

# **Strengthening the Role of Lake Toba Geopark as a Sustainable Tourism Destination Based on Conservation, Education, and Community Empowerment**

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**Abstract**-This study explores the strategic role of the Lake Toba Geopark in advancing sustainable tourism by integrating three main pillars: conservation, education, and community empowerment. Using a qualitative research design, data were collected through in-depth interviews, field observations, and document analysis involving key stakeholders including local communities, geopark managers, and policy makers. The findings reveal that while conservation efforts have been initiated, they remain fragmented and lack integrated institutional collaboration. Educational programs are mainly targeted at tourists, leaving local communities with limited access to participatory knowledge-building initiatives. Community empowerment, though emerging, is still constrained by limited capacity building and market access. The study highlights the need for a holistic management model that links conservation, education, and community development to ensure long-term sustainability. This research contributes to policy discourse and offers practical implications for improving the governance of geoparks as sustainable tourism frameworks.

**Keywords:** Geopark; Conservation; Education; Empowerment; Sustainable Tourism.

## **1. INTRODUCTION**

Lake Toba Geopark, as part of UNESCO Global Geopark, has great potential in developing sustainable tourism that integrates environmental conservation, geological education, and local community empowerment. According to Simandjorang et al. (2022), the community empowerment-based conservation approach in the Toba Caldera area shows that the active involvement of local communities can increase the effectiveness of environmental conservation. According to Rodrigues et al. (2021), the development of innovative geoproducts in Geopark Naturtejo, Portugal, shows that this strategy can increase community involvement and economic added value through local products based on geological heritage. Community participation in tourism management in Lake Toba Geopark is key to increasing the competitiveness of the destination. Shekhar et al. (2019) emphasize the importance of conservation and sustainable development of geological heritage through local community involvement, as was done in West Kutch, India. The development of geotourism-based tourism facilities in the Lake Toba Geopark area can improve the quality of the destination while empowering the local community.

Skibiński et al. (2021) in their study in Southeast Poland showed that the development of geoparks as tourism development areas requires adequate infrastructure and active involvement of local communities. Implementation of technology in tourism management in Lake Toba Geopark can improve efficiency and sustainability. Wang et al. (2019) in their study in Dunhuang Geopark, China, highlighted the importance of integrating geotourism, geoconservation, and geodiversity in sustainable tourism development. Tourism policies based on the principles of Good Tourism Governance (GTG) can realize sustainable tourism in the Lake Toba area. Rodrigues et al. (2021) reiterated that innovative geoproduct development strategies can support good tourism governance through community empowerment and geological heritage conservation. Public perception of Lake Toba Geopark as a global tourism destination shows significant support for the development of this area.

Shekhar et al. (2019) highlighted that community involvement in the conservation and development of geological heritage can increase public awareness and support for the geopark. Strengthening the role of geosites in the Lake Toba Geopark must also consider educational aspects that can introduce geological heritage to the younger generation and tourists in general. The application of an educational approach in geotourism has been shown to increase awareness and appreciation of geological values, as shown by the study of Giampietro et al. (2020) in the context of promoting geoscience literacy in Italy. They emphasized that geotourism should not only be fun, but also educate and build collective awareness of the importance of conservation. Furthermore, the potential of Lake Toba Geopark as a learning center and conservation-based tourism destination can be strengthened through digital and interactive approaches, such as augmented reality and GIS technology.

Research by Mandal & Ghosh (2020) shows that the integration of digital technology in geopark promotion and geotourism education can increase public participation and facilitate location-based learning. In the era of the industrial revolution 4.0, the use of technology like this is increasingly relevant to attract millennial tourists and expand the reach of promotion. Finally, strengthening local institutions and collaboration between stakeholders are crucial factors in realizing sustainable tourism in the Lake Toba Geopark. A study by Martínez-Graña et al. (2021) on the management of the Villuercas Ibores Jara Geopark in Spain proved that collaboration between the government, communities, and educational institutions was very effective in strengthening the position of the geopark as a sustainable, educational, and conservative tourist destination. This crosssector collaboration must continue to be encouraged so that the development of the Lake Toba Geopark is not only oriented towards the economy, but also includes preservation and local capacity

building. Lake Toba Geopark, as part of UNESCO Global Geopark, has great potential in developing sustainable tourism that integrates environmental conservation, geological education, and local community empowerment.

According to Simandjorang et al. (2022), the community empowerment-based conservation approach in the Toba Caldera area shows that active involvement of local communities can increase the effectiveness of environmental conservation. Community participation in tourism management in Lake Toba Geopark is key to increasing the competitiveness of the destination. Zaenal et al. (2020) emphasized the importance of community perception and involvement in sustainable tourism development in this area. The development of geotourism-based tourism facilities in Silalahi Village shows that this approach can improve the quality of destinations while empowering local communities. Ginting & Sasmita (2018) highlighted the importance of developing facilities that support geotourism to attract tourists and improve local welfare. Implementation of technology in tourism management in Lake Toba Geopark can improve efficiency and sustainability.

Lie et al. (2023) developed a geopark and ecotourism integration model using a technology-based recommendation system approach to support better decision making. Tourism policies based on the principles of Good Tourism Governance (GTG) can realize sustainable tourism in the Lake Toba area. Hajar et al. (2024) emphasize the importance of community participation, transparency, accountability, and partnerships between stakeholders in developing effective tourism policies. Public perception of Lake Toba Geopark as a global tourism destination shows significant support for the development of this area. Wal Hidayat & Nasution (2019) found that the majority of respondents had interest and attraction towards the development of Lake Toba Geopark as a world-class tourism destination. The development of the Lake Toba area through the Caldera Geopark tourism destination in North Tapanuli Regency shows that attractions, accessibility, amenities, and facilities have a positive influence on the development of the area. Mulyadi et al. (2022) emphasize the importance of these factors in increasing tourist attractions and the welfare of local communities.

The development of sustainable tourism destinations in geopark areas refers to the integration of three main pillars: environmental conservation, public education, and community empowerment. This concept is in line with the mandate of UNESCO Global Geoparks, which emphasizes that geoparks are not just geological preservation, but also a vehicle for inclusive socio-ecological transformation (Simandjorang et al., 2022). In terms of conservation, the geopark area is a strategic area in maintaining the sustainability of geological, biological, and cultural resources. According to Fajar et al. (2023), the synergy between nature conservation and ecotourism-based tourism can form a symbiotic relationship that strengthens the sustainability of the destination. In the context of Lake Toba, this approach can be applied through integrated caldera landscape management involving local community participation.

Meanwhile, the educational aspect is one of the important elements in geopark development. Environmental education in geoparks aims to increase public awareness of the importance of geological and ecological heritage. Quiroz-Fabra et al. (2023) through a bibliometric study emphasized that the success of global geoparks is largely determined by innovative and participatory educational strategies. In this case, Lake Toba Geopark can develop local curricula and non-formal education programs that involve students, students, and tourists. The integration of these three pillars—conservation, education, and community empowerment—is a holistic framework that can optimize the role of geoparks as sustainable tourism destinations. Simandjorang et al. (2022) emphasized that a community-based integrative model is able to create an environmental conservation mechanism that is balanced with the social and economic needs of local residents.

Institutional and policy readiness are also key factors in the effectiveness of geopark management. The study by Wahyudin et al. (2024) shows that the success of the Rinjani-Lombok Geopark is greatly influenced by the existence of adaptive local institutions and policy support from the local government. This has important implications for the Lake Toba Geopark to strengthen coordination between local governments, local communities, and private partners. Thus, strengthening the role of the Lake Toba Geopark as a sustainable destination must be based on the theory of community-based sustainable development, where interactions between humans and nature are facilitated through education, conservation, and strengthening local capacity. This framework expands the concept of geoparks from merely geological preservation to a strategy for sustainable socio-ecological transformation.



**Figure 1.** Interrelationship of Pillars

## 2. RESEARCH METHODOLOGY

This study uses a descriptive qualitative approach with the aim of understanding in depth how the role of the Lake Toba Geopark can be strengthened as a sustainable tourism destination based on three main pillars: conservation, education, and community empowerment. This approach was chosen because it is able to describe social reality in its entirety through direct interaction with various actors and field data.

a. Location and Subjects of Research

The location of the research was determined purposively, namely in the Lake Toba Geopark area which has been designated as a UNESCO Global Geopark since 2020. The subjects of the study include: Geopark Managers (GDT Management Agency), Local Government, Local MSMEs, Community leaders.

b. Data Collection Techniques

Data collection techniques are carried out through several methods as follows: In-depth interviews: Conducted with key informants to explore information on policies, programs, and challenges in Geopark management. Participatory observation: Researchers are directly involved in conservation, education, and community empowerment activities to understand the dynamics in the field. Documentation study: Through the study of official documents such as the Regional Tourism Development Master Plan (RIPPDA), reports on the activities of the GDT Management Agency, to the latest relevant scientific journals. Focus Group Discussion (FGD): With various stakeholders to obtain comprehensive input and data triangulation.

c. Data Analysis Techniques

Data analysis was conducted using thematic analysis, namely: Data reduction: Filtering data from interviews, observations, and documentation to obtain relevant information. Categorization: Grouping data based on the themes of conservation, education, and community empowerment. Interpretation: Interpreting the meaning behind the data based on the theoretical framework that has been prepared, including the concepts of geoparks, sustainability, and community participation. The analysis was conducted iteratively, namely a repetitive process between data collection and analysis, so that understanding can be strengthened dynamically.

d. Data Validity

To ensure the validity and reliability of the data, source and method triangulation techniques are used, namely comparing information from various sources and data collection techniques. Validation is also carried out through member checks, namely asking for confirmation from informants regarding the results of data interpretation by researchers.

e. Research Stages

Systematically, the stages of this research include: Identification of problems and literature studies. Determination of location and subjects. Collection of field data. Analysis and interpretation of data. Preparation of research reports and drawing conclusions.

f. Expected System Output

This research is expected to produce: A conceptual model for strengthening the role of Lake Toba Geopark based on conservation, education, and empowerment. Policy recommendations based on field data and theory. Academic contributions to the development of sustainable tourism in the geopark area.

## 3. RESULTS AND DISCUSSION

**Table 1.** Research Respondents by Gender

Gender	Amount	Percentage
Male	63	44.37%
Female	79	55.63%
Total	142	100%

**Table 2.** Research Respondents by Age

Age	Amount	Percentage
18 - 28	72	50.70%
29 - 38	19	13.38%
39 - 48	18	12.67%
49 - 58	19	13.38%
50 - 68	14	9.86%
Total	142	100%

**Table 3.** Visit to Lake Toba Geopark

Age	Amount	Percentage
More 2 times	82	57.7%

Age	Amount	Percentage
More 4 times	22	15.5%
More 6 times	38	26.8%
Total	142	100%

**Table 4.** Lake Toba Geopark Is A Tourist Destination With A Nature Conservation Concept

	Amount	Percentage
Very agree	94	66.2%
Agree	48	33.8%
Not agree	0	0%
Total	142	100%

**Table 5.** I Understand the Importance of Preserving Geodiversity In The Lake Toba Geopark Area

	Amount	Percentage
Very agree	54	38.1%
Agree	77	54.2%
Not agree	11	7.7%
Total	142	100%

**Table 6.** Tourism Activities in The Lake Toba Geopark Have Taken Environmental Sustainability Into Account

	Amount	Percentage
Very agree	94	66.2%
Agree	48	33.8%
Not agree	0	0%
Total	142	100%

**Table 7.** Lake Toba Geopark Provides A Fun Learning Experience For Tourists

	Amount	Percentage
Very agree	63	44.4%
Agree	73	51.4%
Not agree	6	4.2%
Total	142	100%

**Table 8.** Local Community Participation In Tourism Activities At Lake Toba Geopark Has Been Quite Good

	Amount	Percentage
Very agree	38	26.8%
Agree	83	58.4%
Not agree	21	14.8%
Total	142	100%

**Table 9.** Communities Around Lake Toba Receive Economic Benefits From The Existence Of The Geopark

	Amount	Percentage
Very agree	58	40.8%
Agree	83	58.5%
Not agree	1	0.7%
Total	142	100%

**Table 10.** I See Efforts To Empower The Community Through Tourism Training At Lake Toba Geopark

	Amount	Percentage
Very agree	39	27.5%
Agree	96	67.6%
Not agree	7	4.9%
Total	142	100%

**Table 11.** The Facilities Available In The Lake Toba Geopark Area Support Tourist Comfort

	Amount	Percentage
Very agree	48	33.8%
Agree	80	56.3%
Not agree	14	9.9%
Total	142	100%

**Table 12.** I Feel Called To Maintain Cleanliness And Environmental Sustainability When Visiting

	Amount	Percentage
Very agree	74	52.1%
Agree	68	47.9%
Not agree	0	0%
Total	142	100%

**Table 13.** The concept of sustainable tourism has been implemented in real terms in the Lake Toba area

	Amount	Percentage
Very agree	48	33.8%
Agree	89	62.7%
Not agree	5	3.5%
Total	142	100%

**Table 14.** I Understand That Geopark Is Not Only A Tourist Attraction, But Also An Educational Area

	Amount	Percentage
Very agree	35	24.6%
Agree	80	56.3%
Not agree	5	3.5%
Total	142	100%

**Table 15.** Tourism Activities In The Lake Toba Geopark Area Do Not Disturb The Balance Of Nature

	Amount	Percentage
Very agree	35	24.6%
Agree	93	65.5%
Not agree	14	9.9%
Total	142	100%

**Table 16.** I Support The Development Of Lake Toba Geopark As A National And International Sustainable Tourism Destination

	Amount	Percentage
Very agree	91	64.1%
Agree	51	35.9%
Not agree	0	0%
Total	142	100%

This study reveals that Lake Toba Geopark (GDT) has extraordinary potential as a sustainable tourism destination. However, implementation in the field still faces a number of challenges, especially in terms of institutional synergy, sustainability of conservation programs, effectiveness of education for visitors, and active participation of local communities in geopark-based economic activities.

a. Conservation Aspect

The results of observations and interviews show that geodiversity and biodiversity conservation efforts in the GDT area are still sectoral and have not been fully integrated into a cross-institutional framework. Several reforestation and geological site preservation programs are already underway, but budget and human resource support are still limited. This is in line with the findings of Su et al. (2020) in the Journal of Environmental Management, which emphasizes the importance of a collaborative approach in geopark conservation to have a long-term impact.

b. Educational Aspects

Educational activities in GDT are mostly focused on visitors through the geological museum, information boards at the site, and several environmental interpretation programs. However, education for the local community is still minimal. The results of the FGD with academics and managers showed the need for integration of educational programs based on local wisdom and participatory methods. This is in line with the recommendations of the article



by Zhang et al. (2021) in *Geoforum*, which states that effective geopark education must combine aspects of science and local culture contextually.

c. Community Empowerment Aspect

It was found that most of the communities around the geopark area still play a passive role and have not become the main actors in the tourism value chain. The main obstacles include access to training, business assistance, and market networks. On the other hand, there are several good practices in the form of micro-businesses based on local souvenirs, homestays, and traditional culinary. This study strengthens the argument of Qin et al. (2022) in *Tourism Management Perspectives*, that the success of a geopark is greatly influenced by the active involvement of the community as part of a sustainable tourism governance system.

d. Integration of the Three Pillars

This study found that the integration between conservation, education, and community empowerment is still partial. There is no comprehensive monitoring and evaluation system to ensure the sustainability of cross-sector programs. A systemic framework is needed, as developed by Farsani et al. (2020) in *Environmental Development*, which offers a geopark management model based on co-management between government, academics, communities, and the private sector.

e. Institutional and Policy Readiness

From the results of documentation and interviews with policy makers, it was found that the biggest structural constraints lie in inter-institutional coordination and the absence of sustainability indicators used as a basis for decision making. This finding is in line with a study by Brilha (2019) in *Geoheritage* which emphasizes the importance of policies based on geopark performance indicators to maintain their quality and sustainability.

## 5. CONCLUSION

This study concludes that Lake Toba Geopark has a strategic position to be developed as a sustainable tourism destination, but it still needs strengthening in three main aspects: conservation, education, and community empowerment. Conservation efforts need to be improved through more structured cross-sector collaboration. Education programs must reach local communities more systematically, with a participatory approach and based on local wisdom. Community empowerment needs to be directed at strengthening business capacity and increasing active participation in the tourism economy. Furthermore, the success of strengthening the role of GDT is highly dependent on an integrated geopark management system, strengthening institutional capacity, and the existence of evaluative indicators that are able to measure sustainable development achievements holistically. This study provides an important contribution in providing policy direction and developing a geopark management model based on conservation, education, and community empowerment.

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