OPEN ACCESS
Jurnal Ilmiah Ilmu Terapan Universitas Jambi
Vol. 9 No. 1. March 2025, pp. 292-312 DOI. 10.22437/jiituj.v9i1.37888
Research Article

THE INFLUENCE OF SUSTAINABLE ECOTOURISM INFRASTRUCTURE ON LOCAL GOVERNMENT POLICY IN THE NATIONAL STRATEGIC TOURISM AREA OF YOGYAKARTA

Muhamad Muhamad[1,*], Ahmad AB[2], Hamam Supriyadi[3]

[1] Graduate School of UGM, Universitas Gadjah Mada Yogyakarta, D. I. Yogyakarta, Indonesia
[2] Hospitality lecturer at Politeknik Pariwisata Makassar, Sulawesi Selatan, Indonesia
[3] ASEAN Languages Cluster, Faculty of Liberal Arts, Thammasat University, Bangkok, Thailand
Corresponding author email: drmuhammad@ugm.ac.id

Article Info
Received: Oct 21, 2024
Revised: Dec 18, 2024
Accepted: Feb 14, 2025
OnlineVersion: Feb 17, 2025

Abstract
Effective policymaking in tourism should reflect on-the-ground realities. This study examines the impact of sustainable ecotourism infrastructure on local government policies in Yogyakarta, assessing whether existing policies align with empirical field evidence. Additionally, it introduces a structured methodology for evaluating sustainability in tourism development. This study employs a mixed-method approach, combining Partial Least Squares-Structural Equation Modeling (PLS-SEM) for quantitative analysis with qualitative descriptive analysis. A purposive sampling method was used to select 100 respondents, including academicians, destination managers, local government officials, and tourism industry specialists. The analysis covers the outer model, inner model, and hypothesis testing to explore the relationship between sustainable infrastructure indicators and policy development. Findings reveal a significant relationship between sustainable tourism infrastructure and government policies, particularly in environmental sensitivity and waste management. However, water resource management has a minimal impact on policy decisions. This suggests that while sustainability concerns shape policymaking, some infrastructure aspects remain underprioritized. This study contributes to sustainable tourism research by introducing a 12-indicator ecological infrastructure assessment aligned with Global Sustainable Tourism Council (GSTC) standards. It also validates the Penta Helix model's effectiveness in integrating multiple stakeholders into policy development. The study highlights the need for improved water management strategies, better environmental monitoring, and stronger policy frameworks. Future research should expand geographic scope and stakeholder representation to enhance policy recommendations for sustainable tourism governance.

Keywords: Ecotourism Infrastructure Indicators, National Strategic Tourism Area, Sustainable Tourism.

INTRODUCTION

Sustainable tourism represents a shift from conventional tourism. Sustainable tourism emphasizes the importance of factors beyond profit, allocating significant attention to environmental and societal aspects (Grieves et al., 2014; Anggoro et al., 2019; Triyasmina et al., 2022; Voronkova et al., 2024). This form of tourism plays a crucial role in contributing to both the environment and at the same time also toward the communities (Khalid et al., 2019; Munthomimah, Yamin, & Rusdi, 2022; Nikolskaya et al., 2022; Tjilen et al., 2022; Zulkarnain et al., 2024). Economic equalization among communities and the management of environmental impacts are vital objectives. Community empowerment is linked to financial equalization (Bhuiyan et al., 2012; Bezuhla, 2020; Baloch et al., 2023). The supply chain in the implementation of sustainable tourism also requires specific attention. Human resources, marketing, destinations, science and technology, intersectoral linkages, cross-country collaboration, and empowering small businesses need enhancement (Imani & Alavi, 2022; Omarzadeh et al., 2022; Taurusi, Septi, & Osma, 2024; Wulandari, Rodriguez, & Afrianda, 2024). The protection and management of sustainable tourism should deliver economic, social, and cultural benefits guided by sustainability principles (Parker & Khare, 2005; Koliopoulos et al., 2021; Hanoum et al., 2024; Rahmah et al., 2025).

Implementing sustainable tourism requires support from all the stakeholders. One of the parties that made a significant impact was the government (Heshmati et al., 2023; Kiper, 2013). Through a set of authorities and policies, governments can help create sustainable tourism (Pujar & Mishra, 2021; Rhama et al., 2020; Samia et al., 2017). Parties with good credibility and responsibility must include the planning, implementation, and supervision process up to the evaluation stage (Barkauskiene & Snieska, 2013; Setini et al., 2021; Hyskaj et al., 2024; Zakiyah, Boonma, & Collado, 2024). The essence of government policy is capable of sustaining or changing environmentally friendly tourism and changing stakeholders' behavior to protect, develop, and utilize the environment in an integrated and sustainable manner (Dunets et al., 2019; Maslovskaia et al., 2020). At this time, sustainable tourism continues to expand and enhance tourism service providers with new environmentally friendly programs, including infrastructure (Kaffashi et al., 2015; Samia et al., 2017; Sayyed, 2013). But what does sustainable tourism mean about the ecological infrastructure of tourism? How can we measure this?.

The world has experienced a population explosion, so the threat of damaging ecological infrastructure is inevitable (Kimbu, 2011; Pasape et al., 2012; Choi, Song, et al., 2017; Saputra, Musonda, & Nikolantonakis, 2024). Implementing sustainable development policy immediately is imperative due to the impact on the vulnerability of environmental infrastructure, socio-cultural life, and economic growth (Choi, Doh, et al., 2017; Habchak & Dubis, 2022; Endra & Villaflor, 2024; Risnawati et al., 2024). Sustainable tourism involves fully considering the present and future economic, socio-cultural, and ecological implications (Pasape et al., 2015; Robledano et al., 2018). The development tourism efforts in various destinations have been promoted by multiple countries that have subsequently issued indicators as a benchmark for programs to build and implement sustainable tourist destinations (Pasape et al., 2015; Wahono et al., 2019; Kumar et al., 2023; Miharja, Bulayi, & Triet, 2024).

Sustainable tourism in the Sleman district is a strategic area of national tourism. Strategy for developing sustainable tourist destinations following the provisions of Law No. 10 of 2009 on Tourism (Clifton & Benson, 2006; Neger, 2022). Creating sustainable tourist destinations is a significant agenda item of the Ministry of Tourism. Being a leader in sustainable tourism in Southeast Asia is a crucial agenda item for Indonesia (Blersch & Kangas, 2013; Dzhandzhugazova et al., 2019; Thompson, 2022). In order to support sustainable tourist development, the local government of 20 districts and cities, including Yogyakarta's Sleman district, signed a memorandum of understanding to launch the initiative in 2015 (Bhuiyan et al., 2012; Bezuhla, 2020; Baloch et al., 2023; Maudia, Awodeyi, & Mohammed, 2023).

The Borobudur-Yogyakarta-Prambanan (BYP) region, designated as a National Tourism Strategic Area (KSPN), launched a critical sustainable tourism initiative in 2020. This initiative sought to foster regional development while enhancing community engagement and local impact. The implementation of KSPN, particularly in Yogyakarta, has transformed local communities across multiple sectors through strategic tourism development. While tourism previously centered on established landmarks, the initiative has opened up new tourism corridors and unveiled hidden gems previously unknown to visitors. The KSPN framework has successfully expanded tourism beyond

Borobudur Temple, creating a network that encompasses surrounding areas like Sleman Regency, where community-driven tourism destinations have flourished.

While the central government has provided comprehensive guidelines for KSPN implementation, local community groups' efforts to develop regional potential remain in early stages. Coordination challenges persist due to limited understanding of tourism management principles and operational strategies among community members. To address these challenges, extensive outreach programs have been conducted, focusing on resource management and community participation in Strategic Area development. Communities, particularly in Sleman Regency, have received specialized training on KSPN frameworks and management fundamentals. This educational initiative has enhanced local awareness of tourism management principles and helped communities capitalize on government tourism initiatives.

The cornerstone of this effort is education in collaborative governance, recognizing that sustainable tourism requires coordinated effort rather than isolated initiatives (Hadi et al., 2021; Hendrayani & Darmastuti, 2019; Khalid et al., 2019; Lemy et al., 2019, León-Gómez et al., 2021). As (Zulkarnain et al., 2024) explains, collaborative governance involves direct participation from non-governmental stakeholders, emphasizing consensus-building and collective decision-making in public policy implementation and program managementm(Dzhandzhugazova et al., 2019; KC et al., 2021; Singgalen, 2022; Thompson, 2022; Fitriana, & Waswa, 2024). This approach prioritizes dialogue, particularly in Sleman Regency and northern Yogyakarta's Mount Merapi communities, to establish trust and develop shared understanding and commitment. The initiative employs a Penta Helix model, integrating academic institutions, private enterprises, media outlets, community organizations (including tourism awareness groups), and government agencies (Butler, 1999; Demolinggo et al., 2020). The collaborative approach to infrastructure governance aims to deepen stakeholders' understanding of cooperative management principles supporting sustainable tourism in the KSPN region. Through ongoing dialogue and educational programs, each participant gains clarity about their role in advancing sustainable tourism practices that responsibly utilize natural resources and environmental services (Tjilen et al., 2022; Zulkarnain et al., 2024).

Sleman district is a hilly and mountainous region extending to Mount Merapi's slopes, with altitudes ranging from 100 to 2,500 amsl. The southern part of the region is relatively flat, except for the hills on the southeast side of Prambanan district and on the southwest side of Gamping district. As we go north, the land gets swellier. In the northern part of the Sleman region, the natural conditions are relatively poor, but the fertility rate is high, and plenty of water sources exist. As an integral part of the Province of Yogyakarta Istimewa District (DIY), the development of Sleman District is directed as an educational center, cultural center, food producer, tourist destination area, development of small industries, agro-industries, and services industries.

Sleman District is one of the pilot projects capable of implementing sustainable tourism. The Pilot Project is a trust between UNWTO and the Ministry of Tourism of the Government of Indonesia. The results of monitoring sustainable tourism development in Sleman District began in 2016. This monitoring was carried out by the Ministry of Tourism, the Tourism Service of the Sleman District, the Regional Planning Agency for Construction of Sleman County, the Environmental Service of the Slemen District, and the Global Sustainable Tourism Council (GSTC), as well as practitioners from the tourism industry. Assessment is carried out based on several of the following criteria: (D1) Environmental risks; (D2) Sensitive environmental protection; (D3) Conservation of wildlife (flora and fauna); (D4) Greenhouse gas emissions (d5) Energy conservation, water management, (D6) Water safety, (d7) Water safety (d8) Water quality, (c) liquid debris; (d10) reduction of solid waste; (D11) light and noise pollution; and (d12) environmentally friendly transport, with the following results.

Table 1. Tourism Ecology Infrastructure Assessment Results in Sleman District of Yogyakarta Province

No	Criteria Assessment	Assessment 2016	Description
D1	Environmental Risk		Limited progress or well-planned initiatives that are not yet implemented (More focus needed)
D2	Protection of Sensitive Environments		Limited progress or well-planned initiatives that are not yet implemented (More focus needed)
D3	Wildlife Protection		
D4	Greenhouse Gas Emissions		Red: no progress or planned initiatives (High Priority to address)
D5	Energy Conservation		
D6	Water Management		Good progress against criterion (Keep it up)
D7	Water Security		Limited progress or well-planned initiatives that are not yet implemented (More focus needed)
D8	Water Quality		Limited progress or well-planned initiatives which are not yet implemented (More focus needed)
D9	Liquid Waste		Red: no progress or planned initiatives (High Priority to address)
D10	Solid Waste Reduction		Red: no progress or planned initiatives (High Priority to address)
D11	Light and Noise Pollution		Good progress against criterion (Keep it up)
D12	Low-Impact Transportation		Limited progress or well-planned initiatives that are not yet implemented (More focus needed)

The results of the assessment on the aspects of ecological infrastructure in tourism in 2016 concluded that there is a document in the Regional Tourism Development Master Plan (RIPPARDA) of Sleman district that considers environmental issues such as liquid and solid waste management. Other outcomes, such as economic, social, cultural, quality, health, and safety, have not been given priority or ignored. Territorial planning and long-term, medium-term, and short-term plans are policy strategies. No solid spatial component in tourism planning exists, and no Sustainable Tourism Master Plan discusses sustainable tourism ecological infrastructure. The stakeholders have not yet been responsible for supervising the prosperous environmental infrastructure. The results of the assessment of sustainable tourism indicators, particularly the ecological infrastructure of 2016, are still partially continuing and are not integrated. The management of liquid and solid waste disposal is concentrated only on untreated waste, so groundwater is contaminated. This ecological infrastructure of tourism needs to be addressed as a priority in tourist destinations when implementing sustainable tourism.

Figure 1: Innovation developed by the community in solid waste management

The problem of liquid and solid waste management is associated with poorly managed landfills. This problem will cause the polluted water to enter the river stream. Ecological infrastructure issues need greater attention to reduce greenhouse gas emissions and energy use. The above-mentioned ecological infrastructure issues require monitoring involving various parties, such as the government, local communities, the tourism industry, and colleges. These problems are approached by multiple methods with the test of hypotheses and investigation related to the indicators of tourism ecological infrastructure, among others: 1). H1 = Environmental Sensitivity to Government Policy; H2 = Liquid Waste Management Effect on Government Policies; H3 = Water Management Impact on Government Politics; H4 = Environmentally Friendly Effects on Local Government Policy.

LITERATURE REVIEW

Ecotourism Infrastructure

Infrastructure for ecotourism is the creation and administration of tangible resources and amenities that promote environmentally conscious travel in wilderness regions (Bhuiyan et al., 2012; Rahmah et al., 2025). To maximize positive effects on the environment and nearby communities while giving guests a comfortable and rewarding experience, it is essential. Infrastructure in ecotourism is closely related to the concept of physical development and management. Infrastructure also relates to services that can support sustainable tourism (Koliopoulos et al., 2021; Parker & Khare, 2005). Together, these aspects provide a comfortable experience for visitors. Negative impacts on the environment can also be minimized because It's based on sustainability. Infrastructure in ecotourism can be described as accessibility, accommodation, waste management, water management, interpretative signs, and community involvement (Heshmati et al., 2023; Kiper, 2013; Koliopoulos et al., 2021). Accessibility relates to the affordability of tourist destinations, such as available transportation. Accommodation relates to lodging, buildings, and so on. Waste management is important as it encourages creating a clean tourist environment. Water management is also an important aspect of the availability of visitors (Barkauskiene & Snieska, 2013; Kiper, 2013; Setini et al., 2021). Signage is closely related to aspects that can guide tourists to have a comfortable travel experience. Meanwhile, the last aspect of ecotourism is community involvement, where the community becomes a crucial component in the planning, development, and organization of ecotourism infrastructure. All of these aspects contribute to creating an ecotourism infrastructure that can provide an experience for visitors (Dunets et al., 2019; Habchak & Dubis, 2022; Maslovskaia et al., 2020).

Government Policy

A series of decisions and actions taken by the government to achieve specific objectives in various fields, such as politics, economics, social, cultural, etc., is referred to as government policy. Government policies provide clear regulations for every existing issue. An issue that should also receive clear regulation is ecotourism. Ecotourism needs to be regulated so that future evaluations and achievements can be improved.

In conceptualizing development planning through tourism, particularly nature and culture-based tourism, the government has prioritized rural areas, recognizing that rural communities are often better stewards of biodiversity and regional resources. This focus creates enhanced opportunities for rural community involvement in development initiatives (Boley & Green, 2016; Cândido et al., 2024a, 2024b; Mbaiwa & Stronza, 2009). This approach also provides stakeholders with a framework to strengthen their strategies, helping them better visualize and identify boundaries and establish development priorities in a step-by-step process toward sustainable tourism destination management and development through ecotourism (Choi, Doh, et al., 2017; Habchak & Dubis, 2022). Ecotourism, which emphasizes nature conservation while conducting low-impact tourism activities designed to benefit local residents' welfare, has been practiced in these areas for several decades (Choi, Doh, et al., 2017; Pasape et al., 2015; Robledano et al., 2018). Ecotourism systems based on wildlife habitats within ecological systems are considered social-ecological systems that maintain feedback relationships with social systems (Pasape et al., 2015; Robledano et al., 2018; Wahono et al., 2019). The National Tourism Strategic Area (KSPN) possesses natural potential that supports tourism sector development. Ecotourism spatial planning requires balancing development and conservation, organizing space based on themes while considering local residents' lives beyond physical data-based spatial planning (Clifton & Benson, 2006; Kumar et al., 2023). With growing interest in ecotourism and ecosystem services

provided by landscapes, these services have become increasingly essential in strategic area planning processes.

The government's role in implementing innovations designed to create significant changes in developing the National Tourism Strategic Area (KSPN) to boost the economy through ecotourism-based tourism is crucial. As noted in research by (Bezuhla, 2020) titled "Regional tourism in Inter-Governmental Authority on Development: A comparative policy and institutional best practice approach," most Regional Economic Communities (RECs) maintain streamlined institutional structures with robust regional tourism policies and institutional planning frameworks that have helped strengthen their global competitiveness. Despite having sustainable tourism master plans, the region still lacks comprehensive policy and institutional frameworks—a gap this paper seeks to address through comparative analysis of these regional economic communities (Clifton & Benson, 2006; Neger, 2022; Valánszki et al., 2018). Government involvement is essential in realizing sustainable development plans. The government serves as the highest authority in implementing development initiatives, as it creates and holds policy-making power for innovative development planning, especially when involving specific regions. Rural ecotourism resources are fundamentally composed of human cultural conditions and natural conditions, with natural landscapes and cultural artifacts being the most prominent elements (Baloch et al., 2023; Bhuiyan et al., 2012; Parker & Khare, 2005; Rahmah et al., 2025).

So far, the Indonesian government has provided significant support for the creation of policies that govern ecotourism. These policies should be based on existing empirical data in the field. Thus, each policy will be able to serve as appropriate evaluation material for the improvement of the ecotourism ecosystem in Indonesia in the future (Heshmati et al., 2023; Koliopoulos et al., 2021). The purpose of creating policies is to maintain stability, improve the welfare of the people, drive economic development, provide protection for the environment, and advance knowledge and technology. In relation to ecotourism, policies will be more directed towards the preservation of sustainable tourism environments. These policies will be effective if related to the ongoing management of ecotourism (Barkauskiene & Snieska, 2013; Kiper, 2013; Kumar et al., 2023; Setini et al., 2021; Wahono et al., 2019).

RESEARCH METHOD

Structural equation modelling (SEM) is the research methodology used. A simultaneous linear relationship between the observation variable (indicator) and the variable that cannot be directly measured (latent variable) can be described by the multivariate analytic approach used by the measurement device. With purposeful sampling, samples are chosen consciously and the researchers decide which portions to take based on predetermined criteria; the samples are not chosen at random but rather by the researchers. In the study, 100 samples were analysed using partial least squares (SEM) (Abdussamad & Sik, 2021; Kusumastuti & Khoiron, 2019; Nasution, 2023). One hundred respondents were selected from among the tourism sector, government agencies, and managers of tourist destinations, including local communities. The area and the Wiasata villages on the slope of Mount Merapi are covered by Yogyakarta Province's Sleman district, where the research was conducted.

The following stage involves testing discriminant validity, which measures the degree of correlation between the structure's indicator and the indicator of the other system by examining cross-loading values and Fornell-Lacker criteria. By comparing each structure's square root of the average variance extracted (AVE) value with the correlations between the construction and the other construction in the model, it is possible to determine that the standard value used for cross-loading and the Fornell-Lauer criteria is more significant than 0.7 (Saptatiningsih, 2019; Yamin et al., 2021a). A building is considered to have an outstanding discriminant value if the root value of its AVE is greater than the correlation between its construction and the other structures in the model (Ali, 2021; Ashshofa, 2013). The amount of variance or variability of the manifest variable that a latent conspiracy may have is shown by the AVE value. The manifest variable is more strongly represented against its latent construction the more variance or disagreement the manifesto variable might have inside the latent structure (Rahardjo, 2011; Wahidmurni, 2017). >= 0.50 is the value of the Average Variance Extracted (AVE). It can be stated that there are more errors in the indicator or item than the system variance value if the average variance extracted value on a structure is less than 0.5 (Streimikiene et al., 2021; Yamin et al., 2021b).

RESULTS AND DISCUSSION

The study's 100 respondents, 53 percent male and 47 percent female, had the following characteristics. 37% of people are between the ages of 25 and 45—57% of employed Civil Servants (ASNs) and 43% of non-ASNs.

The study's performance metrics, which show how Tourism Ecological Infrastructure affects it, are based on standards set by the Global Sustainable Tourism Council (GSTC). These indicators are designed to produce indications based on the monitoring location rather than to be definite. Phase identification and model assessment are the foundations of the following grouping analysis, which quantifies each indication's significance. Convergence validity, discrimination validity, reliability, and the measuring model derived from the PLS algorithm were among the indicators used to assess the measurement evaluation of the measurement model.

Based on the findings of the convergent validity test, the ecological infrastructure research variable, which looked at four variables—environmentally sensitive, water management, liquid waste management, environmentally favorable, and government policy—can be considered credible. If both the loading factor value and the AVE value are positive and more than 0.7, then this is correct. The load factor value of an indicator indicates the relative importance of each item or indication with respect to each variable. Arrows with a high load factor indicate the most important variable measure. Table 2 displays the loading factor value on Table 2.

Table 2 Output Put Smart PLS Variable Value and Loading Factor

Variable	Item	Loading Factor	AVE	Description
Liquid Waste Handling	LC1	0.882	0.783	Valid
	LC2	0.889		Valid
	LC3	0.870		Valid
	LC4	0.901		Valid
	ML1	0.903		Valid
	ML2	0.883		Valid
	ML3	0.881		Va lid
	ML4	0.872		Valid
Environment Friendly	PC1	0.900	0.744	Valid
	PC2	0.867		Valid
	TR1	0.871		Valid
	TR2	0.810		Valid
Government Policy	KP1	0.913	0.776	Valid
	KP2	0.902		Valid
	KP3	0.825		Valid
Sensitive Environment	RL1	0.910	0.731	Valid
	RL2	0.902		Valid
	PLS1	0.892		Valid
	PLS2	0.821		Valid
	PLS3	0.792		Valid
	PAL1	0.868		Valid
	PAL2	0.876		Valid
Water Management	EG1	0.794	0.796	Valid
	EG2	0.830		Valid
	KE1	0.911		Valid
	KE2	0.871		Valid
	PA	0.905		Valid
	KA	0.846		Valid
	KLA1	0.899		Valid
	KLA2	0.918		Valid
	KLA3	0.892		Valid

According to Table 2, all of the indicators are considered valid as measures of the hidden variable because their AVE values are more significant than 0.5 and their consequent loading factor

values are higher than 0.7. The square root of the average variance extracted (AVE) represents any structure in the model that shows a relationship with another system. The AVE root value for each component portion of a structure indicates its outstanding discriminant validity, as indicated by the table below, if the correlation value between the construction and the remaining parts of the model's structure is higher.

Table 3. Table of correlation values between constructions and other constructions in the model (Fornell-Larcker Criterion)

Variable	Government policy	Sensitive Environment	Liquid Waste Handling	Water Management	Environment friendly
Government policy	0.881				
Sensitive Environment	0.660	0.855			
Liquid Waste Handling	0.537	0.372	0.885		
Water Management	0.577	0.853	0.368	0.892	
Environment friendly	0.545	0.415	0.647	0.377	0.863

Table 4 Cross-loading values on each item

Items	Government policy	Sensitive Environment	Liquid Waste Handling	Water Management	Environment friendly
EG1	0.431	0.794	0.158	0.612	0.225
EG2	0.630	0.830	0.400	0.710	0.437
KA	0.502	0.599	0.328	0.846	0.292
KE1	0.563	0.865	0.304	0.911	0.405
KE2	0.522	0.802	0.277	0.871	0.359
KLA1	0.441	0.708	0.336	0.899	0.321
KLA2	0.516	0.760	0.376	0.918	0.311
KLA3	0.478	0.718	0.343	0.892	0.284
KP1	0.913	0.579	0.474	0.462	0.421
KP2	0.902	0.599	0.514	0.509	0.573
KP3	0.825	0.564	0.428	0.556	0.438
LC1	0.454	0.372	0.882	0.371	0.426
LC2	0.440	0.347	0.889	0.339	0.459
LC3	0.475	0.390	0.870	0.335	0.475
LC4	0.436	0.320	0.901	0.349	0.457
ML1	0.538	0.361	0.903	0.349	0.787
ML2	0.456	0.275	0.883	0.278	0.618
ML3	0.481	0.226	0.881	0.230	0.637
ML4	0.507	0.338	0.872	0.355	0.663
PA	0.558	0.845	0.340	0.905	0.367
PAL1	0.535	0.868	0.300	0.772	0.317
PAL2	0.540	0.876	0.360	0.735	0.377
PC1	0.448	0.352	0.561	0.361	0.900
PC2	0.484	0.374	0.542	0.326	0.867
PLS1	0.627	0.892	0.340	0.731	0.374
PLS2	0.541	0.821	0.391	0.791	0.348
PLS3	0.515	0.792	0.208	0.726	0.306
RL1	0.633	0.910	0.299	0.774	0.377
RL2	0.573	0.902	0.358	0.704	0.390

Items	Government policy	Sensitive Environment	Liquid Waste Handling	Water Management	Environment friendly
TR1	0.528	0.379	0.561	0.317	0.871
TR2	0.408	0.321	0.574	0.299	0.810

Tables 3 and 4 demonstrate that the cross-loading value of every item is more than 0.70. When connected to its own latent variable, each item has a higher value than when connected to a separate latent variation. It illustrates how each research variable has effectively clarified the underlying variable and supported the item's overall discriminant validity. The ecological infrastructure variables' applicability in PLS analysis is judged reliable when the Composite reliability value is more than 0.7 and Cronbach's alpha value is recommended to be better than 0.7.

Table 5. Reliability Cronbach alpha and Composite reliability values

Variable	Cronbach's Alpha	Composite Reliability
Government policy	0.855	0.912
Sensitive Environment	0.954	0.961
Liquid Waste Handling	0.961	0.967
Water Management	0.957	0.965
Environment friendly	0.885	0.921

The table above indicates that every variable related to ecological infrastructure research has a composite reliability value greater than 0.7 and a Cronbach Alpha greater than 0.7. By demonstrating that each variable has satisfied composite reliability and Cronbach alpha, these results suggest that the overall ecosystem infrastructure variable has a high degree of realism. This allows for the next analysis, which entails evaluating the inner model and confirming the quality of the fit model. The following step will involve executing the outer test of the model to identify the Structural Model (Inner Model) based on the study's findings. Through the testing of the internal or structural model, the relationship between the construction, the significant value, and the R-square of the research model is investigated.

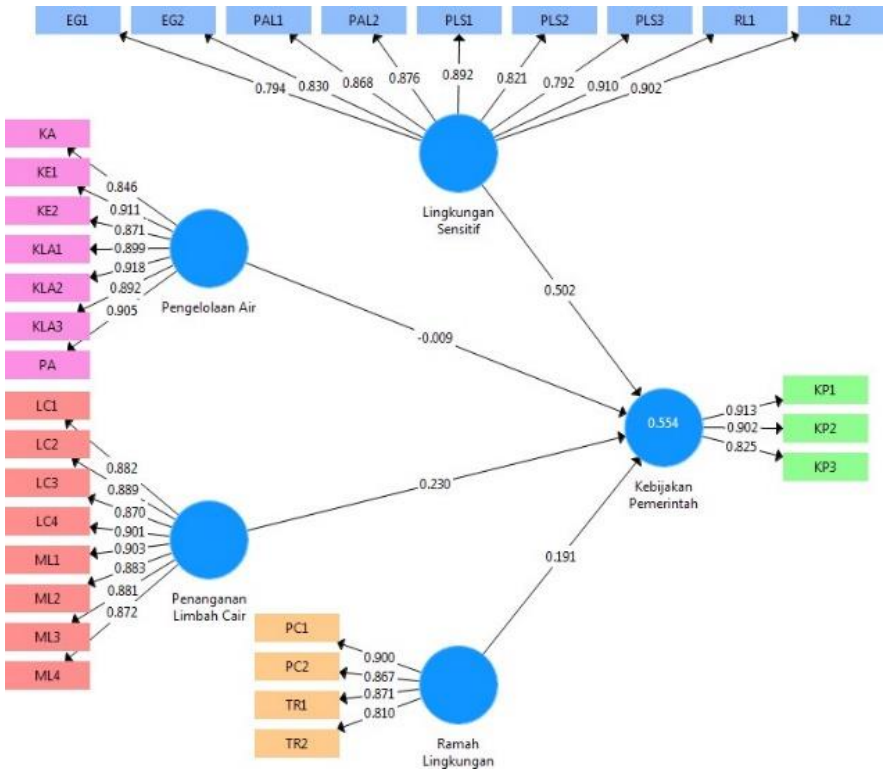

Figure 2: Structural Model Evaluation to see estimated results using PLS

The first step in evaluating the structural model to see the results of the PLS test is to look at the R-square on the government variable dependency of each latent variable, which is the outcome of the estimated R-square using PLS testing results displaying the government policy variable, as shown in the Table 6.

Table 6 Results of R Square testing using PLS

Variable	R-*Square*	R-*Square Adjusted*
Govermen Policy	0.554	0.536

Table 6 above, which displays the Government Policy variable's R-Square value of 0.554, indicates that 55.4% of the Government Policies variable's explanation can be attributed to the independent variable. The remaining 44.6% may be attributed to variables not included in this research. Predictive relevance is the outcome of a test that looks at the value of the Q square to demonstrate how well the observation value is created utilizing the blindfolding process. A deal may have an excellent observational value if it is square > 0 and a value that is observationally not good if it is square < 0.

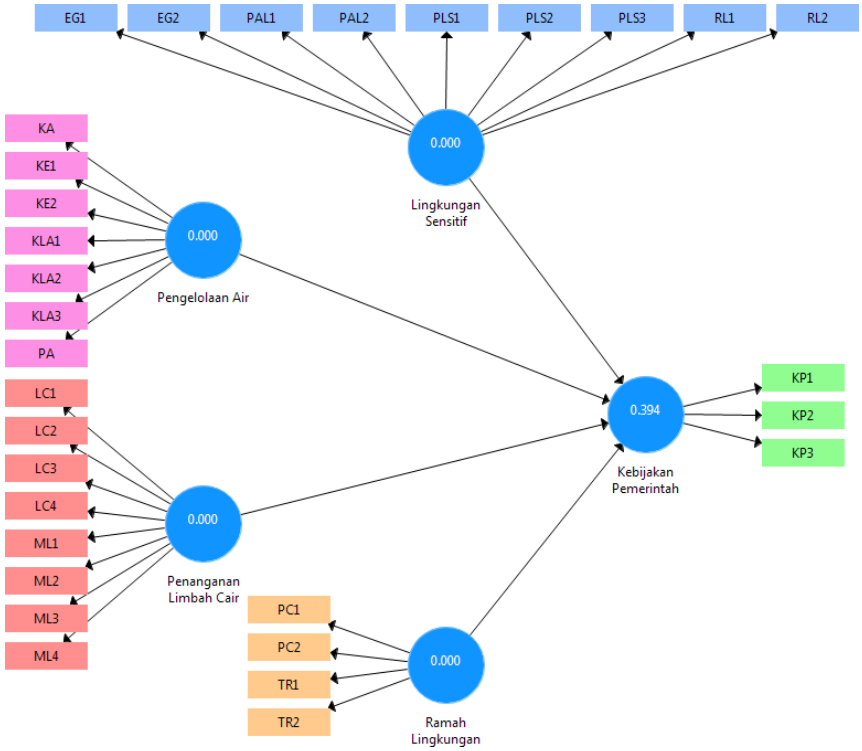

Figure 3. Predictive Relevance

The table below provides a conclusion based on the image above.

Table 7. Predictive Relevance

Variable	Q^2 (=1-SSE/SSO)	Description
Govermen Policy	0.394	Having predictive relevance value

Based on the data in the table above with the government policy variable, it is known that the value of Q square on the dependent variable is more significant than zero. It is possible to conclude from the value that this research has a good observation value because the value of Q square > 0. (nol).

Test Results for the Tourism Ecology Infrastructure Hypothesis.

To explain the relationship between the study's variables, the structural relationship model is put to the test. The structural models are tested using the PLS programme. Directly assessing the hypothesis is based on the image's output and the values discovered on the path coefficients output. Significant effects of external factors on the endogenic variable are indicated by a statistical T value >

1.960 and a p-value < 0.05 (significance threshold = 5%), respectively. This implies that the real basis used to test the hypotheses directly is the one described in detail below, utilising the image.

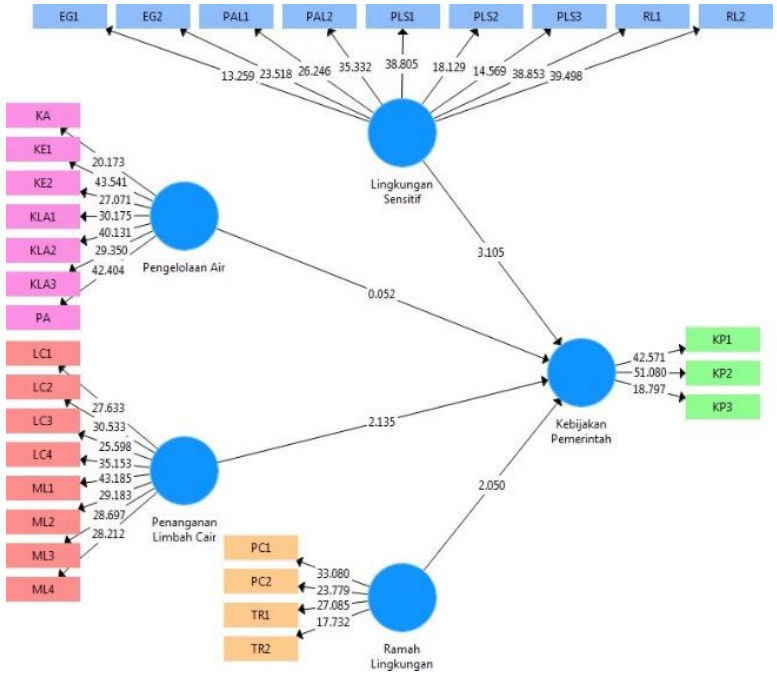

Figure 4. Tourism Ecology Infrastructure Research Hypothesis Test Results.

Table 8. Hypothesis testing of variables and values obtained from ecological infrastructure variables

Variable	Original Sample (O)	T Statistic (O/STDEV)	P Values
Sensitive Environment -> Goverment Policy	0.502	3.105	0.002
Liquid Waste Handling -> Goverment Policy	0.230	2.135	0.033
Water Management -> Goverment Policy	-0.009	0.052	0.958
Environment Friendly -> Goverment Policy	0.191	2.050	0.041

These are the outcomes of the PL bootstrapping analysis. In the PLS analysis, each hypothetical connection is statistically tested via a simulation using the bootstrapping and sample approach. Sensitive environmental issues impact government policies. The influence of sensitive ecological infrastructure on government policy was tested first, and the results indicated a statistical t-value of 3.105 > 1.960 and a coefficient of 0.502. The findings demonstrate how factors in the sensitive environment affect government policy. The table below includes a 4-variable (H1-H4) indicator of sensitive habitats and an indicator based on monitoring evidence, allowing the hypothesis that "sensitive environments have a positive and significant influence on government policy" to be accepted due to various evidence of watching sustainable destinations.

Table 9 Development of variables of sensitive environmental influence on government policy

Variable Development	Indicator and Monitoring Evidence
H1 Environment risk. The destination has identified environmental hazards and has a management system	IN-D1.a. Destination sustainability assessment for the last five years has identified environmental risks. IN-D1.b. The risk management system is available
H2 Sensitive Environmental Protection. Destinations have a system to monitor the impact of tourism on the	IN-D2.a. Implement and update the inventory of sensitive and endangered

Variable Development	Indicator and Monitoring Evidence
environment, preserve existing habitats, species, and ecosystems, and prevent the entry of alien species. (invasive)	habitats and habitats. IN-D2.b. Management systems for monitoring impacts and protecting ecosystems, environments, and sensitive species IN-D2.c. System to prevent the entry of alien species (invasive)
H3 Wildlife Conservation Destinations have a system to ensure compliance with local, national, and international laws and standards for hunting, catching, exhibiting, and selling flora and fauna.	IN-D3.a. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) IN-D3.b. Rules and standards for controlling hunting or capture, exhibiting, and selling flora and fauna
H4 Greenhouse Gas Emissions. Destinations have a system to encourage companies to measure, monitor, minimize, report to the public, and mitigate greenhouse gas emissions for all aspects of operations.	IN-D4.a. A supporting program to assist companies in measuring, monitoring, minimizing, and reporting to the public on greenhouse gas emissions IN-D4.b. A support system to help companies mitigate greenhouse gas emissions

The Impact of Liquid Waste on Government Policy, the second hypothetical test, had statistical t-values of 2.135 > 1.960 and a coefficient of 0.230 with p-values of 0.033 < 0.05. The hypothesis that "Liquid waste disposal has a positive and significant impact on Government policy" is accepted because the data demonstrate that liquid waste management influences government policy. The table below shows four variable-sensitive environmental indicators (H5-H8) with evidence-based monitoring indicators for maximizing ecological benefits. Diverse monitoring evidence for sustainable destinations favorably and positively impacts these indicators.

Table 10. Water Management Indicators Maximize Environmental Benefits and Minimize Negative Impacts.

Variable Development	Indicator and Monitoring Evidence
H5 Energy conservation. Destinations have a system to encourage companies to measure, monitor, reduce, and report energy consumption and dependence on fossil fuels.	IN-D5.a. Programme to promote and measure energy conservation, monitor, reduce, and report energy consumption to the public IN-D5.b. Policies and incentives to reduce dependence on fossil fuels, improve energy efficiency, and encourage the adoption and use of renewable energy technologies
H6 Water Management. Destinations have a system encouraging companies to measure, monitor, reduce, and report water use to the public.	IN-D6.a. A supporting program to assist companies in measuring, monitoring, reducing, and reporting water use
H7 Water Safety. Destinations have a system to monitor water sources and ensure that water usage by the company is in line with the population's needs at the goal.	IN-D7.a. Management system to ensure that the water used by the company and required by the local community is balanced and appropriate
H8 Water Quality. Destinations have a system to monitor drinking and recreational water quality using standard quality. Monitoring results are provided to the public, and goals plan to respond to water quality issues promptly.	IN-D8.a. Management system for monitoring and reporting drinking and recreational water quality to the public IN-D8.b. Monitoring results available to the public IN-D8.c. System to respond to water quality issues accurately

Effect of Government Policy on the Water Management Variable. Water Management Impact On Government Policy, the third hypothetical test result, with t-statistics of 0.052 < 1.960, p-values of 0.958 > 0.05, and coefficients of -0.009. The premise that "water management and waste management have a positive and significant impact on government policy" is rejected in light of the findings indicating that water management influences government policy.

Table 11. The Impact of Water Management on Government Policy.

Variable Development	Indicator and Monitoring Evidence
H9 Liquid waste disposal. Destinations have clear and implemented guidelines for the placement, maintenance, and testing of septic tanks and liquid waste treatment systems. These guidelines ensure that waste is appropriately treated, reused, or disposed of safely with minimal damage to residents and the environment.	• IN-D9.a. Regulations for the placement, maintenance, and testing of septic tanks and liquid waste treatment systems, along with evidence of enforcement measures. • IN-D9.b. Regulations ensuring the size and type of liquid waste treatment are suitable for the site, with proof of enforcement action. • IN-D9.c. A supporting program to assist companies in effectively processing and reusing liquid waste. • IN-D9.d. Programs to ensure safe disposal of waste for reuse or disposal with minimal damage to residents and the environment.
H10 Reduces Solid Waste. Destinations have a system to encourage companies to reduce, reuse, and recycle solid waste. Solid wastes that cannot be recycled are disposed of safely.	• IN-D10.a. A solid waste collection system that records the waste generated. • IN-D10.b. Solid waste management planning with quantitative objectives to minimize and ensure safe and sustainable disposal of waste that is neither reused nor recycled. • IN-D10.c. Programs to help companies reduce, reuse, and recycle solid waste. • IN-D10.d. Program to reduce the use of plastic water bottles by companies and visitors.

Environmentally friendly influence on government policy.

The second hypothesis' test findings, "Environment-Friendly to Government Policy," revealed a statistical t-value of 2.050 > 1.960, a coefficient of 0.191, and p-values of 0.041 < 0.05. The premise that "environmental influences have a positive and significant influence on government policies" is accepted since the data demonstrate that environmental friendliness affects government policies.

Table 12 Development of Environmentally Friendly Variables to Government Policy

Variable Development	Indicator and Monitoring Evidence
H11 Light and Sound Pollution. Destinations have guidelines and regulations to minimize light and sound pollution, and encourage companies to follow these guidelines and rules.	• IN-D11.a. Guidelines and regulations to minimize light and noise pollution. • IN-D11.b. A supporting program to encourage companies to follow guidelines and regulations in minimizing light and noise pollution.
H12 Environmentally friendly transport. Destinations have a system to improve environmentally-friendly transport, including public and active transport.	• IN-D12.a. Programme to enhance the use of environmentally friendly transport. • IN-D12.b. Programs to attract visitors using active transport (such as walking and cycling).

In the fourth hypothesis testing, especially on water management and waste management variables, the results were rejected because the destination does not yet have a system to encourage measuring, monitoring, reducing, and reporting energy consumption and dependence on fossil fuels. In addition, reporting energy consumption to the public does not yet have a vital instrument. Furthermore, they do not yet have a solid tool to reduce dependence on fossil fuels and improve renewable energy efficiency. There isn't currently a tool in place at the tourist destination to encourage businesses to track, measure, cut back on, and notify the community about their water use. The Monitoring Centre for Sustainable Tourism Observatories (MCSTO) has found unfavourable outcomes from its mentorship programme. Furthermore, the tourist spot lacks a framework to keep an eye on water supplies and make sure businesses are using water in a way that satisfies community needs.

There are reliable reports concerning sustainable tourism issues at Sustainable Tourism Observatory (STO) locations. Thirteen major issues have been identified, encompassing local community welfare, cultural heritage preservation, community participation in the tourism sector, tourist satisfaction, health and safety, capturing economic benefits from tourism, protecting valuable natural assets, managing scarce natural resources, limiting negative impacts of tourism activities, controlling tourist activities and their intensity levels, planning and managing tourism destinations, designing products and services, and ensuring sustainability of tourism operations and services. All these major issues are categorized into several components and are explained through indicators with various baseline issues.

The absence of a system to assess drinking water quality using standard quality at the destination is another rejected result. Results of the monitoring are made public, but there is no strategy in place to address problems with the quality of the water. Various programs to conduct benchmarking from 2018 to 2021 have continued to be carried out, but there are still obstacles to their implementation. The sustainable programs that have been carried out are shown in the table 13.

Table 13 of monitoring activities carried out since 2016-2023

Study theme and year	Study location	Financing involvement.
In 2017, the Destination Management and Natural Resources theme was a comparative study of Lombok Island, West Nusa Tenggara Province (NTB).	Sesaot village, Narmada district in West Lombok, West Nusa Tenggara Province (NTB).	Ministry of Tourism, University of Gadjah Mada as STO, Sleman District Government.
In 2017, a comparison study of the district of Pangandaran West Java, the theme of Liquid and Solid Waste Management by the Tourism Community.	Pangandaran Beach area and some particular tourist villages that deal with dense waste.	Ministry of Tourism, Tourism Department of Sleman District, Community.
In 2018, a comparative study of Bali Island in Sanur Beach, the theme of Liquid and Density Waste Management by the Sanur Coast Community.	The Sanur Beach area and some tourist villages include a specialized landfill tourist village that handles solid waste.	Ministry of Tourism, Tourism Department of Sleman District, Community.
In 2019, periodic monitoring will be done in the tourist village of Sleman district implementing sustainable tourism.	The tourist village of Pancoh and the village of Pulesari in the Turi district of Sleman.	Ministry of Tourism, Tourism Department of Sleman District, Community.

Monitoring activities for assessing local satisfaction are understood as the intersection between expectations and reality in the development of tourism activities at destinations, viewed through various perspectives. Local expectations are generally positive and can encompass various sectors, such as job creation in tourism, economic activities, improvement of social services, infrastructure development, and other related ecosystem enhancements. However, in reality, these development activities can also lead to negative outcomes such as social inequality, cultural degradation, environmental damage, resource exploitation, and other issues in destination areas. Achieving positive local satisfaction

(including community, ecological, and tourist satisfaction) in sustainable tourism development represents a major challenge for Monitoring Centers at Sustainable Tourism Observatory (STO) locations, particularly in addressing critical issues marked in red such as waste management and environmental concerns. The Monitoring Center evaluates local satisfaction through various indicator components, including satisfaction levels, community ecological satisfaction, and the number of local community complaints compared to tourist satisfaction.

Reseach Novelty: This research brings several novel contributions to the field of sustainable tourism studies. The study uniquely examines the relationship between ecological infrastructure indicators and government policy in sustainable tourism development through Structural Equation Modeling (SEM), providing a quantitative approach to understanding these complex relationships. Additionally, it offers new insights into the implementation of the National Tourism Strategic Area (KSPN) framework in Sleman district, particularly highlighting how this framework has transformed local communities across multiple sectors. The research also introduces a comprehensive assessment methodology for sustainable tourism development using 12 specific ecological infrastructure criteria based on Global Sustainable Tourism Council (GSTC) standards, creating a more structured approach to evaluating tourism sustainability.

Theoretical Implications: The study makes significant contributions to theoretical understanding in sustainable tourism development. It empirically demonstrates how environmental sensitivity and liquid waste management significantly influence government policy in sustainable tourism, adding to the existing body of knowledge in tourism policy studies. The research validates the effectiveness of collaborative governance through the Penta Helix model, showing how the integration of academic institutions, private enterprises, media outlets, community organizations, and government agencies can create more effective sustainable tourism frameworks. Furthermore, the findings expand the theoretical framework for assessing ecological infrastructure in tourism destinations, providing a more comprehensive understanding of how different environmental factors interact with policy development.

Practical Implications: The practical implications of this research span across multiple stakeholder groups. For government entities, the findings highlight the urgent need to strengthen water management systems, develop better instruments for measuring and monitoring energy consumption, and create more robust frameworks for water quality assessment. Tourism management organizations can benefit from the study's insights on improving waste management systems, developing better environmental impact monitoring systems, and enhancing coordination between different stakeholders. For local communities, the research reveals opportunities for greater involvement in tourism development, emphasizing the need for more training and capacity building in tourism management, while highlighting the importance of community participation in environmental conservation efforts.

Policy Implications: The research findings have substantial implications for policy development in sustainable tourism. They underscore the need for more comprehensive sustainable tourism policies that specifically address environmental infrastructure gaps identified in the study. The results emphasize the importance of developing integrated monitoring systems for sustainable tourism indicators, which can help track progress and identify areas needing improvement. Additionally, the findings highlight the necessity of strengthening policy frameworks for environmental protection in tourism areas, suggesting that current policies may need revision to better address environmental challenges while promoting sustainable tourism development.

Reseach Limitation: This research has several limitations that should be considered. First, the study was confined to a specific geographic area, focusing only on the Sleman district and Mount Merapi slopes in Yogyakarta Province, which may limit the generalizability of findings to other regions. The sample size of 100 respondents, though adequate for the statistical analysis employed, represents a relatively small subset of stakeholders in the tourism sector. Additionally, the research methodology relied primarily on structural equation modeling and purposive sampling, which may not capture all nuances of sustainable tourism development. The study's temporal scope, with baseline data from 2016 and monitoring activities until 2023, may not fully reflect the most current developments in the region's tourism infrastructure. Furthermore, while the research included various stakeholders, the distribution between government officials and non-government participants may not comprehensively represent all relevant perspectives, particularly lacking direct input from tourists themselves. The model's explanation of only 55.4% of the variance in government policies suggests that other significant variables influencing sustainable tourism development may not have been captured in this study. These

limitations provide opportunities for future research to expand upon these findings through broader geographical coverage, larger sample sizes, and more diverse methodological approaches.

CONCLUSION

In conceptualizing sustainable tourism development planning based on natural and cultural potential, the government prioritizes rural areas, recognizing that rural communities are more actively engaged in preserving biodiversity and maintaining regional potential as tourist attractions. Rural community-based tourism offers greater opportunities for involvement in development, particularly in environmental management. This approach provides stakeholders with a framework to enhance their strategies, enabling them to better visualize and identify boundaries and establish development priorities through a step-by-step process toward sustainable tourism destination management and development through ecotourism. A sensitive environment significantly influences government policies, highlighting the importance of environmental factors in shaping policy decisions. The impact of liquid waste management on government policy has been acknowledged as acceptable, demonstrating its alignment with regulatory frameworks. However, the influence of water management on government policies has been found insufficient, leading to its rejection. In contrast, environmentally friendly initiatives have had a positive impact, as these policies have been accepted and integrated into governance. Meanwhile, policies aimed at establishing sustainable tourism can be utilized sustainably by stakeholders throughout the planning, implementation, monitoring, and evaluation stages. However, the overall performance in this area remains weak, indicating the need for improvement.

Sustainable tourism development is a process and framework designed to meet the needs of both tourists and local communities in the present without compromising the ability of future generations to meet their own needs. This concept is founded on principles that prioritize ecosystem preservation within its carrying capacity, fulfill local community interests, enhance human quality of life in physical, spiritual, social, and cultural aspects over the long term, and promote efficient and effective use of natural resources. Economic, social, and aesthetic needs can be met while preserving cultural integrity, maintaining essential ecological processes, protecting biodiversity, and sustaining various life support systems that form the foundation of Indonesia's competitive and sustainable tourism industry.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Directorate of Community Service, Gadjah Mada University, Yogyakarta, for their valuable support and facilitation in conducting this research. Their guidance and assistance have been instrumental in ensuring the smooth execution of this study, which examines the influence of sustainable ecotourism infrastructure on local government policy within the National Strategic Tourism Area of Yogyakarta.

AUTHOR CONTRIBUTIONS

The first author contributed to developing theories and concepts related to tourism infrastructure development within the National Strategic Tourism Area (KSPN). This contribution included implementing an Integrated Approach as a systematic, structured, timely, and sustainable monitoring framework for tourism destination resources. The framework aims to enhance the understanding of tourism impacts and establish a strong foundation of real-time information to support future decision-making. Additionally, the first author played a key role in measuring performance to summarize and share real experiences from tourism destinations, particularly in monitoring the implementation of sustainable development plans, policies, and management actions. These insights were then compiled into an academic article to further disseminate knowledge and best practices.

The second author contributed by calculating and developing periodic monitoring mechanisms, which play a crucial role in ensuring the sustainable growth of the tourism sector at the destination level. This effort helps establish a structured evaluation system that supports the long-term viability of tourism infrastructure and policies. Additionally, the second author conducted extensive research to gather supporting references, ensuring that the study was well-grounded in relevant literature and empirical data.

The third author contributed by conducting performance assessments to summarize and share real-life experiences at tourism destinations, which play a crucial role in monitoring the implementation

of sustainable development plans, policies, and management actions. This effort helps evaluate the effectiveness of sustainability initiatives at the destination level. Additionally, the third author analyzed government policies on the implementation of sustainable tourism, presenting the findings within a comprehensive article framework to provide valuable insights for future improvements.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

REFERENCES

Abdussamad, H. Z., & Sik, M. S. (2021). *Metode penelitian kualitatif*. CV. Syakir Media Press.

Ali, Z. (2021). *Metode penelitian hukum*. Sinar Grafika.

Anggoro, S., Purwanti, F., & Gunawan, B. I. (2019). Strategies for sustainable ecotourism development in the marine waters of Bontang City, Indonesia. *Aquaculture, Aquarium, Conservation & Legislation*, *12*(5), 1779–1787. https://doi.org/10.15575/ks.v5i2.25632.

Ashshofa, B. (2013). *Metode penelitian hukum*. Retrieved from https://senayan.iain-palangkaraya.ac.id/akasia/index.php?p=show_detail&id=12220&keywords=

Baloch, Q. B., Shah, S. N., Iqbal, N., Sheeraz, M., Asadullah, M., Mahar, S., & Khan, A. U. (2023). Impact of tourism development upon environmental sustainability: a suggested framework for sustainable ecotourism. *Environmental Science and Pollution Research*, *30*(3), 5917–5930. https://doi.org/10.1007/s11356-022-22496-w.

Barkauskiene, K., & Snieska, V. (2013). Ecotourism as an Integral part of sustainable tourism development. *Economics & Management*, *18*(3). https://doi.org/10.5755/j01.em.18.3.4272.

Bezuhla, L. (2020). Impact of the macro environment on the ecotourism infrastructure. *Green, Blue and Digital Economy Journal*, *1*(2), 33–38. https://doi.org/10.30525/2661-5169/2020-2-6.

Bhuiyan, M., Siwar, C., Ismail, S., & Islam, R. (2012). The role of ecotourism for sustainable development in East Coast Economic Region (Ecer), Malaysia. *OIDA International Journal of Sustainable Development*, *3*(9), 53–60. https://ssrn.com/abstract=2035588.

Blersch, D. M., & Kangas, P. C. (2013). A modeling analysis of the sustainability of ecotourism in Belize. *Environment, Development and Sustainability*, *15*, 67–80. https://doi.org/10.1007/s10668-012-9374-4.

Boley, B. B., & Green, G. T. (2016). Ecotourism and natural resource conservation: the 'potential' for a sustainable symbiotic relationship. *Journal of Ecotourism*, *15*(1), 36–50. https://doi.org/10.1080/14724049.2015.1094080.

Butler, R. W. (1998). Sustainable tourism: A state-of-the-art review. *Tourism Geographies*, *1*(1), 7–25. https://doi.org/10.1080/14616689908721291.

Candido, L. F., Araujo, D. de S., Leocadio, A. L., Guimaraes, D. B., & Ponchio, M. C. (2024). Sustainable behavior in nature tourism travel: the influence of local infrastructure. *Revista de Administracao Da UFSM*, *17*, e3. https://doi.org/10.5902/1983465984320.

Choi, Y. E., Doh, M., Park, S., & Chon, J. (2017). Transformation planning of ecotourism systems to invigorate responsible tourism. *Sustainability*, *9*(12), 2248. https://doi.org/10.3390/su9122248.

Choi, Y. E., Song, K., Kim, M., & Lee, J. (2017). Transformation planning for resilient wildlife habitats in ecotourism systems. *Sustainability*, *9*(4), 487. https://doi.org/10.3390/su9122248.

Clifton, J., & Benson, A. (2006). Planning for sustainable ecotourism: The case for research ecotourism in developing country destinations. *Journal of Sustainable Tourism*, *14*(3), 238–254. https://doi.org/10.1080/09669580608669057.

Demolinggo, R. H., Damanik, D., Wiweka, K., & Adnyana, P. P. (2020). Sustainable tourist villages management based on javanese local wisdom "memayu hayuning bawono" best practice of desa wisata pentingsari, yogyakarta'. *International Journal of Tourism & Hospitality Reviews*, *7*(2), 41–53. https://doi.org/10.18510/ijthr.2020.725.

Dunets, A. N., Vakhrushev, I. B., Sukhova, M. G., Sokolov, M. S., Utkina, K. M., & Shichiyakh, R. A. (2019). Selection of strategic priorities for sustainable development of tourism in a mountain region: concentration of tourist infrastructure or nature-oriented tourism. *Entrepreneurship and Sustainability Issues*, *7*(2), 1217. http://doi.org/10.9770/jesi.2019.7.2(29).

Dzhandzhugazova, E. A., Maksanova, L. B., Bardakhanova, T. B., Ponomareva, I. Y., & Blinova, E. A. (2019). Ecotourism development in Russia: analysis of best regional practices. *Ekoloji*, *28*(107), 411–415. https://doi.org/10.3390/su151813661.

Endra, K., & Villaflor, G. M. (2024). Integration of the POE Model and Metaphoral Thinking in Student Worksheets: Improving Mathematical Reasoning Abilities in the Modern Education Era. *Journal of Educational Technology and Learning Creativity*, *2*(1), 41-53. https://doi.org/10.37251/jetlc.v2i1.981.

Fitriana, H., & Waswa, A. N. (2024). The Influence of a Realistic Mathematics Education Approach on Students' Mathematical Problem Solving Ability. *Interval: Indonesian Journal of Mathematical Education*, *2*(1), 29-35. https://doi.org/10.37251/ijome.v2i1.979.

Grieves, M., Adler, M., & King, R. (2014). To preserve the mountains and the community: Indigenous ecotourism as a sustainable development strategy. *Social Thought & Research: A Continuation of the Mid-American Review of Sociology*, 83–111. https://doi.org/10.17161/STR.1808.18446.

Habchak, N. F., & Dubis, L. F. (2022). Analysis of ecotourism infrastructure within the nature-protected areas of the Transcarpathian region (on the example of National Nature Park "Synevyr"). *Journal of Geology, Geography and Geoecology*, *31*(1), 22–30. https://doi.org/10.15421/112203.

Hadi, C. E., Reinarto, R., & Rahadi, R. A. (2021). Conceptual Analysis of Sustainable Tourism Management in Indonesia. *Journal of Tourism, Hospitality and Environment Management*, *6*(23), 35–41. https://doi.org/10.35631/JTHEM.623004.

Hanoum, N. A., Villaverde, K., Saputra, Y., Nuhuyeva, Aehla, & Ye, T. (2024). Design and development of tempe fermentation tool based on fuzzy method to determine tempe maturity level. *Journal of Educational Technology and Learning Creativity*, *2*(2), 235-255. https://doi.org/10.37251/jetlc.v2i2.1418.

Hendrayani, Y., & Darmastuti, S. (2019). Local Government Partnership Strategy in Realizing Sustainable Tourism in East Lombok Indonesia. *International Journal of Multicultural and Multireligious Understanding*, *6*(8), 43–53. https://doi.org/10.18415/ijmmu.

Heshmati, M., Nemati, A., Gheitury, M., Ahmadi, M., & Mohebi, A. (2023). *Evaluation factors threatening ecotourism and its needed infrastructures for sustainable natural resources in Kermanshah province, Iran*. https://doi.org/10.22034/IWM.2023.1998777.1069.

Hyskaj, A., Ramadhanti, A., Farhan , H., Allaham, A., & Ismail, M. A. (2024). Analysis of the role of the flo application as a digital educational media for adolescent reproductive health in the technology era. *Journal of Educational Technology and Learning Creativity*, *2*(1), 71-82. https://doi.org/10.37251/jetlc.v2i1.1414.

Imani, B., & Alavi, S. (2022). An Analysis of the Infrastructure for the Development of Rural Ecotourism in Ardabil Province. *Journal of Research and Rural Planning*, *11*(4), 73–98. https://doi.org/10.22067/jrrp.v11i4.2207.1053.

Kaffashi, S., Radam, A., Shamsudin, M. N., Yacob, M. R., & Nordin, N. H. (2015). Ecological conservation, ecotourism, and sustainable management: The case of Penang National Park. *Forests*, *6*(7), 2345–2370. https://doi.org/10.3390/f6072345.

KC, A., Ghimire, S., & Dhakal, A. (2021). Ecotourism and its impact on indigenous people and their local environment: case of Ghalegaun and Golaghat of Nepal. *GeoJournal*, *86*, 2747–2765. https://doi.org/10.1007/s10708-020-10222-3.

Khalid, S., Ahmad, M. S., Ramayah, T., Hwang, J., & Kim, I. (2019). Community empowerment and sustainable tourism development: The mediating role of community support for tourism. *Sustainability*, *11*(22), 6248. https://doi.org/10.3390/su11226248.

Kimbu, A. (2011). The role of transport and accommodation infrastructure in the development of eco/nature tourism in Cameroon. *Tourism Analysis*, *16*(2), 137–156. https://doi.org/10.3727/108354211X13014081270323.

Kiper, T. (2013). *Role of ecotourism in sustainable development*. InTech.

Koliopoulos, T. K., Kouloumbis, P., Ciarkowska, K., Antonkiewicz, J., & Gambus, F. (2021). A roadmap for integrated green health ecotourism infrastructures, safe cultural heritage experience and agritourism destinations in the post Covid-19 pandemic era. *Advances in Tourism, Technology and Systems: Selected Papers from ICOTTS20, Volume 1*, 108–119. https://doi.org/10.1007/978-981-33-4256-9_10.

Kumar, S., Hasija, N., Kumar, V., & Sageena, G. (2023). Ecotourism: a holistic assessment of environmental and socioeconomic effects towards sustainable development. *Current World Environment*, *18*(2), 589–607. http://dx.doi.org/10.12944/CWE.18.2.14.

Kusumastuti, A., & Khoiron, A. M. (2019). *Metode penelitian kualitatif*. Lembaga Pendidikan Sukarno Pressindo (LPSP).

Lemy, D. M., Teguh, F., & Pramezwary, A. (2019). Tourism development in Indonesia. In *Delivering Tourism Intelligence* (Vol. 11, pp. 91–108). Emerald Publishing Limited. https://doi.org/10.1108/S2042-144320190000011009.

Leon-Gomez, A., Ruiz-Palomo, D., Fernandez-Gamez, M. A., & Garcia-Revilla, M. R. (2021). Sustainable tourism development and economic growth: Bibliometric review and analysis. *Sustainability*, *13*(4), 2270. https://doi.org/10.3390/su13042270.

Maslovskaia, O., Kopeva, A., Petrova, E., Ivanova, O., & Khrapko, O. (2020). Development of ecotourism infrastructure at protected areas of Primorsky Krai. *IOP Conference Series: Materials Science and Engineering*, *890*(1), 012002. https://doi.org/10.1088/1757-899X/890/1/012002.

Maudia, N., Awodeyi, A. F., & Mohammed, A. S. (2024). Enhancing pedagogical content knowledge in mathematics teachers through collaborative professional development. *Interval: Indonesian Journal of Mathematical Education*, *2*(1), 36-49. https://doi.org/10.37251/ijome.v2i1.1342.

Mbaiwa, J. E., & Stronza, A. L. (2009). The challenges and prospects for sustainable tourism and ecotourism in developing countries. *The SAGE Handbook of Tourism Studies*, 333–353. https://doi.org/10.4135/9780857021076.n19.

Miharja, M. A., Bulayi, M., & Triet, L. V. M. (2024). Realistic mathematics education: Unlocking problem-solving potential in students. *Interval: Indonesian Journal of Mathematical Education*, *2*(1), 50-59. https://doi.org/10.37251/ijome.v2i1.1344.

Munthomimah, R., Yamin, M., & Rusdi, M. (2022). Exploring physics: Engaging Inquiry-Based labs for sman 1 Muaro Jambi's Class X. *Tekno - Pedagogi : Jurnal Teknologi Pendidikan*, *12*(2), 10-19. https://doi.org/10.22437/teknopedagogi.v12i2.32523.

Nasution, A. F. (2023). *Metode penelitian kualitatif*. Harfa Creative, Bandung

Neger, C. (2022). Ecotourism in crisis: an analysis of the main obstacles for the sector's economic sustainability. *Journal of Ecotourism*, *21*(4), 311–333. https://doi.org/10.1080/14724049.2021.1942019.

Nikolskaya, E. Y., Uspenskaya, M. E., Galkin, D. V., & Shelygov, A. V. (2022). Economic and legal aspects of developing ecotourism infrastructure. *Relações Internacionais No Mundo Atual*, *4*(37), 690–700. http://dx.doi.org/10.21902/Revrima.v4i37.5928.

Omarzadeh, D., Pourmoradian, S., Feizizadeh, B., Khallaghi, H., Sharifi, A., & Kamran, K. V. (2022a). A GIS-based multiple ecotourism sustainability assessment of West Azerbaijan province, Iran. *Journal of Environmental Planning and Management*, *65*(3), 490–513. https://doi.org/10.1080/09640568.2021.1887827.

Omarzadeh, D., Pourmoradian, S., Feizizadeh, B., Khallaghi, H., Sharifi, A., & Kamran, K. V. (2022b). A GIS-based multiple ecotourism sustainability assessment of West Azerbaijan province, Iran. *Journal of Environmental Planning and Management*, *65*(3), 490–513. https://doi.org/10.1080/09640568.2021.1887827.

Parker, S., & Khare, A. (2005). Understanding success factors for ensuring sustainability in ecotourism development in southern Africa. *Journal of Ecotourism*, *4*(1), 32–46. https://doi.org/10.1080/14724040508668436.

Pasape, L., Anderson, W., & Lindi, G. (2012). *Towards sustainable ecotourism through stakeholder collaborations in Tanzania*. http://dx.doi.org/10.4172/2324-8807.1000109.

Pasape, L., Anderson, W., & Lindi, G. (2015). Assessment of indicators of sustainable ecotourism in Tanzania. *Anatolia*, *26*(1), 73–84. https://doi.org/10.1080/13032917.2014.912244.

Pujar, S. C., & Mishra, N. (2021). Ecotourism industry in India: a review of current practices and prospects. *Anatolia*, *32*(2), 289–302. https://doi.org/10.1080/13032917.2020.1861040.

Rahardjo, M. (2011). *Metode pengumpulan data penelitian kualitatif*. Retrieved from http://repository.uin-malang.ac.id/1123/.

Rahmah, M., Nugroho, A., & Darmansyah, D. (2025). Systematic Literature Review On Sustainable Cities And Communities: The Role Of Eco-Tourism Industry, Creativity And Innovation, And Infrastructure Investment. *International Journal of Social Science*, *4*(5), 651–658. https://doi.org/10.53625/ijss.v4i5.9623

Rhama, B., Timang, J. H., Palangka, J. R., & Raya, K. P. (2020). The meta-analysis of Ecotourism in National Parks. *African Journal of Hospitality, Tourism and Leisure*, *9*(1), 1–17. https://doaj.org/article/6129514d22484ac3b6a06c1cd98d35f1

Risnawati, R., Ramadan, M., Baba, K., Hammad, S., & Rustaminezhad, M. A. (2024). The impact of Augmented Reality-Based learning media on students' digital literacy skills: A study on junior high school students. *Journal of Educational Technology and Learning Creativity*, *2*(1), 63-70. https://doi.org/10.37251/jetlc.v2i1.1415.

Robledano, F., Esteve, M. A., Calvo, J. F., Martínez-Paz, J. M., Farinós, P., Carreño, M. F., Soto, I., Avilés, M., Ballesteros, G. A., & Martínez-Baños, P. (2018). Multi-criteria assessment of a proposed ecotourism, environmental education and research infrastructure in a unique lagoon ecosystem: The Encañizadas del Mar Menor (Murcia, SE Spain). *Journal for Nature Conservation*, *43*, 201–210. https://doi.org/10.1016/j.jnc.2017.10.007.

Samia, D. S. M., Angeloni, L. M., Bearzi, M., Bessa, E., Crooks, K. R., D'Amico, M., Ellenberg, U., Geffroy, B., Larson, C. L., & Loyola, R. (2017). Best practices toward sustainable ecotourism. *Ecotourism's Promise and Peril: A Biological Evaluation*, 153–178. https://doi.org/10.1007/978-3-319-58331-0_10.

Saptatiningsih, R. I. (2019). *The Importance of Yogyakarta Duchy Tourism Village Management in Realizing Sustainable Tourism Development (Similarity)*. Retrieved from http://repository.upy.ac.id/2365/1/Similarity%20Check%20The%20Important.pdf

Saputra, A., Musonda, A., & Nikolantonakis, K. (2024). Transformation of Character Assessment through ICT Technology: A Study of the Use of Web-Based Platforms. *Interval: Indonesian Journal of Mathematical Education*, *2*(1), 60-68. https://doi.org/10.37251/ijome.v2i1.1345.

Sayyed, M. R. G. (2013). SWOT analysis of Tandooreh National Park (NE Iran) for sustainable ecotourism. *Proceedings of the International Academy of Ecology and Environmental Sciences*, *3*(4), 296. https://doi.org/10.35248/2167-0269.23.12.517.

Setini, M., Wardana, I., Sukaatmadja, I., Ekawati, N., Yasa, N., & Astawa, I. (2021). Policy models for improving ecotourism performance to build quality tourism experience and sustainable tourism. *Management Science Letters*, *11*(2), 595–608. http://dx.doi.org/10.5267/j.msl.2020.9.007.

Singgalen, Y. A. (2022). Tourism infrastructure development and transformation of vegetation index in Dodola Island of Morotai Island Regency. *Journal of Information Systems and Informatics*, *4*(1), 130–144. https://doi.org/10.51519/journalisi.v4i1.230.

Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The systematic literature review. *Sustainable Development*, *29*(1), 259–271. https://doi.org/10.1002/sd.2133.

Taurusi, T., Septi, S. E., & Osma, U. S. (2024). Discovery learning model to improve creative thinking skills and ability to understand concepts in ohm's law material: Meta analysis. *EduFisika: Jurnal Pendidikan Fisika*, *9*(1), 104-116. https://doi.org/10.59052/edufisika.v9i1.32640.

Thompson, B. S. (2022). Ecotourism anywhere? The lure of ecotourism and the need to scrutinize the potential competitiveness of ecotourism developments. *Tourism Management*, *92*, 104568. https://doi.org/10.1016/j.tourman.2022.104568.

Tjilen, A. P., Sahetapy, W., Tambaip, B., & Betaubun, M. (2022). Ecotourism development policy, supporting capacity and development of sustainable tourism facilities and infrastructure in Raja Ampat Regency, West Papua Province. *International Journal of Science and Society (IJSOC)*, *4*(03). https://doi.org/10.1016/j.tourman.2022.104568.

Triyasmina, T., Rusdi, M., Asyhar, R., Dachia, H. A., & Rukondo, N. (2022). Chemistry learning revolution: Interactive multimedia E-Learning with a problem based learning approach. *Tekno - Pedagogi : Jurnal Teknologi Pendidikan*, *12*(2), 1-9. https://doi.org/10.22437/teknopedagogi.v12i2.32521.

Valanszki, I., Foris, E. D., & Kovacs, K. F. (2018). Parallel development of green infrastructure and sustainable tourism-case studies from Hungary. *Polish Journal of Natural Sciences*, *33*(4), 625–647. https://doi.org/10.54783/ijsoc.v4i3.493.

Voronkova, V., Nikitenko, V., Oleksenko, R., Cherep, A., Cherep, O., & Harbar, H. (2024). The creative development of green ecotourism concept as a sustainable development factor. *Revista de La Universidad Del Zulia*, *15*(42), 370–388. http://dx.doi.org/10.46925//rdluz.42.21.

Wahidmurni, W. (2017). *Pemaparan metode penelitian kualitatif*. Retrieved from http://repository.uin-malang.ac.id/1984/

Wahono, P., Poernomo, D., & Kusumah, M. S. (2019). Strategy for developing sustainable ecotourism. *IOP Conference Series: Earth and Environmental Science*, *361*(1), 012014. https://doi.org/10.1088/1755-1315/361/1/012014.

Wulandari, M., Rodriguez, E. V. ., & Afrianda, S. (2024). Analysis of high school students' creativity ability in solving physics problems. *EduFisika: Jurnal Pendidikan Fisika*, *9*(1), 117-122. https://doi.org/10.59052/edufisika.v9i1.29637.

Yamin, M., Darmawan, A., & Rosyadi, S. (2021). Analysis of Indonesian tourism potentials through the sustainable tourism perspective in the new normal era. *Jurnal Hubungan Internasional*, *10*(1), 44–58. https://doi.org/10.18196/hi.v10i1.10500.

Zakiyah, Z., Boonma, K., & Collado, R. (2024). Physics learning innovation: Song and Animation-Based media as a learning solution for mirrors and lenses for junior high school students. *Journal of Educational Technology and Learning Creativity*, *2*(2), 183-191. https://doi.org/10.37251/jetlc.v2i2.1062.

Zulkarnain, I., Rumanti, A. A., Prambudia, Y., Rizaldi, A. S., & Amelia, M. (2024). Sustainable Ecotourism Development Through Open Innovation and Infrastructure Facilities: Systems Modeling Approach. *2024 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, 703–707. https://doi.org/10.1109/IEEM62345.2024.10857216.