THE PATHWAY TO THE RESILIENT AND SUSTAINABLE FUTURES: THE GREEN TRANSFORMATION OF TOURISM DESTINATIONS

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ARTICLE INFO

Original Article

Received: *20 November 2025*

Accepted: *15 December 2025*

doi:10.59267/ekoPolj2601151R

UDC 502.131.1:338.48-44

Keywords:

green economy, sustainable development, rural areas, island economies, resilience

***JEL**: F63, Q01, Q10, Q56*

ABSTRACT

Global development in recent decades has been characterized by increased resource consumption and growing environmental pressures, highlighting the need for sustainable economic and social progress. Tourism, despite its significant contribution to economic growth, often puts pressure on natural resources and ecosystems, underscoring the need for sustainable development in territories with substantial rural characteristics, such as islands. This paper examines the role of green transformation as a driver of economic resilience and sustainable development of Croatian island economies. Research was conducted among stakeholders in island destinations who are involved in tourism planning, development and management, using a structured questionnaire survey. The results from Partial Least Squares Structural Equation Modeling (PLS-SEM) show that green transformation of tourism positively influences all four sustainability dimensions of destination development, with the strongest effect on environmental sustainability. These findings support decision-makers in shaping development strategies for island destinations.

Introduction

Contemporary economic development is marked by a continuous increase in resource demand, resulting in intensified environmental pressures, declining biodiversity, and the destabilisation of local communities. These trends encourage the search for development models that simultaneously ensure economic progress and preserve ecosystems. At the centre of debates on new development trajectories is the concept

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of sustainable development, defined in the Brundtland Report (WCED, 1987) and in Barbier's work (1987), which has become a cornerstone of modern development policies and academic discourse. Sustainable development entails balancing the needs of present generations with the ability of future generations to meet their own needs, relying on the integration of economic, environmental, social, and cultural dimensions (UCLG, n.d.; Vornholz, 1994; Hawkes, 2001; Du Pisani, 2006; Zaccai, 2012; Barbier & Burgess, 2017). Despite its wide acceptance, the concept is often criticised for its ambiguity and normative flexibility (Lélé, 1991; Sharpley, 2009; Dernbach & Cheever, 2015). Nevertheless, global challenges such as climate change, resource depletion, and widening inequalities (Hopwood et al., 2005; Hoffman & Bazerman, 2007) further reinforce the need for an integrative approach that aligns economic, environmental, and social objectives (Bäckstrand, 2006; Kanie et al., 2019).

Several analytical frameworks have been developed to structure the multidimensional concept of sustainability. The Triple Bottom Line (TBL) (Elkington, 1994) and the Quadruple Bottom Line (QBL) (Mohd Zawawi & Abd Wahab, 2019; Tiller et al., 2022) frameworks decompose sustainability into three or four interconnected dimensions. The TBL encompasses economic, social, and environmental components (Norman & MacDonald, 2004; Fauzi et al., 2010), while the QBL additionally incorporates the cultural dimension as an essential element of sustainable destination development. In island destinations, this framework supports a holistic understanding of sustainability by integrating economic stability, social cohesion, cultural integrity, and environmental resilience.

Building on the abovementioned theoretical foundation, tourism emerges as a field in which the application of sustainability principles is especially imperative. The tourism industry accounts for more than 10% of global GDP. It employs one in ten people worldwide (World Bank, 2025), generating strong multiplier effects on innovation, investment, and regional development (Tang et al., 2023; Sastri et al., 2024). At the same time, it exerts significant pressure on the environment, ranging from greenhouse gas emissions to high energy and water consumption and increased pressure on infrastructure and local resources (Gössling, 2002). The observed dynamics underscore the need to reframe tourism growth in alignment with sustainability and low-carbon development pathways.

Growing pressures on natural and social resources further encourage the search for development models that transcend linear patterns of growth. In this context, the green transformation of tourism is increasingly recognised as a key instrument for aligning economic development with the principles of environmental responsibility and long-term sustainability (OECD, 2022; UN Tourism, 2025). This process goes beyond isolated technical interventions and involves profound changes in production, organisational, and consumption patterns, to create more resilient economies (OECD, 2013; Wang & Luo, 2023).

At the European Union level, the green transition is reinforced by a strong institutional framework. The European Green Deal (Fetting, 2020), the EU Industrial Strategy (Krpata, 2022), the Circular Economy Action Plan (European Commission, 2020), and the Clean Energy for EU Islands (European Commission, 2021) and Smart Islands initiatives (2017) steer the economy towards climate neutrality and resource efficiency. The European Agricultural Fund for Rural Development plays an important role in strengthening territorial cohesion in rural areas, including island communities facing specific structural constraints. Programs financed through the fund support increased competitiveness, more efficient resource use, and the mitigation of climate change impacts (European Commission, n.d.). Rural development measures under the Common Agricultural Policy (CAP) further contribute to building a low-carbon and climate-resilient economy, thereby creating conditions for the sustainable transformation of island areas.

These development instruments are further supported by a broader European framework relevant for island territories, including the Barcelona Convention on Integrated Coastal Zone Management (UNEP/MAP, 2011). Additional momentum for the green-digital transition is provided by the Green Digital Action Declaration, adopted at COP29 (International Telecommunication Union, 2024), which emphasises climate-positive digitalisation and the reduction of the environmental footprint of technological systems. Taken together, this institutional framework demonstrates the strong interconnection between rural and island development policies and their contribution to the European green transition.

Within the existing institutional framework, tourism stands out as a sector with high environmental pressures but significant potential for adopting green solutions. In island areas, the green transformation represents both an opportunity and a necessity, i.e., an opportunity to strengthen local economies and increase added value, and a necessity arising from ecological and economic vulnerability. Due to these characteristics, some authors describe island destinations as “laboratories of sustainable development” (e.g., Pathirana, 2025). The adoption of green technologies, the development of circular models, the establishment of sustainable energy systems, efficient waste management, and the promotion of local production and cultural heritage can generate multiplier effects, including cost reductions, increased competitiveness, and employment growth.

Despite strong institutional support, empirical research on the green transformation in island zones remains limited and methodologically fragmented. Although sustainable tourism indicators are conceptually multidimensional, existing approaches lack standardisation and show considerable variability in capturing ecological, economic, social, and cultural aspects (Law et al., 2017). Furthermore, previous studies on sustainable tourism policy have tended to prioritise environmental elements, while social issues have received less attention (Guo et al., 2019). Consequently, there remains a research gap in understanding how ecological efficiency interacts with social cohesion, cultural valorisation, and the economic prosperity of island destinations.

Due to the abovementioned shortcomings in existing measurement practices, sustainable destination management requires high-quality, comparable, and adaptable indicator systems. Indicator frameworks (Meadows, 1998; OECD, 2000; Pintér et al., 2005) facilitate monitoring progress towards sustainability goals and timely policy adjustments. In the tourism sector, UNWTO (2004) emphasises the importance of comparable and flexible indicators, while the Croatian CROSTO system, based on the ETIS framework, enables monitoring of economic, social, and environmental impacts at the destination level (Pavlinović Mršić & Čale, 2020). Such indicator systems provide the analytical basis for evaluating and guiding the green transformation in tourism.

Drawing on this theoretical and normative foundation, the green transformation acquires a clear development-economic rationale. In the literature, it is defined as the restructuring of the economy toward low-carbon growth models, supported by innovation and sustainable resource management (UNEP, n.d.; OECD, 2011). Achieving such systemic change typically requires coordinated institutional action and broad stakeholder engagement. Empirical studies (Apostu et al., 2023; Kozar & Sulich, 2023) further confirm positive effects on competitiveness, productivity, and long-term economic resilience. Stern (2007) argues that the costs of inaction on climate change far exceed the costs of investing in sustainable measures, providing the green transition with a strong economic justification.

Linking the green transformation with the concept of resilience is particularly important in island economies. Resilience is defined as the capacity of a system to absorb disturbances, adapt to change, and maintain essential functions (Folke et al., 2010; Biggs et al., 2012). In island contexts, the principles of the green transformation naturally align with the blue economy, which promotes sustainable use of marine resources and synergies between tourism, fisheries, and renewable energy (OECD, 2020). The integration of green and blue practices can contribute to the development of circular value chains, increase local added value, and reduce dependence on external resources, thereby strengthening the foundation for greater self-sufficiency of small island economies.

Building on this EU framework, recent policy initiatives, such as the Transition Pathway for Tourism, further strengthen the development of sustainable energy and tourism practices. In this context, the green transformation of tourism entails transitioning to renewable energy, sustainable resource management, circular business models, and the active participation of local communities (European Commission, 2023). Resulting impacts include economic gains through efficiency and innovation, social benefits such as inclusion and equity, cultural benefits linked to the preservation of identity and heritage, and environmental benefits through reduced emissions and resource use.

Within this broader policy and conceptual setting, the paper examines how green transformation in tourism affects the four dimensions of sustainability in Croatian island destinations and explores its implications for their economic resilience and long-term development.

Materials and methods

The research employs a quantitative approach to examine the relationships between green transformation in tourism and four dimensions of sustainability. The study relies on the conceptual framework of the Quadruple Bottom Line (QBL) model, which provides an integrated understanding of sustainability by balancing economic, social, cultural, and environmental effects.

The research model consists of five latent constructs: green transformation (GRT) and four sustainability constructs: economic (ECS), social (SOS), cultural (CUS), and environmental sustainability (ENS). All constructs were operationalised using multiple indicators based on relevant literature (UNWTO, 2004; OECD, 2011; Geissdoerfer et al., 2018; Tiller et al., 2022).

The independent variable, green transformation in tourism (GRT), was operationalised through five indicators capturing: community involvement in the green transformation of tourism (GRT1), the development of green products, services, and business models (GRT2), the preservation and promotion of cultural–ecological practices (GRT3), the development of green tourism infrastructure and spatial planning (GRT4), and resource conservation and energy efficiency (GRT5).

Economic sustainability (ECS), as a dependent variable, was measured using indicators of innovation and revenue growth (ECS1), employment (ECS2), the competitiveness of local products (ECS3), and entrepreneurship development (ECS4).

The dependent variable social sustainability (SOS) was measured through indicators capturing: increased social cohesion and inclusion within the community (SOS1), improvements in the quality of life of local residents (SOS2), greater involvement of the local community in planning and decision-making regarding destination development (SOS3), and a more active social life through event organisation and extended tourism seasons (SOS4).

Cultural sustainability (CUS) included indicators related to: the growth in organised activities and services managing the destination's cultural resources (CUS1), increased cultural and intercultural exchange and the strengthening of local customs and traditions (CUS2), an increase in cultural landmarks and the visibility of the local cultural identity (CUS3), and the development of cultural offerings and promotion of authentic culture to the wider public (CUS4).

Environmental sustainability (ENS) was measured through indicators related to: the reduction of uncontrolled waste and other forms of environmental pollution (ENS1), the increase in activities and services that sustainably manage the destination's natural resources (ENS2), improved management and quality of water resources (ENS3), and the growth of environmental awareness and biodiversity protection within the local community (ENS4). All indicators were measured using a five-point Likert scale (1 – "strongly disagree" to 5 – "strongly agree"), enabling the standardised evaluation of respondents' perceptions and attitudes.

Data were collected in 2024 through an online questionnaire (survey method) distributed to stakeholders in Croatian island destinations involved in planning, managing, and developing tourism activities. The total number of valid responses was N = 303, which ensures adequate statistical power in line with PLS-SEM methodological criteria (Hair et al., 2021). The sample includes diverse island destinations of different sizes and levels of tourism development, enabling the generalisation of results within the context of Croatian islands.

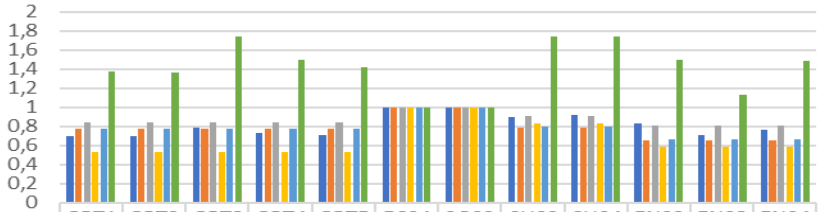
The Partial Least Squares Structural Equation Modeling (PLS-SEM) method was applied, as it is well-suited for examining complex relationships among latent variables and for analyses based on relatively small sample sizes (Hair et al., 2021). This method allows simultaneous testing of both the measurement and structural models, ensuring the assessment of reliability, validity, and the strength of relationships among constructs. The analysis aimed to quantify the effects of green transformation across four sustainability dimensions in island destinations and to determine the direction and strength of relationships among the observed constructs.

In line with the PLS-SEM approach, data analysis was conducted in RStudio and followed a two-phase procedure. First, the measurement model was assessed, including the examination of construct reliability (Cronbach's alpha and composite reliability), convergent validity (Average Variance Extracted – AVE), and discriminant validity (Fornell–Larcker criterion and HTMT ratios). Second, the structural model was assessed, including testing the effects of green transformation on each sustainability dimension using standardised coefficients (β), p-values, and the coefficient of determination (R^2). Bootstrapping with 1,000 iterations was performed to assess the robustness of the results.

Results and discussions

To ensure methodological robustness, an assessment of the reliability and validity of the constructs included in the model was conducted (*Figure 1*).

Figure 1. Reliability and validity of the measurement models



	GRT1	GRT2	GRT3	GRT4	GRT5	ECS4	SOS2	CUS2	CUS4	ENS2	ENS3	ENS4
Outer Loadings	0,697	0,695	0,789	0,73	0,71	1	1	0,902	0,915	0,836	0,703	0,759
Cronbach's α	0,774	0,774	0,774	0,774	0,774	1	1	0,789	0,789	0,653	0,653	0,653
rhoc	0,847	0,847	0,847	0,847	0,847	1	1	0,905	0,905	0,811	0,811	0,811
AVE	0,526	0,526	0,526	0,526	0,526	1	1	0,826	0,826	0,589	0,589	0,589
rhoA	0,775	0,775	0,775	0,775	0,775	1	1	0,792	0,792	0,666	0,666	0,666
VIF	1,38	1,362	1,745	1,494	1,425	1	1	1,74	1,74	1,493	1,131	1,486

Source: author's calculations in RStudio using the SEMinR package

The results in Figure 1 indicate satisfactory values across all evaluated indicators. Cronbach's alpha and composite reliability (CR) exceed the recommended threshold of 0.70, demonstrating the internal consistency of the measurement instruments. Furthermore, all Average Variance Extracted (AVE) values are above 0.50, confirming convergent validity and indicating that the constructs explain a sufficient proportion of variance in their corresponding indicators. Thus, the measurement model meets the criteria of internal consistency and convergent validity. The composite reliability values for the ECS and SOS constructs equal 1, which does not indicate perfect reliability but results from their single-indicator specification; this specification is considered methodologically acceptable within the PLS-SEM approach. Accordingly, the selected indicators reliably and validly represent the constructs included in the measurement model.

Discriminant validity was then assessed using the Fornell–Larcker (FL) criterion (*Table 1*) and the Heterotrait–Monotrait ratio of correlations (HTMT) (*Table 2*).

Table 1. Fornell–Larcker criterion

	GRT	ECS	SOS	CUS	ENS
GRT	0.725				
ECS	0.359	1			
SOS	0.300	0.533	1		
CUS	0.350	0.522	0.557	0.909	
ENS	0.403	0.515	0.527	0.635	0.768

Source: author's calculations in RStudio using the SEMinR package

According to the Fornell–Larcker criterion, the square root of each construct's AVE value should exceed its correlations with all other constructs in the model. The results confirm that the constructs GRT (0.725), CUS (0.909), and ENS (0.768) meet this requirement, indicating clear construct separation and an adequate level of discriminant validity.

Given that the Fornell–Larcker criterion may be limited in detecting issues of discriminant validity, the HTMT ratio was additionally examined. All HTMT values fall below the conservative threshold of 0.85, thereby providing further support for the discriminant validity of the measurement model (*Table 2)*. The highest recorded value refers to the relationship between ENS and CUS (0.881), which slightly exceeds the conservative threshold but remains within the bounds of the less restrictive interpretation (≤ 0.90). Therefore, it can be concluded that the model as a whole satisfies the criteria for discriminant validity.

Table 2. HTMT criterion

	GRT	ECS	SOS	CUS	ENS
GRT					
ECS	0.408				
SOS	0.342	0.533			
CUS	0.447	0.589	0.627		
ENS	0.555	0.638	0.653	0.881	

Source: author's calculations in RStudio using the SEMinR package

Given that all reliability and validity criteria have been met, the reflective measurement model can be considered appropriate for further PLS-SEM analysis. In the next stage of the research, the structural model is assessed to examine the relationships among the latent variables. The model comprises five constructs, with green transformation in tourism (GRT) defined as the exogenous construct, while economic (ECS), social (SOS), cultural (CUS), and environmental sustainability (ENS) are specified as endogenous constructs. To evaluate the significance and stability of the path coefficients, a bootstrap resampling procedure was conducted. The results indicate that all constructs retain satisfactory measurement quality, and all coefficients are statistically significant at the 1% level (*Table 3*).

Table 3. Structural paths obtained through the bootstrap procedure

Assumed relationship	Structural coefficients	t-test	Effect size
GRT ->ECS	0.359***	5.959	0.148
GRT ->SOS	0.300***	5.098	0.099
GRT ->CUS	0.350***	5.663	0.139
GRT ->ENS	0.403***	7.961	0.194

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01*

Source: author's calculations in RStudio using the SEMinR package

The explanatory power of the examined relationships was assessed using the coefficients of determination (R^2). The obtained values show varying levels of explained variance across the sustainability dimensions: environmental ($R^2 = 0.163$), economic ($R^2 = 0.129$), cultural ($R^2 = 0.122$), and social ($R^2 = 0.090$). The highest explained variance is observed in the environmental dimension, which aligns with the nature of the analysed phenomenon.

The research findings show that green transformation in tourism exerts a statistically significant and positive effect on all analysed dimensions of sustainability in island destinations, confirming its multidimensional developmental role. The strongest effect is observed in the ecological dimension, indicating that environmental benefits and ecosystem resilience manifest most rapidly through measures that involve more efficient resource management, reduced negative impacts, and improved efficiency.

At the same time, the positive effects identified across the economic, social, and cultural components demonstrate that green transformation is not limited to environmental outcomes but also functions as an integrated development framework that supports economic activity, social inclusion, and the preservation of local community identity. From an economic perspective, the results suggest that sustainable practices can stimulate entrepreneurial activity, increase local revenues, and contribute to job creation. Social effects are linked to greater community participation, strengthened cohesion, and improved quality of life, while the cultural dimension confirms the importance of sustainable approaches in safeguarding local identity, traditions, and heritage.

Overall, the findings indicate that green transformation serves as a fundamental

mechanism for long-term sustainability in island economies, enabling the alignment of ecological, economic, social, and cultural objectives. Such an integrated effect is particularly important for island destinations, which, due to limited resources, seasonality, and structural vulnerabilities, require development models that strengthen both resilience and competitiveness. Taken together with the existing literature, the results suggest that green transformation in tourism represents a meaningful and evidence-based pathway that can support the sustainable development of island destinations when implemented through targeted, systematic and long-term measures.

Conclusions

The conducted research confirms that the green transformation in tourism represents an important development mechanism for enhancing the sustainability of island destinations, with positive effects evident across all examined dimensions – economic, social, cultural, and environmental. The findings indicate that sustainable practices not only help reduce environmental pressures but also lay the foundations for diversifying the local economy, strengthening social cohesion, and ensuring the long-term preservation of cultural identity. The greatest impact is observed in the environmental dimension, confirming that green transition processes on islands primarily manifest through improved resource management and reduced ecological footprints. At the same time, positive effects across the remaining dimensions highlight the multidimensional nature of sustainable development.

Island areas, as specific and often vulnerable forms of rural space, require development models that account for the spatial, economic, demographic, and cultural characteristics of each local community. The results show that uniform policies, although useful as a strategic framework, have limited reach if they fail to recognise the heterogeneity of island and rural contexts. Therefore, implementing the green transformation on islands requires an approach grounded in local capacities, the involvement of community stakeholders, and the adaptation of objectives to local development realities.

From a practical perspective, the findings point to the need to strengthen institutional and financial instruments targeting rural economies, particularly in the fields of renewable energy, sustainable mobility, circular economy models, and the valorisation of local resources. The importance of developing participatory governance structures, continuous stakeholder education, and local partnerships is likewise emphasised, as these elements are crucial for ensuring long-term resilience and competitiveness.

From a theoretical standpoint, the research contributes to a deeper understanding of the interrelations between green transformation and the multidimensional sustainability of rural and island areas. At the same time, at the policy level, it opens space for differentiated development approaches that integrate economic, social, cultural, and environmental objectives.

However, the research conducted for this paper is subject to several methodological limitations. It relies on a questionnaire survey as the primary data collection method,

which may introduce response bias related to the subjective interpretation of individual items. In addition, the empirical analysis focuses exclusively on stakeholders involved in tourism planning, development, and management in island destinations. Although these actors are important for the implementation of sustainable strategies, their perceptions do not necessarily reflect the views of other relevant groups, such as local residents. These limitations should be considered when interpreting the findings and point to the need for complementary research designs that incorporate additional stakeholder perspectives and data sources.

In conclusion, the sustainable development of island destinations requires strategic thinking that simultaneously incorporates the specificities of rural areas, the potential of the green transition, and the needs of local communities. Future research should further explore these processes by analysing long-term effects and identifying governance models that support resilient, equitable, and ecologically grounded development of island tourism economies.

Conflict of interests

The authors declare no conflict of interest.

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