrid: UNWTO. https://www.unwto.org/digital-transformation

15. United Nations Development Program (UNDP). (2020). Biodiversity conservation and the impacts of nature-based tourism in the Annapurna Conservation Area, Nepal. UNDP Nepal. https://www.undp.org/nepal/biodiversity-conservation-and-impacts-nature-based-tourism-annapurna-conservation-area

16. Sustainability Directory. (n.d.). GIS for tourism and protected area management. https://sustainability-directory.com/term/gis-for-tourism/

DOI https://doi.org/10.30525/978-9934-26-677-5-37

THE SOCIOECONOMIC IMPACT OF UKRAINE'S TRANSITION TO THE PRINCIPLES OF THE CIRCULAR ECONOMY

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Circularity economy (hereinafter referred to as CE) means "the effective reuse and recycling of resources, materials and products in closed cycles. In other words, circularity is an economic model that represents sustainable development as a transition from a linear model based on consumption and disposal to a model in which the lifetime of products is maximized and materials and waste are minimized" [8, p. 5-6].

The implementation of circular economy principles in European countries has demonstrated the benefits of this approach, particularly the economic ones. Circularity in economic activity is becoming more than just a profitable economic mechanism; it is, above all, a mechanism essential for the safe, comfortable, and sustainable existence of humanity. For Ukraine, the transition to a circular economic policy is a complex, multifaceted issue. Politically, it is an instrument of European integration. Economically, it is a means of a rational approach to the country's post-war reconstruction and a strategy for survival in conditions of dwindling (limited) resources. It is precisely this multi-dimensional nature that makes the study of this issue **relevant**.

The aim of this study is to examine the socioeconomic implications of implementing a circular economy in Ukraine.