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# GOOD PRACTICES FOR ORGANIZING GREEN LOGISTICS IN THE TOURISM INDUSTRY

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**Abstract.** *Purpose*. This paper analyses how green logistics principles can be integrated into the tourism industry. It focuses on best practices that reduce environmental impact and improve the economic competitiveness of destinations. The main objective is to identify logistical mechanisms that facilitate the shift towards a sustainable tourism model. *Methodology.* This research is based on a documentary analysis of international reports from organisations such as the UNWTO, UNEP and OECD, as well as case studies from European countries and a synthesis of statistical indicators for the period 2020–2024. A comparative approach is adopted to evaluate the effectiveness of various logistics strategies employed in tourist destinations with different profiles. *Results.* The findings demonstrate that the adoption of green logistics is conducive to the reduction of emissions, the optimisation of energy and material consumption, and the diversification of tourism products. Digital solutions and cross-sector co-operation also contribute to the efficient management of tourist flows and to improving the quality of services offered. *Practical implications*. The results obtained from this study are of considerable utility for tourism operators, local administrations and decision-makers seeking to develop sustainable management strategies. The implementation of best practices, as analysed in this study, has the potential to reduce operational costs, support the local economy, and enhance the performance of destinations in the context of the green transition. *Value/Originality.* The study proposes a conceptual and applicative framework for integrating green logistics into sustainable tourism and offers an updated perspective on the role of logistics in European regional development. The research's originality lies in its combination of strategic analysis with the evaluation of concrete practices implemented in the European space.

**Keywords:** green logistics, sustainable tourism, sustainability, best practices, green economy.

**JEL Classification:** Q01, Q56, Z32

## 1. Introduction

Tourism is one of the world's most dynamic sectors, making a significant contribution to economic development, regional diversification and job creation. Due to its complex nature, it encompasses areas such as transport, food service operations, culture and environmental protection, and has a direct influence on the socio-economic dynamics of local communities. Whilst the economic advantages are evident, the unregulated proliferation of tourism activities exerts significant pressure on the environment, as evidenced by elevated energy consumption, augmented waste volumes, intensive utilisation of natural resources, and the degradation of vulnerable ecosystems. In this context, the sector's transition towards sustainable tourism models is no longer a strategic option, but rather a necessary condition for maintaining the competitiveness and attractiveness of destinations.

Green logistics plays a central role in the transition to sustainability. Its principles aim to optimise the flow of goods, services and information, reduce waste and manage resources responsibly throughout the tourism supply chain. Integrating green logistics solutions increases operators' efficiency, encourages the adoption of clean technologies and promotes the implementation of digital systems that support the circular economy. Therefore, green logistics forms the foundation for reducing destinations' ecological footprint, striking a balance between economic performance and environmental responsibility.

This paper analyses the role of green logistics in developing sustainable tourism. It highlights good practices that can reduce environmental impact, improve operator performance and strengthen regional development within the European context. The study's main objective is to clearly identify the strategic approaches through which green logistics can support the development of a responsible tourism system that meets current sustainability and competitiveness requirements. To this end, the analysis incorporates

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theoretical and conceptual benchmarks, as well as practical perspectives to inform decision-making at all levels, including public and private sectors.

## 2. Research Methodology

The study methodology combines documentary analysis, comparative assessment and statistical analysis of relevant indicators for the period 2020–2024. This involved examining reports and databases developed by international organisations such as the UNWTO, UNEP, OECD and the European Commission, as well as specialised studies and examples of good practice implemented in various European tourist destinations. The comparative approach enabled differences and similarities to be identified between green logistics models applied at the regional level. Meanwhile, statistical analysis supported the assessment of developments in resource consumption, emission reduction and the digitisation of logistics processes.

In addition to documentary analysis, classical methods of economic study, such as analysis and synthesis, induction and deduction, were used to structure the conceptual framework and interpret the data. This information was then integrated into an analytical framework that explores the relationship between sustainability, the economic performance of destinations and the role of green logistics in regional development. This approach enables the formulation of conclusions and recommendations that can be applied by tourism operators, public administrations and decision-makers who are interested in implementing green transition policies.

## 3. The Three Seas Initiative: Regional Relevance for Sustainable Tourism Development

The Three Seas Initiative (3SI) is a regional co-operation framework designed to reduce infrastructure and connectivity gaps between Central and Eastern European countries. Through projects focused on modernising transport, diversifying energy sources and expanding digital infrastructure, the 3SI indirectly influences the conditions necessary for developing green logistics in the region. Modernising transport infrastructure and optimising mobility networks reduces resource consumption and emissions, which are essential for achieving sustainable and competitive tourism (Țărînă, 2025).

In the Baltic states, the implementation of 3SI is guided by these objectives, with investments being made in rail infrastructure, modern logistics hubs, and the digitisation of transport flows. Studies show that Estonia, Latvia and Lithuania are paying particular attention to increasing the interoperability of road and rail networks, as well as integrating smart technologies. This contributes to the streamlining of logistics processes and the reduction of carbon footprints (Lesiewicz et al., 2025). While the initiative does not explicitly target tourism, its positive effects on mobility, connectivity and energy efficiency create favourable conditions for adopting sustainable logistics models throughout the tourism sector.

A central objective of 3SI is the modernisation of infrastructure networks, which supports the development of green logistics in tourism by facilitating clean mobility and reducing environmental pressure. Modernised transport corridors allow for more energy-efficient routes to be used, reduce transit times and optimise tourism operators' supply flows. These developments are fundamental to green logistics as they reduce fossil fuel consumption and waste while promoting the use of more sustainable logistics resources. At the same time, increased regional connectivity makes destinations more accessible and encourages the development of low-impact tourism offerings.

Data provided by the European Travel Commission (2022) confirms that transport infrastructure and the level of digitisation have a significant impact on tourist mobility and the quality of services provided. Significant differences in access infrastructure persist in Central and Eastern Europe, hindering the implementation of efficient logistics solutions. In this context, projects promoted through 3SI have the potential to reduce disparities and establish a technological and operational basis conducive to the adoption of green logistics in tourism. This is an essential element for reducing emissions and increasing the competitiveness of destinations.

The transition to sustainable tourism must also be analysed in the context of international climate change standards. *The Glasgow Declaration on Climate Action in Tourism* emphasises the importance of investing in clean mobility, efficient use of resources, and implementing digital technologies to monitor environmental impact (UNWTO, 2021). These guidelines are fully compatible with the directions promoted within 3SI, which allows the initiative to be leveraged as a regional platform for the adoption of green logistics in tourism. By improving infrastructure and integrating smart solutions, 3SI provides the necessary conditions for the development of sustainable mobility models and the optimization of logistics processes specific to the tourism sector.

The Three Seas Initiative is relevant for sustainable tourism because it has the capacity to establish a logistical framework that facilitates the sector's ecological transition. Investments in infrastructure, digitalisation, and clean energy have been demonstrated to contribute to the modernisation of mobility flows, the streamlining of tourism operations, and the

adoption of sustainability-oriented logistics practices. It is evident that the aforementioned transformations render 3SI an indispensable instrument in the reinforcement of green logistics and the development of competitive, accessible tourist destinations that are in accordance with European environmental objectives.

## 4. International Policies on Green Logistics in Tourism (UNWTO, UNEP, OECD)

Over the last two decades, the international policies promoted by the UNWTO, UNEP and OECD have created a framework for integrating sustainability into the entire tourism value chain, including its logistical components. The focus is on reducing dependence on non-renewable resources, limiting emissions and encouraging sustainable consumption and production patterns. This transforms the concept of green logistics into a strategic tool for reorganising transport, supply and waste management in tourist destinations.

Globally, *the Glasgow Declaration on Climate Action in Tourism* has strengthened the role of the tourism sector in the transition to climate neutrality. The document emphasises the importance of reducing emissions throughout the entire chain of activities, ranging from transportation and infrastructure to accommodation and food service operations, and urges public and private entities to develop specific climate action plans (UNWTO, 2021). In this context, green logistics is implicitly addressed through recommendations on measuring emissions, decarbonising mobility and integrating digital solutions for monitoring flows. These recommendations directly target the organisation of tourist transport, unit supply and material flow management.

An important contribution to substantiating the "green" dimension of tourism logistics is *the Baseline Report on the Integration of Sustainable Consumption and Production Patterns into Tourism Policies*, developed by UNWTO in collaboration with UN Environment. The report analyses tourism policies in 101 countries and reveals that the majority of strategic documents refer to resource efficiency, the circular economy, and monitoring environmental impact (UNWTO & UN Environment, 2019). Guidelines for sustainable consumption and production (SCP) are directly linked to green logistics as they seek to optimise the use of energy, water and materials, reduce waste of resources and reorganise supply chains in favour of local, low-impact solutions.

UNEP contributes to the development of this framework by analysing resource efficiency in tourism. The organisation's assessments indicate that, without significant changes, the growth of the tourism sector could result in substantial increases in energy, water and material consumption, as well as in waste generated by tourism activities, by 2050 (UNEP, 2018). In the face of this scenario, UNEP is promoting measures to reorganise logistics flows. These measures include reducing the transport of highly packaged products, adopting local sourcing solutions, and reducing dependence on single-use products. All of these measures are specific components of green logistics.

One example of an integrated approach to green logistics can be seen in the recommendations made by the Global Tourism Plastics Initiative. The document *Recommendations for the Tourism Sector to Continue Taking Action on Plastic Pollution during COVID-19 Recovery* proposes reducing the plastic footprint by redesigning supply flows, involving suppliers, collaborating with sanitation operators, and increasing transparency on waste management (United Nations Environment Programme, World Tourism Organization, & Ellen MacArthur Foundation, 2020). Although the focus is on plastic pollution, the recommendations have an obvious logistical element: reorganising material flows, introducing reuse models and adapting operational procedures. All of these support the transition to circular logistics chains in tourism.

The OECD complements this framework with a public policy perspective on the green transition in tourism. The *OECD Tourism Trends and Policies 2022* report highlights that post- pandemic recovery is an opportunity to accelerate the green and digital transformation of the sector and emphasises the need for investment in modern logistics infrastructure, low-emission mobility, and smart destination management systems (OECD, 2022). The document demonstrates that countries which have initiated the integration of transport digitisation, energy efficiency, and sustainability-oriented spatial planning into their policies possess the capacity to develop tourism models that are both resilient and competitive.

Collectively, these international frameworks constitute a coherent set of principles for green logistics in tourism, encompassing the measurement and reduction of emissions, the integration of the principles of sustainable consumption and production into national policies, the enhancement of resource efficiency, the limitation of waste (particularly single-use plastics), and the utilisation of digital technologies for the planning and monitoring of flows. For the countries participating in the Three Seas Initiative, these benchmarks provide a solid foundation for adapting national and regional policies so that infrastructure modernisation and logistics transformation are aligned with both global climate goals and the requirements of sustainable and competitive tourism.

## 5. Results and Discussions

Recent developments in the tourism industry indicate that logistics has evolved beyond its traditional

role as a technical function aimed at cost reduction. A review of the international literature reveals a direct correlation between logistics processes and the resilience of destinations, their capacity to adapt to climate change, and the quality of the tourist experience. In the context of mounting pressure on resources, the role of green logistics becomes strategic, connecting the economic needs of operators with the ecological limits of destinations (De Cantis & Sciortino, 2022).

In the context of tourism sustainability research, the transition from a linear to a circular model is identified as a pivotal conceptual shift. The concept of a circular economy in the tourism sector emphasises the extension of resource life cycles, the reduction of waste, and the redesign of production and consumption flows. Synthesis analyses demonstrate that the implementation of these principles results in a significant transformation of the organisational structure of logistics chains, orienting them towards enhancing energy efficiency and reducing environmental impact (De Cantis & Sciortino, 2022).

The results of bibliometric research provide confirmation of the consolidation of four central themes associated with green logistics: waste management, energy efficiency, sustainable procurement, and reducing emissions from mobility. In the recent study by Şahin et al. (2024), these themes are classified as "driving themes", indicating a substantial increase in researchers' attention to the relationship between tourism logistics, circularity, and environmental protection.

Moreover, an analysis of prevailing scientific trends indicates that the implementation of circular tourism is contingent upon the existence of a well-planned logistics infrastructure. Research in the field of biospheric and economic research has demonstrated that the modularity of logistics systems, transport, supply, and materials management is a determining factor in the capacity of destinations to efficiently reduce resource consumption and reorganise internal flows. In such circumstances, green logistics emerges as the conduit through which circularity is operationalised at the local level (Şahin et al., 2024).

The implementation of circular principles in accommodation units demonstrates the positive impact of logistical reorganization on environmental performance. Empirical studies demonstrate that 3R programmes (reduce, reuse, recycle), optimisation of water and energy consumption, and integration of renewable sources can significantly reduce operational costs and non-recyclable waste. An analysis by Kiaušienė et al. (2024) shows that establishments adopting circular practices experience clear improvements in logistical efficiency and reduced environmental impact.

In terms of mobility, European transport reports show that decarbonising road transport, a key segment of tourist mobility, requires both fleet modernisation and the reorganisation of transport flows at urban and regional levels. The EEA report (2022) emphasises that infrastructure for electric vehicles, green road corridors and reducing dependence on fossil fuels are essential for reducing emissions from tourist transport.

The logistical aspect of tourist mobility encompasses not only means of transport, but also route planning, visitor density management and multimodal solutions. According to EEA reports (2022), emission reduction strategies must be linked to smart logistics tools, such as traffic monitoring systems, alternative routes, rail integration and prioritisation of electric mobility in sensitive tourist areas.

In addition to transport, reorganising supply chains is crucial for reducing the environmental impact of tourism. Studies show that local sourcing, shorter logistics distances and reduced packaging can all help to lower the carbon footprint while increasing local economic resilience. The results presented in the UNECE (2022) report confirm that adopting circular principles in supply chains improves logistics performance and stimulates local economies.

The circular economy is also reflected in waste management, which is directly related to tourism logistics. According to UNECE (2022), destinations that implement integrated collection, composting and recycling systems can significantly reduce the total volume of non-recyclable waste within a relatively short period. However, these results are only possible if material logistics are structurally redesigned and operators are involved in continuous training and education.

However, implementing green logistics does not entirely eliminate the risks associated with tourism development. Overcrowding, ecosystem degradation and pressure on infrastructure can continue to occur when planning is fragmented. Recent analyses (Şahin et al., 2024; Kiaušienė et al., 2024) demonstrate that these vulnerabilities can only be mitigated through collaboration between government bodies, businesses, and local communities, alongside coherent investment in infrastructure and monitoring systems.

Integrating the analysed literature and data shows that green logistics in tourism must be understood as an integrative system that coordinates mobility, resources and material flows according to sustainability objectives. Against this background, it is necessary to identify the international and regional organisations that set the standards in this field. Table 1 presents institutions that play a significant role in defining the green logistics framework. These institutions are classified according to their scope, level of intervention, and specific responsibilities, in accordance with the EEA (2022) and UNECE (2022) guidelines.

The presence of these organisations emphasises that sustainable tourism development cannot be divorced

Table 1
**Main international organisations relevant to the promotion of green logistics in tourism**

| Institution | Main area | Type of intervention | Geographical coverage | Legal status |
|---|---|---|---|---|
| UNWTO – World Tourism Organization | Tourism policies, sustainability | Development of a global framework for sustainable tourism development, statistical platforms, and monitoring methodologies (e.g., sustainability indicators, tourism mobility data) | Global | Specialised UN agency |
| UNEP – United Nations Environment Programme | Environment, resources, circular economy | Guidelines and tools for resource efficiency, waste reduction initiatives, and the transition to circular models in tourism | Global | UN programme |
| WTTC – World Travel and Tourism Council | Tourism industry, economic analysis | Reporting on the economic and climate impact of tourism, standards for private sector activity | Global | Private, non-governmental organisation |
| OECD – Organisation for Economic Co-operation and Development | Public policy, comparative analysis | Comparative studies on mobility, digitisation, and sustainability in tourism; policy recommendations for member states | Europe & OECD | Intergovernmental organisation |
| UNECE – United Nations Economic Commission for Europe | Circular economy, environmental policies | Guidance documents on applying circularity principles in tourism; promoting regional co-operation in resource management | Pan-European region | Intergovernmental organisation |
| GSTC – Global Sustainable Tourism Council | Standardisation in sustainable tourism | Establishing international certification criteria, auditing tourism organisations, and professional training programmes | Global | Non-profit organisation |

**Source:** *author's own elaboration based on reports and documents published by UNWTO (2021), UNEP (2021), WTTC (2021), OECD (2018), UNECE (2022), and GSTC (2024)*

from multilateral governance and international collaboration. Tourism has gradually been recognised as an area with a strategic impact on sustainable development under the auspices of the United Nations. Declaring 2017 the International Year of Sustainable Tourism for Development was a milestone, as it encouraged more and more countries to incorporate environmental and social considerations into their tourism policies, including how they organise logistics and mobility (UNWTO, 2018). Following the pandemic, attention has turned from straightforward economic recovery to the necessity of a green transition. This transition aims to reduce carbon emissions, boost energy efficiency and safeguard ecosystems under threat from tourism (UNEP, 2021; WTTC, 2022).

These recent changes form part of the 2030 Agenda for Sustainable Development, which was adopted by the UN General Assembly in 2015 and sets out 17 Sustainable Development Goals (SDGs). Integrating these goals into national and regional strategies has transformed tourism planning and management, including logistics systems. SDGs 8, 12 and 13 are currently particularly relevant to the tourism sector as they address economic growth, responsible consumption and production, and tackling climate change simultaneously.

SDG 8 focuses on promoting inclusive economic growth and quality employment. It has led to tourism being reconsidered as a source of green jobs and a means of diversifying regional economies. In many destinations, vocational training programmes, support for local entrepreneurship and public-private partnerships have not only aimed to expand tourism offerings, but also to introduce low-impact logistics solutions, from encouraging the use of public transport and electric mobility to developing local supply chains.

At the same time, SDG 12, which focuses on responsible consumption and production, is resulting in a clearer reconfiguration of tourism logistics. Infrastructure modernisation, replacing energy-intensive equipment, introducing resource management systems and applying circular economy principles to procurement and waste management have become integral to tourism strategies. In many destinations, these measures have resulted in a reduction in waste disposal, limited food waste and optimised the value chain from producer to consumer.

SDG 13, which aims to combat climate change, is reflected in investment on a large scale in renewable energy sources, the development of infrastructure for low-emission mobility, and the strengthening of systems for monitoring emissions. Many countries and tourist regions are implementing decarbonisation projects that include technological measures, such as installing photovoltaic panels in tourist facilities and introducing electric transport, as well as organisational measures, such as sustainable urban mobility plans and regulations on access to environmentally sensitive

areas. This translates climate goals into concrete logistical decisions.

The three goals (SDGs 8, 12 and 13) work together to create a framework in which economic performance, environmental protection and social inclusion support each other. Tourism is no longer viewed solely as a sector that generates revenue, but as an area in which transport, supply and waste management must be organised in line with climate targets and green economy standards.

At the national level, many countries, including the Republic of Moldova, have adopted this reference framework in their tourism development strategies. This has been achieved by setting up councils or structures to coordinate sustainable development, as well as by adapting public policies to the principles of the green economy. The United Nations Development Programme (UNDP) supports these processes by running projects that aim to modernise infrastructure, digitise tourism services, and promote environmental education among local businesses and communities (UNDP, 2023). In this context, sustainable tourism is a practical way of implementing green logistics, reducing environmental impact and strengthening communities' capacity to benefit equitably from tourist numbers.

## 6. Modern Practices for Organising Green Logistics in Tourism: Integrating Economic, Social, and Environmental Dimensions

In the Three Seas Initiative (3SI) region, a group of countries located between the Baltic, Adriatic and Black Seas, sustainable tourism is playing an increasingly strategic role. The modernisation of the tourism sector is being accelerated by the strengthening of economic and infrastructural interconnectivity between member states, with green logistics becoming the operational mechanism through which economic efficiency, reduced environmental pressure and social benefits can be achieved simultaneously. Current observations show that the most visible transformations occur where the digitisation of processes, the circular economy and resource planning are integrated in a coordinated manner. This enables a transition from traditional tourism to models that are competitive, energy-efficient and environmentally responsible.

At the European level, green logistics is now seen as a standard component of sustainable tourism management. According to analyses by the UNWTO (2023), activities such as transport, supply, food services and waste management account for around 8% of global tourism-related emissions. Green transition scenarios show that this impact could be reduced by 25–30% by 2030 through the gradual electrification of transport infrastructure, the integration of digitalised energy management in accommodation facilities, and the optimisation of supply flows through short chains.

Implementing green logistics requires planning mechanisms that correlate resource consumption, transport capacity and waste management. According to data from the European Travel Commission (2022), over 60% of European tourism operators have introduced systems to measure their carbon footprint and monitor their resources. Common practices include using electric transport in mountainous regions, installing smart heating and cooling systems in hotels, and automating booking processes between transport and accommodation providers. The economic impact is clear: energy consumption decreases, operational times are reduced and service quality improves.

In the Republic of Moldova, international co-operation projects, such as those developed by the UNDP and the Ministry of Culture, are supporting the transition to green logistics models. The EcoRoutes Moldova programme introduces electric transport, digitally optimised routes and infrastructure solutions based on recyclable materials. Assessments in 2023 revealed an average 18% reduction in fuel consumption and a 12% increase in visitor satisfaction, confirming the positive impact of digitisation and logistical optimisation on the quality of tourist experiences.

From an operational point of view, green logistics fulfills essential functions in structuring tourism activity:

1. Strategic planning and flow control through real-time monitoring of routes, occupancy rates, and energy consumption.
2. Digital integration of logistics chains (digitalised green supply chain), reducing processing times and resource consumption.
3. Supply optimisation, applying zero waste principles in hotels and restaurants.
4. Local partnerships in the value chain with regional producers, which reduces transport and supports the local economy (Gössling & Hall, 2021).

Emerging technologies play a decisive role in improving the efficiency of logistics. Between 2020 and 2024, the use of the Internet of Things (IoT) for monitoring tourist flows increased significantly (OECD, 2023). In Slovenia, the Bled model reduced domestic traffic by 27% in a single year and improved air quality by 15%. This shows that digitising logistics produces measurable effects when supported by related public policies and regulations.

The social component of green logistics is often underestimated. According to the World Travel & Tourism Council (2022), companies that have introduced environmental training programmes for their staff have achieved an average productivity increase of 10–12%, while reducing operating costs. In the Republic of Moldova, the EcoVillage and

AgroTour GreenLine initiatives demonstrate this trend, with optimised logistics processes reducing costs by around 20% and improving reputation in EU markets. In the context of 3SI, the adoption of green logistics produces results in three major areas:

1. Conservation of natural resources by reducing waste and promoting the reuse of materials (European Commission, 2024).
2. Energy efficiency and accelerated digitisation, with operational savings of 25–30% (UNEP, 2022; UNDP, 2023).
3. Increased tourism value and ecotourism safety, supported by investments with a multiplier effect on revenue (WTTC, 2022).

An increasing number of countries are trialling cross-border logistics models, such as the SmartGreen Tourism Corridor, to facilitate the exchange of data and best practices. According to reports from Moldova and Romania, logistics time has been reduced by 40% and administrative costs by 25% (OECD, 2024), confirming the role of regional collaboration in accelerating the green transition.

Therefore, green logistics is emerging as a tool that connects economic development, social responsibility and environmental protection. In the 3SI region, this convergence is taking shape in the form of concrete projects with measurable performance indicators. Table 2 summarises these interventions, highlighting their operational efficiency and sustainability relevance for the period 2020–2024.

The data presented in Table 2 demonstrate that the consistent implementation of green logistics solutions has a discernible impact on both the environment and the economic performance of operators. The reduction of emissions, the decrease in volumes of non-recyclable waste, the enhancement of energy efficiency, and the digitisation of logistics processes result in a reduction of operating costs, a more stable service provision, and an improved perception of destinations among tourists. Moreover, the role of regional collaboration within the Three Seas Initiative has been found to exceed initial expectations. This is due to the facilitation of knowledge exchange, the scaling up of successful projects, and the harmonisation of sustainability standards. From this standpoint, the 3SI region has the potential to serve as a model for the implementation of the Sustainable Development Goals, particularly SDGs 8, 12, and 13. In this context, green logistics emerges as a tangible instrument for organisational innovation and enhanced competitiveness in the realm of sustainable tourism (United Nations, 2015).

In recent years, the role of green logistics in the tourism industry has grown considerably, evolving from an operational efficiency concept to a strategic tool in the transition to a low-emission economy. According to recent documents from the World Tourism Organization, optimising logistics flows – particularly in terms of transport, supply, energy and waste management – is now one of the most important components of tourism competitiveness (UNWTO, 2023). An increasing number of destinations are adapting their policies and infrastructure so that the logistics chain becomes an integral part of sustainability rather than merely providing technical support. By reducing resource consumption and embracing digital solutions, the tourism industry is striving to

Table 2
**Impact of green logistics practices in tourism in the Three Seas region, 2020–2024**

| Category of intervention | Example of practice | Measurable results (2020–2024) | Sources |
|---|---|---|---|
| Carbon emissions reduction | Use of electric/hybrid fleets for tourist transfers in urban and natural destinations | Estimated $CO_2$ emissions reductions of 15–25%, correlated with a decrease in fossil fuel consumption | WTTC (2022); UNDP (2023) |
| Waste management | Introduction of biodegradable packaging and expansion of selective collection in HoReCa establishments | Observed decreases in non- recyclable waste of 20–30%, increase in the perceived attractiveness of destinations | European Commission (2024) |
| Energy efficiency | Solar systems, smart automation for air and lighting in accommodation facilities | Average energy consumption reduced by 12–22%, increased operational profit at local level | UNEP (2022); OECD (2024) |
| Logistics digitalisation | IoT, integrated mobility and booking apps, digital guidance for tourist flows | 20–28% reduction in logistics times and operating costs; increased processing speed | OECD (2024); WTTC (2023) |
| Community partnerships | Local supply (short supply chain), direct collaboration with regional producers | Local revenues +10–18%; reduction in transport costs 8– 15% | Gössling & Hall (2021); UNWTO (2023) |
| Environmental education | Internal training, visitor information through sustainability programmes | Increase in tourist satisfaction 10–16%; reduction in non-compliant behaviour in natural areas | WTTC (2022); UNDP (2023) |

*Source: author's own elaboration based on consolidated data from WTTC (2022, 2023), UNWTO (2023), UNEP (2022), OECD (2024), European Commission (2024), UNDP (2023), Gössling & Hall (2021).*

boost its economic performance without harming the environment, thereby reinforcing the foundations for a green transition.

### 6.1 Economic Dimension: Efficiency and Competitiveness

Applying green logistics principles has direct economic effects. According to data from the World Travel & Tourism Council, investments in efficient energy systems, digitalised supply, and low-emission transport can reduce operating costs by 18–25% in the medium term (WTTC, 2023). In many European destinations, modernising tourism networks through electrification, smart consumption management and integrating the circular economy increases businesses' profitability, reduces material waste and diversifies revenue sources. In the Republic of Moldova, low-carbon tourism projects supported by the UNDP have decreased energy consumption and increased attractiveness to international tourists, confirming the direct link between green logistics and market capacity (UNDP, 2023).

### 6.2. Environmental Dimension: Reducing Pressure on the Environment

Globally, the tourism industry generates around 8% of total $CO_2$ emissions, with transport and supply accounting for the majority (UNWTO, 2023). Between 2020 and 2024, the implementation of measures such as transport electrification, increased use of renewable energy, and waste reduction in Central and Eastern Europe led to measurable reductions in pollution, with some countries achieving reductions of between 25% and 30%. Romania, Slovenia and Croatia have introduced integrated coastal and mountain resource management strategies that are based on reuse and recycling and that reduce water consumption. These strategies have reduced pressure on ecosystems. These results confirm that green logistics is not merely a technical step, but a fundamental requirement for safeguarding the natural resources of destinations.

### 6.3. Social Dimension: Inclusion and Employment

The social dimension of green logistics is often overlooked. Reducing emissions and modernising infrastructure has led to a growing demand for green jobs, vocational training and community participation. Data from the UNDP (2023) highlights the growth in employment opportunities in rural areas, particularly in agritourism, responsible guiding, recycling and local food production. At the same time, green logistics influences how communities manage their cultural and natural resources, thereby strengthening social cohesion and responsibility towards the territory.

### 6.4. Cultural Dimension: Identity and Heritage

Implementing green logistics systems in tourist destinations enables heritage to be showcased without causing damage. According to UNESCO studies (2023), sustainably managed cultural routes featuring electric transport, green infrastructure and flow control are experiencing a significant increase in visitors seeking authentic experiences. This approach promotes the protection of historical sites and the appreciation of intangible heritage, while preventing the negative effects of overcrowding and excessive consumption. Meanwhile, local logistics partnerships support traditional producers and artisans, thereby maintaining the cultural identity of the regions.

In contrast to the 2010–2019 period, during which European tourism focused on increasing volumes and reducing immediate costs, the 2020–2024 period marks a shift towards a model centred on quality, energy efficiency, and sustainability. According to the WTTC (2024), the proportion of tourism that uses renewable energy has grown from 18% to 36%, the rate at which waste is recycled has risen from 42% to 61%, and the proportion of tourists who prefer eco-certified services has reached 65%. These trends are confirmed by the UNWTO and the UNEP, who have highlighted the increase in investment in digitisation, green mobility and reducing resource waste in European tourist facilities.

To summarise the above results and emphasise the relationship between economic efficiency, environmental protection, social development and heritage enhancement, Table 3 outlines the interdependence of the four dimensions of green logistics in tourism. It highlights practical examples and quantifiable results achieved in the Three Seas region between 2020 and 2024.

The data presented in Table 3 demonstrate that the impact of green logistics cannot be considered in isolation; rather, it is the result of a complex interplay between four distinct dimensions: economic, environmental, social, and cultural. The integration of these dimensions into tourism strategies has the potential to contribute to a reduction in emissions, enhanced resource efficiency, the creation of green jobs, and the strengthening of local cultural identity. In the context of the Three Seas Initiative, this integrated approach is becoming increasingly pertinent in practical terms for regional competitiveness and for achieving sustainable development goals (particularly SDGs 8, 12, and 13), as the capacity to organise logistics flows in a sustainable manner is becoming an essential criterion for distinguishing between destinations.

In order to illustrate these trends with empirical evidence and capture recent transformations in the application of green logistics principles, it is useful to analyse statistical indicators at the European

Table 3
**Interdependence of green logistics dimensions in tourism, 2020–2024**

| Dimension | Main objectives | Examples of applied practices | Measurable results/effects |
|---|---|---|---|
| Economic | Optimisation of logistics costs, increased operational efficiency | Implementation of digital logistics management systems (IoT, ERP), local sourcing, renewable energy | Reduction of average costs by 20–25% in accommodation and transport |
| Ecological | Reducing $CO_2$ emissions, increasing the use of renewable resources and the circular economy | Electric transport, selective collection, solar panels, biodegradable packaging | Reduction of emissions by up to 30%, increase in recycling & circularity |
| Social | Creating green jobs and developing local communities | Green training programmes, volunteering, integration of local producers into the logistics chain | 10–15% increase in employment in sustainable tourism |
| Cultural | Protecting heritage and developing low-impact tourist routes | Themed ecotourism routes, promotion of traditional crafts, green cultural events | 12–15% increase in cultural tourism flows |

*Source: prepared by the author based on comparative data provided by UNWTO (2024), WTTC (2023), UNDP (2023), OECD (2024), European Commission (2024), UNESCO (2023) and academic studies by Streimikiene et al. (2021) and Zhang, Ma & Hu (2021).*

and regional levels for the period 2020–2024. As demonstrated in reports and databases compiled by the World Tourism Organization, in the post-pandemic era, there has been an increasing trend of accommodation establishments and tourist destinations adopting renewable energy solutions, enhancing their monitoring of resource consumption, and implementing systematic reporting of sustainability indicators (UNWTO, 2022). This development signals a paradigm shift, as performance criteria are now linked not only to the number of tourists or the level of revenue, but also to how resources are managed and their environmental impact.

From a mobility perspective, data compiled by the World Travel & Tourism Council highlights a clear trend towards diversification of transport modes and an increase in the share of low-carbon solutions, both for domestic transport and regional routes (WTTC, 2023). In Central and Eastern European countries, there has been an expansion of tourist corridors promoting routes considered "eco-friendly". These have been developed with an emphasis on modernised public transport, improved rail connections, and reduced use of private vehicles in sensitive areas. These logistical changes have been demonstrated to contribute to a reduction in pressure on the environment, whilst concomitantly improving the tourist experience by reducing congestion and increasing accessibility.

Digitalisation is another pivotal element in the enhancement of green logistics. Recent analyses conducted by the OECD (2022) have indicated a substantial increase in investment in digital solutions for tourism, flow monitoring systems, integrated booking applications, and capacity and mobility management platforms across a significant number of member states. The integration of these tools into logistics chains has been demonstrated to contribute to a reduction in processing times, a more efficient use of infrastructure, and a rapid adaptation of services to variations in demand. Concurrently, the data produced by these systems facilitates more rigorous resource planning and a more accurate assessment of environmental impact.

In order to provide empirical evidence in support of the conceptual analysis and to anchor the discussion on green logistics in a quantitative framework, it is necessary to examine the evolution of indicators reflecting the use of renewable energy, the digitisation of logistics processes, the reduction of emissions, and changes in tourist behaviour between 2020 and 2024. As demonstrated in Table 4, which synthesises data from the UNWTO (2022), WTTC (2023), and OECD (2022), the progression of green logistics in tourism can be interpreted at both the European and regional levels. This objective analysis provides a foundation for evaluating the impact of green logistics in tourism.

The data presented in Table 4 demonstrate a consistent progression in the implementation of green logistics practices within the European tourism sector between the years 2020 and 2024. The increased utilisation of renewable energy sources and the expansion of recycling programmes indicate a discernible emphasis on diminishing resource consumption and enhancing environmental performance. Concurrently, the accelerated implementation of digital solutions underscores a process of operational modernisation, exerting a direct influence on logistics efficiency and the adaptability of tourism systems to conditions of uncertainty. This trend is further substantiated by the analysis of low-carbon supply chains within the tourism sector (Zhang, Ma & Hu, 2021). Moreover, the rise in the proportion of tourists who express a preference for green services indicates a gradual shift in consumer behaviour, thereby reinforcing the economic rationale for augmenting investment in sustainable practices. Collectively, these developments are indicative of

Table 4
**Evolution of key green logistics indicators in tourism (2020–2024)**

| Indicator | 2020 | 2022 | 2024 | Evolution, (%) |
|---|---|---|---|---|
| Use of renewable energy in tourist facilities | 22 | 32 | 41 | +19 |
| Waste recycling | 43 | 54 | 65 | +22 |
| Reduction of $CO_2$ emissions from tourist transport | 0%* | -14 | -24 | -24 |
| Implementation of digital logistics systems (IoT) | 25 | 46 | 70 | +45 |
| Percentage of tourists who prefer eco-friendly services | 48 | 57 | 65 | +17 |
| Increase in profitability of green operators | 0%* | +9 | +18 | +18 |

*Source: prepared by the author based on aggregated data from UNWTO (2022, 2024), WTTC (2023), and OECD (2022)*

the gradual maturation of green approaches in the tourism sector and serve to reinforce their relevance for strategic planning at the regional level.

In the Republic of Moldova, the integration of green logistics principles into the tourism sector has intensified, particularly following the initiation of the EcoRoutes Moldova programme (UNDP, 2023) and the Green Destination Moldova 2030 initiative. Between 2020 and 2024:

– Energy consumption in tourist facilities decreased by 22%;
– the volume of waste generated was reduced by 19%;
– and the share of eco-certified establishments increased from 9% to 28%.

These developments were facilitated by investments in excess of 4.7 million EUR and workforce development programmes, which resulted in the creation of over 1,200 green jobs. From a theoretical standpoint, these findings are in alignment with the conclusions of recent studies on the correlation between tourism competitiveness and the systematic application of circular economy-oriented logistics tools (Streimikiene et al., 2021).

The region has seen notable advancements, with investments in green infrastructure rising by 31%, logistics costs decreasing by an average of 18%, and current digitisation levels exceeding 75%. A comparative analysis of the data suggests that a 1% increase in investment in logistics digitization is associated with an average reduction of 0.8% in operating costs and a moderate increase of around 0.5% in tourist satisfaction levels. Concurrently, destinations that implement energy efficiency and circular resource management measures concurrently experience an average increase of 12–14% in competitiveness (WTTC, 2023). This aspect is complemented by the conclusions on the correlation between sustainability and economic performance highlighted in the literature review on sustainability and economic performance (Streimikiene et al., 2021).

Globally, the green tourism industry generated revenues of over 260 billion USD in 2023, accounting for 11% of total international tourism revenues (UNWTO, 2024). Projections made by 's for the year 2030 indicate that this figure will increase twofold to 20–22%, a development that is set to occur as green standards become obligatory within the tourism supply chain. In a similar manner, the extant literature corroborates the assertion that low-carbon logistics chains offer the most stable trajectory for reducing emissions and increasing financial performance in the context of climate risks (Zhang, Ma & Hu, 2021).

Recent developments indicate a transition in the position of green logistics within tourism sustainability strategies, suggesting a shift from a secondary role to a central position. In order to maintain the effectiveness of isolated measures, it is necessary to replace them with a unified approach, which should be integrated into public policies and cross-border co-operation mechanisms. In the Three Seas region, implementing the concept of "green corridor logistics" – green tourist corridors equipped with electric infrastructure and local partnerships – could generate economic growth of 10–12% by 2030 (European Commission, 2024). Furthermore, supply chain modelling indicates that integrated logistics systems mitigate operational risk and accelerate return on investment (Zhang, Ma & Hu, 2021).

Furthermore, the expansion of the use of IoT technologies, smart-data analytics, and AI-supply-chain optimisation in tourism management will enable additional cost reductions of up to 20%, whilst concomitantly improving the tourist experience and the energy efficiency of destinations (OECD, 2024). The advancement of green logistics is contingent upon the effective translation of sustainability objectives into coherent operational frameworks by public and private entities. This notion is further substantiated by extant literature, which underscores the pivotal role of competitive green models in enhancing economic performance within the tourism sector (Streimikiene et al., 2021).

## 7. Conclusions

An analysis of developments in the period 2020–2024 confirms that green logistics has become a defining element of the transition to sustainable

tourism in Europe and the Three Seas Initiative region. The progressive integration of renewable energy sources, the digitisation of logistics flows, and the expansion of circular resource management systems have resulted in quantifiable effects, including a reduction in ecological footprints and an enhancement in economic efficiency. The indicators analysed indicate a clear maturation of the sector, with a significant increase in the share of tourism units adopting green solutions and a diversification of the operational tools used in logistics chain management. Aggregate data from international sources demonstrate that the green transition is no longer an experimental process, but a functional mechanism that directly contributes to tourism performance and destination competitiveness (UNWTO, 2024).

A key finding of the research is the confirmation of the interdependence between the economic, environmental, social, and cultural dimensions of green logistics. The reduction of emissions and the enhancement of energy efficiency are facilitated by digital innovation mechanisms. Concurrently, the augmentation of recycling and the optimisation of local sourcing have been observed to be associated with a discernible increase in tourism attractiveness. Modern tourists favour sustainable options, and there is a growing preference for eco-certified services, which gives operators a long-term competitive advantage (WTTC, 2023). At the same time, cultural routes featuring green infrastructure, community partnerships and educational programmes help to protect heritage, create jobs and diversify tourism products. For the Republic of Moldova, the results point to a clear strategic direction. Projects implemented after 2020 demonstrate that investing in clean technologies, electric transport, the digitisation of logistics, and the development of professional skills can lead to reduced energy consumption, increased eco-certification, and the expansion of tourism markets. At the same time, there is increasing convergence with European standards, facilitating the country's integration into the Three Seas Initiative's regional networks. To consolidate this progress, a stable regulatory framework is required, as well as the expansion of green infrastructure and economic incentives for operators, to ensure that investments are sustainable in the long term.

At the European level, development directions focus on four major axes:

1. The full digitisation of logistics chains through IoT, big data, and integrated monitoring systems.
2. Accelerating the transition to renewable s ources and circular systems for materials and waste management.
3. The development of cross-border green tourism corridors and increased infrastructure interoperability.
4. Expanding educational programmes and organisational culture based on sustainability.

The validity of these directions is supported by both sectoral data and extant literature, which emphasises the role of green logistics as a structural element in the future competitiveness of European tourism (Streimikiene et al., 2021; Zhang, Ma & Hu, 2021).

In conclusion, green logistics can be said to represent a core element of tourism transformation, and not merely a technical component. The resilience, growth potential, and attractiveness of destinations are increasingly contingent on the modernisation, digitalisation, and adaptation of logistics flows to the principles of the circular economy. In the forthcoming years, the adoption of an integrated model that is sustainable, competitive, and socially oriented has the potential to transform the Three Seas region into a European benchmark for best practices in green tourism development. The tourism economy is entering a new phase, one in which performance is measured not only in terms of volume but also in terms of quality, balance, and responsibility.

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