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Analyzing the influence of geopark kaldera toba development on the architecture of the toba community in samosir regency

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Abstract
This study focuses on the development and significance of Geopark Kaldera Toba in Samosir Regency as a UNESCO Global Geopark. The research employed a qualitative approach and descriptive design, gathering information from key informants, primary informants, and additional informants. The findings reveal the unique architectural heritage of traditional Batak houses in the region, showcasing a harmonious blend of traditional and modern aesthetics. Geopark Kaldera Toba fulfills the criteria set by the Geopark Guideline and Criteria, emphasizing conservation, education, and geotourism. To maintain its UNESCO Global Geopark status, the geopark needs to develop linkages between geological heritage and other territorial heritages, strengthen partnerships, engage in global networks, enhance education strategies, and promote research and conservation efforts. The study highlights the importance of maintaining the connection between geology and ecology while actively sharing knowledge with visitors to foster the sustainable development of Geopark Kaldera Toba.

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Introduction

Tourism is the most effective sector for boosting Indonesia's foreign exchange reserves. One of the reasons is the availability of resources required for tourism development within the country (Rahma, 2020) [15]. Besides human resources (HR), these resources include the vast territory and diversity found in the country (Zaman *et al*., 2021) [20]. These resources are a distinct attraction for international tourists. This is because tourism is considered a lucrative sector to be developed as a promising asset that provides a sustainable source of income.

During the 209th Session of the Executive Council of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Toba Caldera was designated as a UNESCO Global Geopark. The Executive Council members at the session designated 16 new UNESCO Global Geoparks, including the Toba Caldera Geopark. A geopark is a clearly demarcated area with a sufficiently large surface area for local economic development (Nasution *et al*., 2021) [3]. Geoparks comprise not only various geological diversities of special significance, rarity, and beauty, known as geological heritage, but also cultural and biotic diversity (Han *et al*., 2018) [4]. Geoparks are classified into three categories: global, national, and local geoparks (Oktariadi, 2017) [13]. Indonesia has national-scale geoparks, namely the Batur-Bali Geopark, Gunung Sewu-Jogjakarta Geopark, Rinjani-Lombok Geopark, Ciletuh-Java Barat Geopark, Belitong-Bangka Belitung Geopark, and Toba Caldera Geopark in North Sumatra.

The uniqueness of the Toba Caldera strengthens the government's initial intention to propose it as a Geopark, named Toba Caldera Geopark. To materialize this intention, the Toba Caldera Geopark Acceleration Team was formed to become a member of the Global Geopark Networking UNESCO. This was achieved through the issuance of the Decree of the Governor of North Sumatra No. 188.44/404/KPTS/2013 on June 26, 2013. Toba Caldera Geopark was acknowledged as a National Geopark in

2013, covering seven regencies. It has submitted applications to UNESCO three times, first in 2014, then in 2017, and the third time in 2019.

The Toba Caldera eventually succeeded in being included in the UNESCO list after being assessed and decided upon by the UNESCO Global Geoparks Council at the 4th International Conference on UNESCO Global Geoparks. Specifically, on July 7, 2020, the Toba Caldera was designated as the UNESCO Global Geopark Toba Caldera. The journey to establish the Toba Caldera as a UNESCO Global Geopark required collective efforts from various stakeholders, including the central and local governments, as well as the local community residing in the Lake Toba area.

The designation of Toba Caldera as a UNESCO Global Geopark presents both opportunities and responsibilities for Indonesia, particularly the local community (Bangun & Junita, 2020) [1]. This designation has the potential to stimulate economic development and foster sustainable development in the region. Through the sustainable development of geotourism, it opens up possibilities for the local community to promote their cultural heritage, local products, and create wider employment opportunities. This recognition entails obligations for the government and local community to enhance and preserve the cultural integrity, environment, and overall well-being of the Toba Caldera area.

The research objective serves as an indication of the direction in which the research is conducted and the specific data and information to be achieved through the study. Research objectives are formulated as concrete statements that can be observed and measured. The objectives of this study are as follows:

1. To analyze the development of Toba Caldera Geopark in shaping the Toba architecture, specifically in Samosir Regency.
2. To examine whether Toba Caldera Geopark in Samosir Regency fulfills the criteria for a Geopark according to the Guideline and Criteria for Geoparks.
3. To analyze the factors that need to be considered for Toba Caldera Geopark in Samosir Regency to maintain its status as a UNESCO Global Geopark.

Literature

Development is defined as an activity that involves adding, enhancing, improving, or expanding. Meanwhile, a region is an area that shares similar characteristics, both in terms of natural and human aspects, and has clear administrative boundaries in accordance with the established regulations and laws (Rustadi, 2018). Regional development refers to actions taken to develop or build a specific area or region with the aim of improving the well-being of its inhabitants (Yunus and Parapat, 2021) [19], or advancing, improving, and enhancing something that already exists (Pasau, *et al*., 2021) [14].

The development of a region needs to be supported by at least six aspects, as follows (Amin, 2019):

1. The Biogeophysical aspect includes the content of biological resources, non-biological resources, and existing facilities and infrastructure in the region.
2. The Economic aspect encompasses economic activities taking place within and around the region.
3. The Social and Cultural aspect includes culture, politics, and defense and security (Hankam), which involve the development of human resources.
4. The Institutional aspect involves the institutions within the community that contribute to the management of a region, determining whether the environment is conducive or not.
5. The Location aspect indicates the interconnection between one region and another in terms of production, management, and marketing facilities.
6. The Environmental aspect involves studying how the production process utilizes inputs from natural resources, whether it causes damage or not.

The understanding and concept of Geopark can be comprehended through its meaning, functions, and implementation as interconnected components related to the Earth. Based on terminology, the term "Geopark" does not mean "Geological Park," but the prefix "Geo-" signifies the Earth. In Indonesian, Geopark is interpreted as "Taman Bumi" or "Earth Park." Geopark is defined as an area with outstanding geological elements, including archaeological, ecological, and cultural values, where local communities actively participate in the conservation and enhancement of natural heritage (Zheng *et al*., 2021). With the paradigm shift in Geoparks in 2015, UNESCO defines Geopark as a unified area that integrates distinctive geological features and landscapes of international geological significance, managed based on the principles of protection, education, and sustainable development (Kistiyah *et al*., 2021) [6].

Geopark is an area that has significant geological heritage, and its geological features are important for educational, scientific, and aesthetic purposes. It is not solely focused on geological characteristics but also encompasses the value of the site in terms of geology, archaeology, history, and cultural heritage (Hutabarat & Pratiwi, 2022) [5]. According to UNESCO, Geoparks can contribute to sustainable economic development through geological heritage or geotourism. Geopark serves as a method to protect areas of geological interest at the regional, national, and international levels. Geoparks are protected through legal provisions established by a country or region.

A Geopark can be considered to have achieved its goals if it successfully meets several criteria (Catana and Brilha, 2020) [2]. These criteria are outlined in the guidelines and criteria for Geoparks published by the Global Geopark Network (GGN) UNESCO in 2006. The criteria include the following:

Table 1: Geopark Criteria

No	Criteria	Description
1	Size and Location	Has clear boundaries with a sufficiently large delineated area
		Encompasses the entire natural system
2	Management and Local Community Involvement	Established management plan
		Developed bottom-up
		Organized management
		Distinctive features are clearly visible
		Tourism activities involve local communities

		Geopark planning incorporates input from various stakeholders
3	Economic Development	Stimulates economic activities and sustainable development
		Links cultural heritage with geological and environmental heritage
4	Education	Provides knowledge of geosciences/geology
		Coordinates with stakeholders involved in education
		Educational activities
5	Protection and Conservation	Protects geological heritage
		Converts important geological values

***Source*:** Guideline and Criteria Geopark GGN

The Executive Board of the United Nations Educational, Scientific and Cultural Organization (UNESCO) has agreed to designate Toba Caldera as a UNESCO Global Geopark during the 209th session held in Paris. Alongside 15 oother newly designated UNESCO Global Geoparks, Toba Caldera was recognized for its strong geological connections and rich cultural heritage, particularly its significance to the local community in terms of cultural traditions and biodiversity. The Indonesian government successfully conveyed to UNESCO the geological and traditional heritage value of Toba Caldera, leading to the support of UNESCO member states in preserving and protecting Toba Caldera as part of the UNESCO Global Geopark network.

The following are the 16 geological sites (Geosites) within the Kaldera Toba Geopark area

1. Sipisopiso-Tongging Geosite (Karo Regency)
2. Silalahi-Sabungan Geosite (Dairi Regency)
3. Haranggaol Geosite (Simalungun Regency)
4. Parapat-Sibaganding Geosite (Simalungun Regency)
5. Taman Eden Geosite (Samosir Regency)
6. Balige-Liang Sipege-Batu Basiha-Meat Geosite (Samosir Regency)
7. Situmurun-Uluan Block Geosite (Samosir Regency)
8. Hutaginjang Geosite (Tapanuli Utara Regency)
9. Tapian Nauli-Muara-Sibandang Geosite (Tapanuli Utara Regency)
10. Sipinsur Geosite (Humbang Hasundutan Regency)
11. Bakara-Tipang-Baktiraja Geosite (Humbang Hasundutan Regency)
12. Tele-Efrata-Sihotang Geosite (Samosir Regency)
13. Pusukbuhit Geosite (Samosir Regency)
14. Hutatinggi-Sidihoni Geosite (Samosir Regency)
15. Ambarita-Tuktuk-Tomok Geosite (Samosir Regency)
16. Batak Museum Simanindo-Batuhoda-Stone Tombs Geosite (Samosir Regency)

Mulyadi (2022) [10] demonstrates that attractions, accessibility, amenities, and facilities have a positive and significant influence on the development of the Lake Toba Geopark area. A similar study by Masatip *et al*. (2022) [8] found that The Kaldera Toba Nomadic Escape has vast land that can be further developed for its tourism potential, not only natural attractions but also artificial tourist attractions. The Kaldera Toba Nomadic Escape offers a perfect view of Lake Toba, complemented by the serene village of Sigapiton. The Kaldera Toba Nomadic Escape has great potential to attract investors, provided that land acquisition has been successfully completed.

Manurung and Sinabariba (2021) [7] conducted a research study titled "Indonesia Soft Power: Toba Caldera as UNESCO Global Geopark 2020." The study reveals the interconnectedness between the central and regional governments in Indonesia and the sustainable contributions of stakeholders who are committed to the development of sustainable tourism in the Kaldera Toba Geopark region. These stakeholders actively advocated for the recognition of Kaldera Toba as a UNESCO Global Geopark. After a span of nine years, from 2011 to 2020, Kaldera Toba finally achieved the status of a UNESCO Global Geopark during the 209th Plenary Session held in Paris on July 7, 2020. As a result, the Kaldera Toba Geopark has gained international acclaim and has become a renowned global tourist destination, showcasing breathtaking scenic spots such as Tongging Sipiso-Piso, Silalahi Sabungan, Haranggaol, Sibaganding Parapat, Taman Eden, Balige Liong Spige Meat, Situmurun Blok Uluan, Hutaginjang, Muara Sibandang, Sipinsur Bakti Raja, Bakara Tipang, Tele Pangururan, and Pusuk Buhit.

Ginting, *et al*. (2021) [3] conducted a research study titled "Geotourism Development through the Public Facilities in Geotrail Bakkara, Toba Caldera Geopark." The aim of this study was to investigate and analyze the progress of geotourism in the Bakkara tourist destination. Bakkara is a village with tourism potential situated in the Sibandang Geoarea, which is part of the Kaldera Toba Geopark, designated as a UNESCO Global Geopark. The research aimed to contribute insights that can be utilized for the preservation of geotourism values, encompassing conservation, education, economy, and promotion. The qualitative methodology, employing observations and focus group discussions, was employed for data collection and analysis. The findings of the study indicated that although public facilities for geotourism development have been established, their impact on tourism remains limited and requires further enhancements.

Tobing *et al*. (2020) [18] conducted a research study titled "Physical form Sustainability of Huta Siallagan Samosir Architecture in Supporting Toba Caldera Geopark Cultural Tourism." The research aimed to investigate the aspect of sustainability from an architectural perspective, focusing on the physical form of Huta Siallagan. The study aimed to determine the survival value of Huta Siallagan by exploring its architecture, traditions, and cultural significance. Huta Siallagan, located in Samosir Regency, is recognized as the birthplace of the legal system civilization in Samosir. This tourist village encompasses a 500-year-old stone trial site, which serves as a significant cultural attraction. The well-preserved Stone Trial has attracted tourists and is considered one of the historical sites within the Geosites of the Kaldera Toba Geopark. Consequently, the preservation of Huta Siallagan holds great importance. The Samosir Regency government has implemented sustainable tourism practices to ensure the long-term conservation of the area.

Bangun and Junita (2020) [1] conducted a research study titled "Strategies for the Development of Kaldera Toba Geosite Area after its Designation as a UNESCO Global Geopark." The study aimed to address the following research questions: a) What are the factors influencing the development of Lake

Toba as a tourism destination? b) What strategies can be implemented to ensure the success of Kaldera Toba as a tourist area? The data collection for this study utilized literature review, documentation, field observations, and unstructured interviews with informants. The findings of the research are as follows: a) The collaborative strategy among regions, based on SWOT analysis, has proven to be a significant strength by capitalizing on available opportunities. b) In addition to leveraging strengths and opportunities, the government can mitigate weaknesses and threats by fostering interregional collaboration under the coordination of the Lake Toba Tourism Development Authority (BOPDT). c) Further development of Kaldera Toba can be achieved through the enhancement of attractions, accessibility, and amenities, while simultaneously empowering local traditions and preserving biodiversity.

Research Method

This research employed a qualitative approach. The design format used in qualitative research consists of three types: descriptive format, verification format, and in-depth research format. In this study, a qualitative method with a descriptive design was employed. The study was conducted in the Kaldera Toba Geopark, specifically focusing on the Geosites located on Samosir Island, namely:

1. Geosite Ambarita-Tuktuk-Tomok
2. Geosite Hutatinggi-Sidihoni
3. Geosite Batak Museum Simanindo-Batu Hoda-Stone Tombs

The subjects of this research are informants who will provide various necessary information during the research process. The research informants include three types:

1. **Key Informants:** They possess essential information relevant to the research.
2. **Primary Informants:** They are directly involved in the researched issue.
3. **Additional Informants:** They can provide information despite not being directly involved in the researched issue.

The research utilizes key informants, primary informants, and additional informants as follows:

1. **Key informant:** Head of the Kaldera Toba Geopark Information Center.
2. **Primary informants:** Community leaders and tourists visiting the Kaldera Toba Geopark, particularly the Geosites located on Samosir Island.
3. **Additional informants:** Local residents.

Teknik analisis data yang digunakan dalam penelitian ini adalah analisis interaktif. Menurut Miles, *et. al.*, (2014) [9] aktivitas dalam analisis data kualitatif dilakukan secara interaktif dan berlangsung secara terus-menerus sampai tuntas, sehingga datanya sudah jenuh. Berikut ini teknik analisis data interaktif menurut Miles dan Hubberman, yaitu (Sugiyono, 2017) [17] yang meliputi Pengumpulan data, Reduksi Data. Penyajian Data dan Penarikan Kesimpulan

Results and Discussion

Each ethnic group possesses its distinct architectural style in building design, as exemplified by the construction of traditional houses. The design encompasses form, size, function, and ornamentation, all intricately intertwined with the religious systems embraced by specific ethnic communities. Likewise, the creation of traditional Batak Toba houses exhibits a unique architectural style that stands as a national cultural asset in terms of artistry and structural design. Within Batak Toba society, these traditional dwellings hold a sacred significance due to the cosmological and philosophical values underlying their spatial organization and purpose. The philosophical values are further reinforced by the symbolic significance of various gorga motifs adorning the facades of traditional houses.

The architectural heritage of traditional Batak houses serves as a tangible record of history, providing insights into the continuity of community life from the past to the present and for future generations. These architectural legacies not only represent historical evidence but also carry significant historical and socio-cultural meanings that can be cherished by future generations.

The distinctive characteristic of traditional Batak houses is their curved roof, which is sometimes adorned with buffalo horns at the front end, giving the appearance of a buffalo. The curved roof represents the back of the buffalo, while the legs of the buffalo are depicted through pillar-like structures supporting the base of the house. As the traditional Batak Toba community was not acquainted with metric measurements, they employed local units of measurement such as "depa" (dopa), "jengkal" (jongkal), "asta," and "langkah" (langka). Consequently, each traditional house tends to have varying dimensions due to the utilization of this non-standardized measurement system.

Fig 1: Original Traditional Batak Toba House in Samosir Regency, Singapuran Village

Fig 2: Original Traditional Batak Toba House in Samosir Regency, Singapuran Village

Fig 3: Remodeled and Authentic House in Singapuran Village

Fig 4: Remodeled and Authentic Traditional House in Singapuran Village

Fig 5: Original Traditional Batak Toba House in Samosir Regency, Langat Village

Fig 6: Remodeled and Authentic Traditional House Building in Langat Village.

The research findings also indicate that the Toba Caldera Geopark in Samosir Regency meets the criteria set forth by the Geopark Guideline and Criteria. According to the Geopark Guideline and Criteria (GGN), for an area to be recognized as a geopark, it must fulfill the following requirements:

1. As an area that encompasses various geological elements with distinct boundaries, holding significance and function as natural heritage.
2. As a means of introducing Earth's heritage.
3. As a protected area for Earth's heritage.
4. As a site for geotourism development.
5. As an effective and efficient platform for collaboration with the local community.
6. As a site for the implementation of various scientific and technological knowledge.

Based on the GGN UNESCO guidelines (2006), the purpose of a Geopark is to develop and effectively utilize the natural geological heritage and other components, including cultural aspects, in the area. The goals include protecting Earth's diversity (geodiversity) and conserving the environment, as well as promoting education and earth sciences broadly. To achieve the recognition of Geopark Kaldera Toba as a part of the UGG network, certain requirements and recommendations must be fulfilled, such as accessibility, facilities, community empowerment, and other supporting factors for tourism as outlined in the Geopark Kaldera Toba Dossier. This necessitates the involvement of multiple stakeholders, including the World Bank, the Ministry of Public Works and Housing, local governments, private entities, and others, in the development of the Geopark Kaldera Toba region.

Despite Geopark Kaldera Toba being recognized as part of the UNESCO Global Geopark on July 9, 2020, development

activities in the Lake Toba region are still ongoing. Each implemented development plan undergoes evaluation to assess the progress and realization of the programs. This includes reviewing the completed, ongoing, and upcoming initiatives to gauge their effectiveness and impact. Continuous monitoring and assessment ensure that the planned programs are carried out as intended and contribute to the overall development of the Geopark Kaldera Toba area.
The study results indicate that factors that need to be considered for Geopark Kaldera Toba in Samosir Regency to maintain its status as a UNESCO Global Geopark are as follows. The Kaldera Toba Geosite is inhabited by various indigenous ethnic groups, particularly in Samosir Regency. In terms of natural resources, the caldera is situated along the shores of Lake Toba, which is home to diverse flora such as aquatic plants, as well as fauna, especially various freshwater fish and mammals. Likewise, on the lake's mainland, there are various flora in the form of forest vegetation and unique fauna specific to Lake Toba.
As a UNESCO Global Geopark, it firmly believes that Toba Caldera has a strong geological and cultural connection with the local community and diverse biodiversity. UNESCO has provided six recommendations, as follows: (1) Developing a strong relationship between the geological heritage and the local community, (2) Establishing partnership strategies for tourism activities with local product producers, (3) Strengthening engagement in the Global Geoparks Network and the Asia Pacific Geoparks Network, (4) Developing educational strategies through collaborative partnerships, (5) Enhancing educational strategies and activities to facilitate the mitigation of natural hazards and climate change in local schools, and (6) Strengthening the involvement of the UGG in research studies, conservation efforts, and the promotion of local indigenous populations, their culture, and language.
Since the designation of Lake Toba as a UNESCO Global Geopark, the scope of the Toba Caldera area, which serves as a catchment area, has been able to support the development of Toba Caldera Geopark as a tourism destination. According to the UNESCO GGN guidelines, the purpose of a Geopark is to explore, develop, appreciate, and benefit from the close relationship between geological heritage and other aspects of natural heritage, including culture and values within the area. To achieve these goals, a Geopark must have clearly defined boundaries and a sufficiently large area for local economic development. Thus, within a Geopark, at least three important activities should take place: conservation, education, and geotourism. These principles align with the six recommendations issued by UNESCO upon the designation of Toba Caldera as UNESCO Global Geopark.

Conclusion and Recommendation

The development of Geopark Kaldera Toba has led to significant transformations in Toba architecture, particularly in Samosir Regency. These changes are evident through the evolution of architectural works that showcase the diverse range of traditional Batak designs in the region. The architectural development has resulted in the creation of numerous representative structures, including the incorporation of traditional design elements into modern buildings. This integration of traditional architectural features into contemporary structures demonstrates a harmonious blend of traditional and modern aesthetics, highlighting the rich architectural heritage of the Batak culture in Samosir Regency.
Geopark Kaldera Toba in Samosir Regency has met the criteria for Geopark designation according to the Guideline and Criteria for Geoparks. It fulfills the following requirements: a) It is an area that encompasses various geological features with clear boundaries, serving as a significant natural heritage, b) It serves as a platform for introducing and promoting earth heritage, c) It functions as a protected area for conserving earth heritage, d) It provides opportunities for the development of geotourism, e) It facilitates effective and efficient collaboration with the local community, and f) It serves as a site for the implementation of various scientific knowledge and technologies.
Factors to be considered by Geopark Kaldera Toba in Samosir Regency to maintain its status as a UNESCO Global Geopark are as follows: 1) Developing the relationship between geological heritage and other territorial heritage, developing partnership strategies that include clear methodologies and criteria for becoming partners, strengthening engagement in activities of the Global Geoparks Network and Asia Pacific Geoparks Network to promote the international value of the region through partnerships with Global Geoparks under the UGG umbrella, developing education strategies by working in partnership with other UGGs, enhancing education strategies and activities to facilitate the mitigation of natural hazards and climate change in schools for the local population, and strengthening UGG's engagement in research studies, conservation, and promotion of the indigenous local population and their culture and language.
To maintain its status as a UNESCO Global Geopark, Geopark Kaldera Toba in Samosir Regency needs to develop the linkages between geological heritage and other territorial heritages, such as natural biotic, cultural, and intangible heritage through interpretation, education, and tourism. This includes training local guides, tourism operators, and the local community, among others. Additionally, establishing the connection between geology and ecology is crucial to actively share knowledge with visitors.

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