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Geotourism as a 16-Geosite Empowerment Strategy—For Tourism Sustainability in Toba Caldera Geopark

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Abstract

The study on empowerment strategies for tourism sustainability was carried out in 16 geosites located in seven regencies. These include Karo, Dairi, Simalungun, Samosir, Toba Samosir, North Tapanuli, and Humbang Hasundutan, in Toba Caldera Region (TCA), North Sumatra Province. The empowerment strategies will enhance local and national tourism development policy directives, boost development geared towards community tourism interests, and achieve GGN directives according to the concepts outlined by UNESCO. This geotourism development has been formulated through a synthesis of various investigations including the analyses of government references, potential tourist attractions, and SWOT. Furthermore, the SWOT analysis showed that a travel plan combining the elements of cultural heritage and geosites is an alternative empowerment for sustainable regional development through geotourism, using Pusuk Bukit as a pilot area. Geosites have been mapped as the basis for Toba Caldera's development.

Keywords

Analysis of Potential Tourist Attractions, SWOT Analysis, Geotourism, Policy Studies, Caldera Toba

1. Introduction

The Executive Board of the United Nations Educational, Scientific and Cultural Organization (UNESCO) designated the Toba Caldera as a UNESCO Global Geopark. This occurred at the 209th Session of the UNESCO Executive Council in Par-

is (07/07/2020). The Lake Toba Caldera, North Sumatra, is one of the five Super Priority Destinations (SPD) promoted by the government. Furthermore, Samosir Island in North Sumatra Province is an example of a natural heritage that needs to be preserved. This is due to its interesting and unique geosites in form of the oldest rock formations, rock structures, fossils, waterfalls, landscapes, lake tours, and the Toba Caldera geopark volcano as a new tourist destination. The preservation of this island is an innovation towards the protection of natural heritage and the transfer of Earth knowledge or geosciences [1]. Explained that geotourism is a form of special interest tourism activity geared towards exploring geological features. This form of tourism promotes an understanding of the environment, nature, and culture. Furthermore, it enhances appreciation and the need for the conservation and preservation of natural resources. The established forms of tourism in a more holistic geological environment include visits, learning, appreciating, and engaging in geosites [2]. Several studies by [3] [4] as well as [5], formulated the SGG (Sustainable Tourism Goals) indicators for tourism development in geosites. Therefore, the principles of Sustainable Development Goals (SDGs) can also be applied consistently; stated that a geosite is a region of high scientific value, assessed quantitatively and qualitatively through an inventory, assessment, and selection process to develop a management as well as a threat prevention plan [6]. According to [7] basic studies and safeguards of geosites should follow careful evaluations, while preserving and maintaining their original features, to inform sustainable geotourism goals (SGGs).

Geotourism has been conceptualized as a union of three components: Form, process, and tourism [1] [8] (**Figure 1**).

The Form denotes the existing landscapes with their characteristics and components. Processes include tectonic activity, weathering, deposition, etc. Tourism refers to the human dimension of tourism activities as well as the appreciation of geology and geomorphology [1] [9]. These three components form the concept of geotourism [10]. Observed that geotourism plays an important role in the preservation of geological heritage. This is known as geoconservation, where tourist visits contribute to the economy, which in turn is important for providing environmental incentives incentives [11]. UNESCO states that geotourism implies traveling through an area where the tourist explicitly understands that

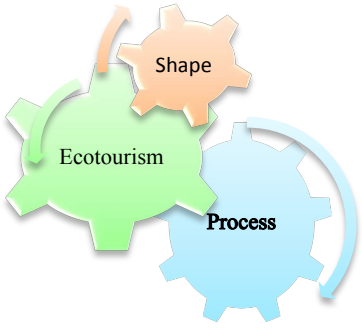

Figure 1. Conceptualization of the nature and scope of geotourism.

the landscape being observed contains unique shapes that are modeled by dynamic processes that have left visible traces [12]. Furthermore, a geosite is a place where well-defined geodiversity elements are present which also possess cultural, touristic, or scientific value. According to [13], Prosser, C.D. (2018), this is a site of high scientific value that has been assessed quantitatively and qualitatively through an inventory, assessment, and selection process to develop a threat management and prevention plan. A transferable geological heritage also refers to elements of the earth sciences exposed to natural or human degradation that should be protected *ex-situ*. Therefore, inclusion in museum collections often signifies the only means to preserve these priceless lifeless natural monuments [14] [15]. Geosites have geomorphological importance due to their geological heritage, which promotes their conservation.

A geopark is a concept that was introduced by UNESCO in 2004. In recent years, there has been an increase in the number of UNESCO geoparks, reaching 161 in 2020. This has initiated many geosite characterization studies and the development of assessment methods [16]. According to [7], the safeguarding of geosites should follow a careful, detailed evaluation while respecting the original features, to enhance sustainable tourism. This is in line with the Spatial Planning Law Number 26 of 2007: Spatial planning regulates the distribution of activities in a space, thereby providing a geographic expression to economic, social, cultural, and ecological policies.

To support the achievement of these goals, the capacity and independence of the community need to be improved and facilitated. This involves Law Number 32 of 2009 which states that the community is obliged to play a role in environmental management. With the enactment of Law Number 32 of 2004 by the Regional Government, various efforts to develop regional potential have become attractive, and have been attempted by various parties for optimal utilization. Consequently, besides tourism, other sectors strive to maximize their potential to contribute to the success of governance. In many cases, tourism has become a potential focus of policy orientation to boost the contribution of regional income. This will enable the maximization of touristic assets in certain areas. Due to many potential geotourism areas owned by Indonesia, especially the Toba Caldera, North Sumatra, geosites in each area should be introduced to the outside world with a background of geological knowledge. Therefore, the province of North Sumatra is expected to become an independent provider of geotourism in the future. The tourism sector has great potential if geoparks are developed for geological knowledge and empowerment.

Geotourism is an activity that includes visits to geosites for picnics or other recreational purposes, and involves curiosity, learning, and appreciation of the places visited [17]. The numerous potentials must be explored, developed, and optimized to attract more tourists, thereby increasing the number of visitors.

2. Research Methods

The target area was 16 geosites in 17 sub-districts in the Lake Toba, spread over

seven regencies in North Sumatra Province. According to the natural heritage potential, in one regency, there is one geosite, while in another, there can be more than one geosite. The following are the target areas:

1) Geosite Sipisopiso-Tongging (Karo Regency).
2) Geosite Silalahi-Sabungan (Dairi Regency).
3) Geosite Haranggaol (Simalungun Regency).
4) Geosite Sibaganding (Simalungun Regency).
5) Geosite Taman Eden (Toba Samosir Regency).
6) Geosite Batu Basiha-TB Silalahi Balige (Toba Samosir Regency).
7) Geosite Situmurun (Toba Samosir Regency).
8) Geosite Hutaginjang (Tapanuli Utara Regency).
9) Geosite Muara Sibandang (Tapanuli Utara Regency).
10) Geosite Sipincur (Humbanghasundutan Regency).
11) Geosite Bakara-Tipang (Humbanghasundutan Regency).
12) Geosite Tele (Samosir Regency).
13) Geosite Pusukbuhit (Samosir Regency).
14) Geosite Hutatinggi Sodihoni (Samosir Regency).
15) Geosite Ambarita-Tuktuk-Tomok (Samosir Regency).
16) Geosite Danau (unifying all regencies in the Lake Toba region).

Here's the Caldera Geosite Map Toba (Figure 2).

2.1. Methods and Stages

The method of secondary data analysis was based on literature reviews, regional geological studies, reports, and other previous related studies of the study area.

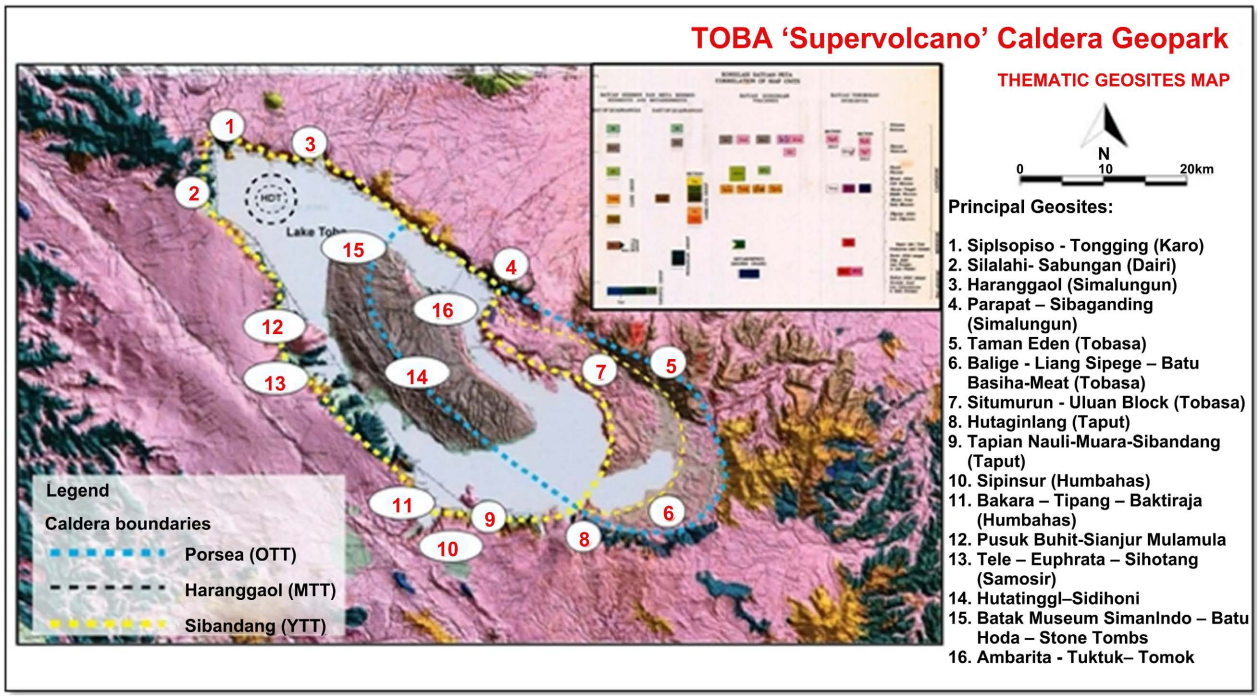

Figure 2. Toba Caldera Geosite Thematic Map. Source: http://geopark2.calderatobageopark.org/geosite/.

The primary method utilized was a descriptive field that covered geological data using field mapping methods for plotting locations. Furthermore, scoring was performed during the process of making maps, tabulation, SWOT, and quantitative analysis. The interactive data included discussions and direct interviews with the community, results of self-assessment scoring given to respondents, and geological databases on the need for tourism empowerment. Information and environmental education on geoparks were also prepared.

The data were analyzed using a descriptive-analytical approach synthesized to obtain results, as well as provide further recommendations. The method used was organized into three stages:

1) consists of compiling information, inventory, and initial selection of potential geosites;

- At this stage, inventory, description, and location plotting were carried out using GPS for geosites plotted on a base map to determine specific locations.
- Making temporary field reports.

2) the scoring method gives weighting to geosites and finally provides empowerment of the 16 selected and recommended geosites for assessment, and finally,

3) involves analyzing strengths, weaknesses, opportunities, and threats (SWOT).

2.2. SWOT Analyses

SWOT analysis is used to systematically evaluate the existing factors and assess the weight of each factor [18] and determine the SO, WO, ST, WT strategy in the development of the Jambi Merangin Geopark as an effort to develop eco-geotourism [19] SWOT analysis was chosen because it is simpler and has accurate results, SWOT analysis can be used as an analysis in the business world (Leskinen *et al.*, 1998) but in its development SWOT analysis is used as an effort to analyze natural resources and make an assessment of sustainable tourism (Lozano-oyola *et al.*, 2010) [20]. Strengths and weaknesses are internal factors while opportunities and challenges are external factors in a SWOT analysis [21]. Evaluation of internal and external factors is important in determining sustainable tourism development strategies.

3. Results and Discussion

There are 16 main geosites mapped and located in 31 Sub-districts of the Lake Toba Region. In the geosite distribution map, these geosites show different and unique geological characteristics for interpretation purposes. These include several elements in form of rock outcrops, geological formations, landscapes, and panoramic views, cultural sites, and museums/information centers (**Table 1**). Based on the results of the review and field description, the geosite distribution map is shown in **Figure 3**.

The steps taken in the implementation of tourism include observing existing problems and identifying geological potential as well as tourism development.

Table 1. Study on the potency of tourism attraction from 16 geosites in Caldera Toba.

No	Geosite	Component	Sub-Component	Score	Weight	Score	No
	G1	**Sipiso-piso – Tongging, Kodon-kodon**	Attraction	Resource (panoramic, lithology, structure water fall)	20	5	100
				Tourism activity	20	5	100
				Cleanness of geosite	10	4	40
				Comfort of geosite region	10	5	50
		Accessibility			20	5	100
		Supporting facilities and Infrastructure			20	5	100
		Total Score			100	29	490
	G2	**Silalahi-Sabungan, Western Caldera Wall**	Attraction	Resource (panoramic, lithology, structure waterfall)	10	3	30
				Tourism activity	20	5	100
				Cleanness of geosite	20	3	60
				Comfort of geosite region	10	5	50
		Accessibility			20	3	60
		Supporting facilities and Infrastructure			10	3	30
		Total Score			100	22	380
	G3	**Haranggaol Northern Caldera Wall**	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
				Tourism activity	20	5	100
				Cleanness of geosite	10	3	30
				Comfort of geosite region	20	5	100
		Accessibility			20	5	100
		Supporting facilities and Infrastructure			10	3	30
		Total Score			100	26	460
	G4	**Sibaganding**	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
				Tourism activity	10	4	40
				Cleanness of geosite	20	5	100
				Comfort of geosite region	20	5	100
		Accessibility			20	5	100
		Supporting facilities and Infrastructure			10	3	30
		Total Score			100	27	470
	G5	Balige-Liang Spege, Batu Basiha Souther Caldera Wall	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
				Tourism activity	20	5	100
				Cleanness of geosite	20	3	60
				Comfort of geosite region	20	3	60
		Accessibility			10	5	50
		Supporting facilities and Infrastructure			10	3	60
		Total Score			100	24	430

Continued

G6	**Situmurun-Uluan**	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
			Tourism activity	20	5	100
			Cleanness of geosite	20	4	80
			Comfort of geosite region	20	5	100
	Accessibility			10	5	50
	Supporting facilities and Infrastructure			10	3	30
	Total Score			100	27	460
G7	**Hutaginjang, Southern Caldera Wall**	Attraction	Resource (panoramic, lithology, structure waterfall)	10	3	30
			Tourism activity	20	5	100
			Cleanness of geosite	20	5	100
			Comfort of geosite region	20	3	60
	Accessibility			20	3	60
	Supporting facilities and Infrastructure			10	3	30
	Total Score			100	22	380
G8	**Muara-Sibandang**	Attraction	Resource (panoramic, lithology, structure waterfall)	10	3	30
			Tourism activity	20	3	60
			Cleanness of geosite	10	4	40
			Comfort of geosite region	20	5	100
	Accessibility			20	5	100
	Supporting facilities and Infrastructure			20	5	100
	Total Score			100	25	430
G9	**Sipinsur-Baktiraja, Southern Caldera Wall**	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
			Tourism activity	20	5	100
			Cleanness of geosite	10	3	30
			Comfort of geosite region	20	5	100
	Accessibility			10	5	50
	Supporting facilities and Infrastructure			20	5	100
	Total Score			100	28	480
G10	**Bakkara-Tipang, Welded OTT**	Attraction	Resource (panoramic, lithology, structure water fall)	20	4	80
			Tourism activity	10	3	30
			Cleanness of geosite	20	5	100
			Comfort of geosite region	20	5	100
	Accessibility			20	5	100
	Supporting facilities and Infrastructure			10	3	30
	Total Score			100	25	420

Continued

G11	**Geosite Tele**	Attraction	Resource (panoramic, lithology, structure water fall)	10	3	30
			Tourism activity	20	5	100
			Cleanness of geosite	10	5	50
			Comfort of geosite region	20	5	100
	Accessibility			20	5	100
	Supporting facilities and Infrastructure			10	5	50
	Total Score			100	28	430
G12	**Pusuk Buhit**	Attraction	Resource (panoramic, lithology, structure waterfall)	20	5	100
			Tourism activity	20	5	100
			Cleanness of geosite	10	5	50
			Comfort of geosite region	20	5	100
	Accessibility			10	5	50
	Supporting facilities and Infrastructure			20	5	100
	Total Score			100	30	500
G13	**Huta Tinggi-Sidihoni**	Attraction	Resource (panoramic, lithology, structure water fall)	20	4	80
			Tourism activity	20	5	100
			Cleanness of geosite	20	3	100
			Comfort of geosite region	20	5	100
	Accessibility			10	5	50
	Supporting facilities and Infrastructure			10	3	30
	Total Score			100	25	460
G14	**Simanindo-Batuhoda**	Attraction	Resource (panoramic, lithology, structure water fall)	10	3	30
			Tourism activity	20	5	100
			Cleanness of geosite	10	4	40
			Comfort of geosite region	20	5	100
	Accessibility			20	5	100
	Supporting facilities and Infrastructure			20	3	60
	Total Score			100	25	420
G15	**Ambarita-Tuk Tuk**	Attraction	Resource (panoramic, lithology, structure water fall)	10	2	20
			Tourism activity	20	5	100
			Cleanness of geosite	20	3	60
			Comfort of geosite region	20	5	100
	Accessibility			10	5	50
	Supporting facilities and Infrastructure			20	5	100
	Total Score			100	27	430
G16	A unifying lake for all regencies of the Lake Toba area				-	

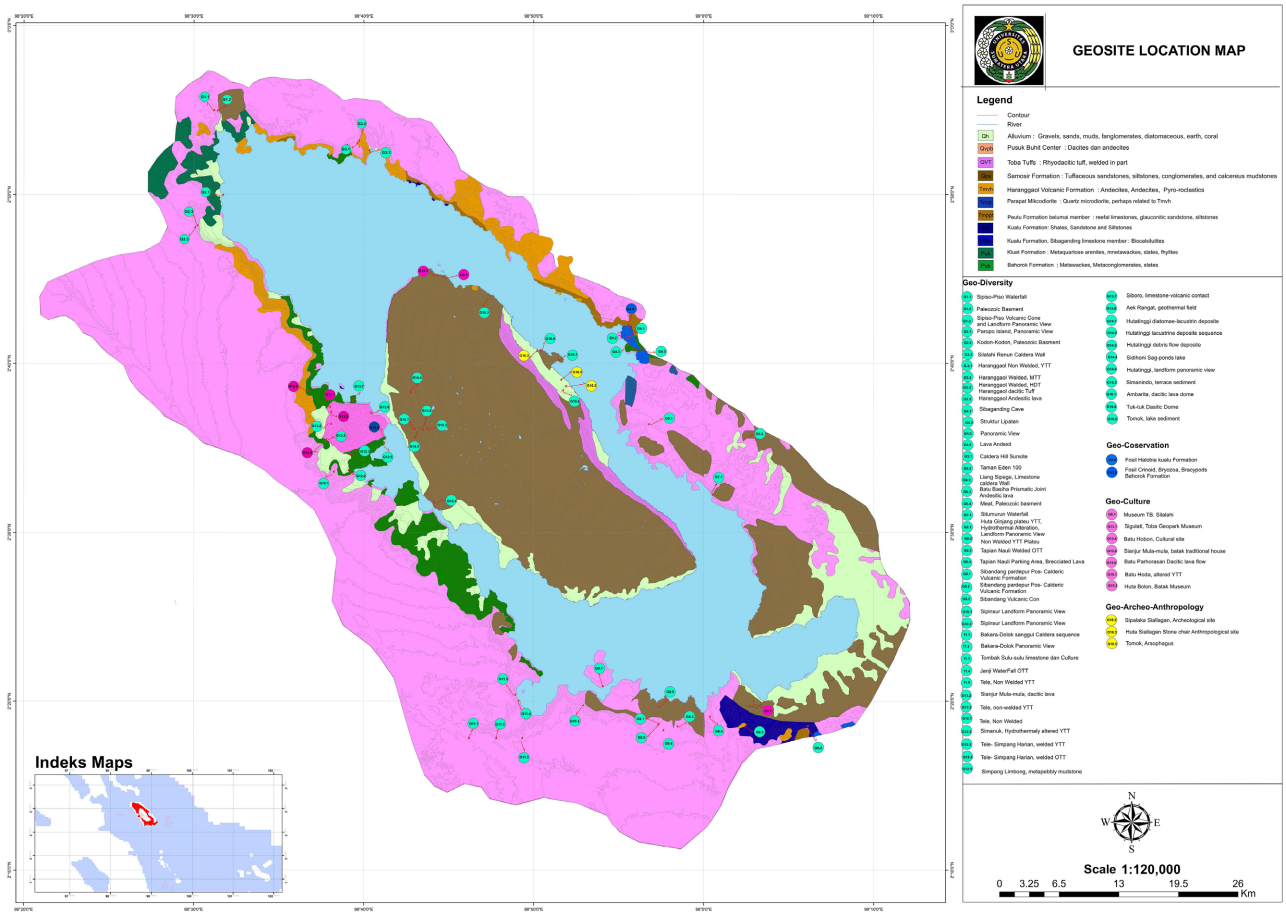

Figure 3. The distribution location of the geosites in the Toba Caldera Region.

The identification of potentials and shortcomings was carried out to collect data and information for the development of a geosite into a tourist destination. These include ascertaining aspects of natural attractiveness, uniqueness, ecological/environmental conditions, social, cultural, and economic conditions in general as well as the facilities and infrastructure for tourism activities in the study area.

After identifying the potential shortcomings of the 16 geosites, the results were analyzed to obtain an overview of tourism development priorities and recommendations or directions in the Toba Caldera area. Therefore, the assessment given to the tourism component in each geosite is based on: 1) Attractions in form of natural, cultural, objects, or activities for tourists; 2) Facilities provided by tourist objects; and 3) Accessibility, including problems to reach tourist sites. The assessment obtained is shown in **Table 1**.

The abundance of geosite wealth in Toba Caldera, North Sumatra needs to be addressed through an accurate development plan. This should be in line with the development plan of the seven regencies to collectively improve community welfare. Based on the assessment of geological resource potential, the priority for the empowerment of the 16 existing geosites is listed in **Table 2**.

Spatially, the priority list of geosite empowerment is shown in **Figure 4**.

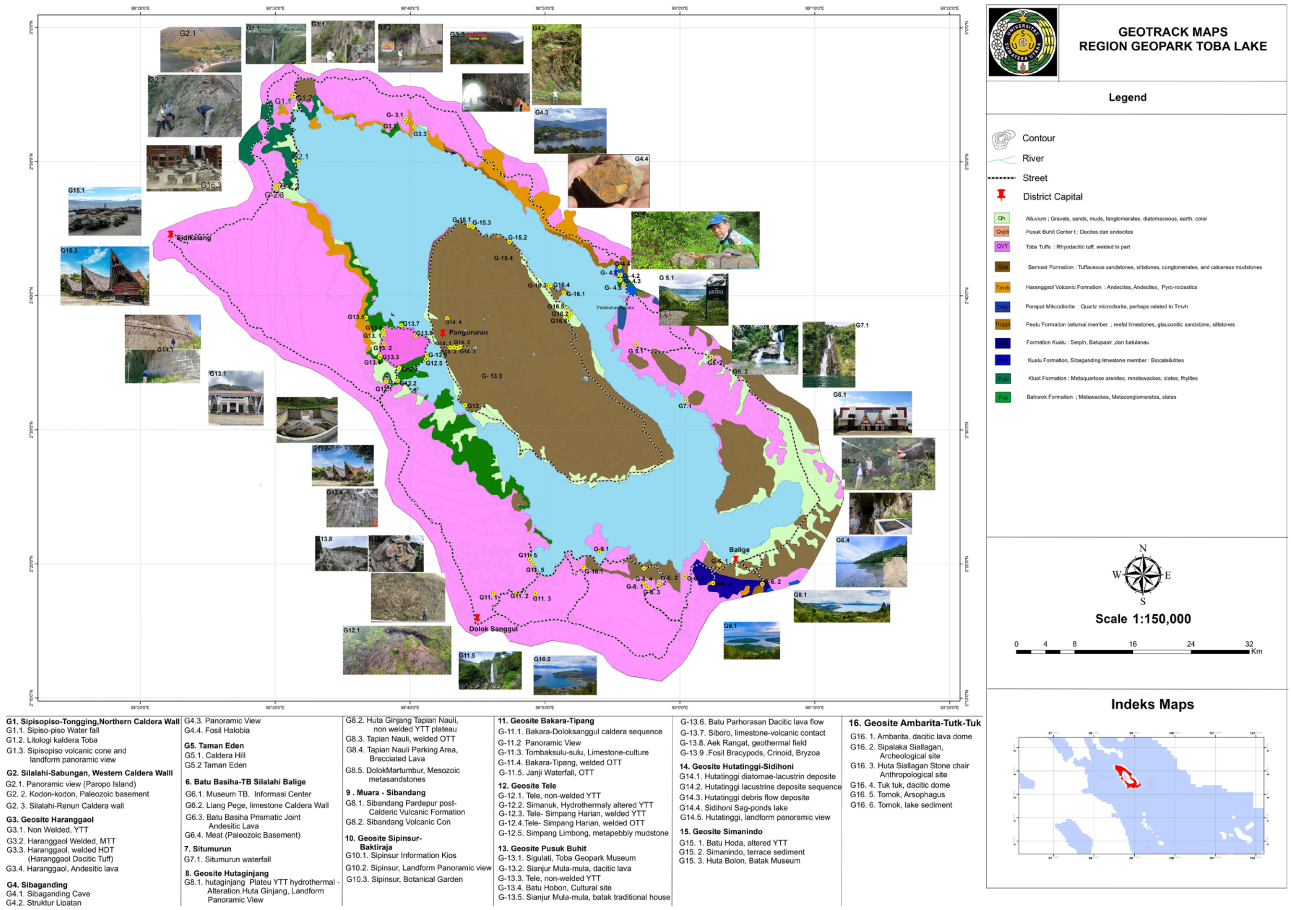

Figure 4. Geosite empowerment priority on geotrack map in Toba Caldera.

Table 2. List of priority of geosite development in Toba Caldera, North Sumatera Province.

No.	Geosite	Geosite Code	Total score	Regency
1.	Pusuk Buhit	G.12	500	Samosir Regency
2.	Sipisopiso-Tongging, Kodon-kodon	G.1	490	Karo Regency
3.	Sipinsur-Baktiraja, Southern Caldera Wall	G.9	480	Humbanghasundutan Regency
4.	Sibaganding	G.4	470	Simalungun Regency
5.	Haranggaol Northern Caldera Wall	G.3	460	Simalungun Regency
6.	Situmurun-Uluan	G.6	460	Toba Samosir Regency
7.	Hutatinggi-Sidihoni	G.13	460	Samosir Regency
8.	Geosite Tele	G.11	430	Samosir Regency
9.	Ambarita-Tuk Tuk	G.15	430	Samosir Regency
10.	Muara-Sibandang	G.8	430	Tapanuli Utara Regency
11.	Bakkara-Tipang, Welded OTT	G.10	420	Humbanghasundutan Regency
12.	Simanindo-Batuhoda	G.14	420	Samosir Regency
13.	Balige-Liang Spege, Batu Basiha Souther Caldera Wall	G.5	400	Toba Samosir Regency
14.	Silalahi-Sabungan, Western Caldera Wall	G.2	380	DairiRegency
15.	Hutaginjang, Southern Caldera Wall	G.7	380	Tapanuli Utara Regency
16.	Geosite Danau	G.16		Unifying all regencies in the Lake Toba region

Each of the 16 geosites in the Toba Caldera has its uniqueness and charm to be developed for geotourism. The Pusuk Buhit geosite, in this case, has several advantages due to its strong geological characteristics, regional culture, and infrastructure and access to public transportation. Tourism can boost its potential

Table 3. Alternative geosite empowerment strategy based on SWOT analysis.

Internal Factor / External Factor	**Opportunity (O)** 1) The support of Law No. 26 of 2007 on the Spatial Plan 2) Support Number 32 of 2009. About. Protection and management of the environment 3) The support of Law No. 11 of 2010 on Tourism 4) Support of Law Number 32 of 2014 concerning Regional Government 5) The support of Law No. 11 of 2013 on Cultural Site 6) Support of North Sumatra Governor Regulation Number 48 of 2020 concerning Toba Caldera Management Agency Unesco Global Geopar 9) The Toba Caldera Geopark area is listed on the Global Geopark Network 10) Increased tourist interest both domestic and foreign tourists	**Threat (T)** 1) There is community mining around the geosite 2) Lack of monitoring and protection of the area around the geosite 3) There is still a lack of understanding and public awareness of environmental conservation 4) Cleanliness in the environment around the geosite has not been maintained 5) Infrastructure facilities are not yet built in the geosite environment
Strength (S) 1) Has abundant geosite wealth and aesthetics 2) Strong Commitment and support from Government and Society 3) The increasing number of visitors to the Pusuk Buhit geosite 4) The development of community commitment to managing the Pusuk Buhit geosite as a tourist attraction 5) Great support and development of geotourism through geosite and community empowerment 6) Promotion of the rapidly growing Pusuk Buhit geosite for tourists	**The Strategy of SO Development** 1) Identifying geosite conditions 2) Documenting and publishing the uniqueness of the geosite 3) Formulating a geotourism empowerment plan, synergistically, with other potential tourist attractions by maintaining the preservation and sustainability of the geosite 4) Formulating a geotourism management model by involving the community 5) Using advanced technology in geotourism management efforts	**The Strategy of ST Development** 1) Increasing public understanding and awareness about the importance of environmental conservation 2) Formulating a geosite conservation/preservation plan 3) Formulating a damaged geosite restoration plan 4) Formulating management and empowerment plans and the need for integrated tourism area development.
Weaknesses (W) 1) Low public understanding of the geopark concept 2) The management of geotourism is still limited 3) The coordination in the management of geotourism among stakeholders has not been maximized 4) The absence of a professional geotourist guide 5) Less development of tourism diversification in response to geodiversity	**The Strategy of WO Development** 1) Improving public understanding of the geopark concept 2) Formulating a geotourism management plan according to the geopark concept 3) Formulating a geotourism management integration model 4) Formulating a geotourism promotion and marketing plan 5) Developing diversification in response to biodiversity 6) Utilizing technological advances in geotourism management efforts	**The Strategy of WT Development** 1) Increasing public understanding and awareness about the importance of environmental conservation 2) Formulating a geosite conservation plan 3) Developing diversification in response to geodiversity

as it has a high assessment in the socio-cultural aspect. Furthermore, Pusuk Buhit geosite has been developed as a tourist attraction by the local community through several tourism awareness groups. Pusuk Buhit spans three sub-districts namely Penguruan, Sianjur Mula-mula, and Harian Boho, in Samosir Regency, North Sumatra Province. It is one of the peaks located 1982 meters above sea level on the western edge of Lake Toba.

The local government alongside tourism awareness groups independently organizes and develops tourism at the Pusuk Buhit geosite according to its potential. The community's commitment towards tourism activities shows their awareness and concern for the socioeconomic improvement of this geosite as well as the area. This opens up opportunities for significant development that guarantee the achievement of geosite potential as a tourist attraction. Therefore, this agrees with Page and Ross (2002) that stakeholder support plays a highly important role in the development of tourism attractiveness in an area. Based on the general description of the profile of geosites in Toba Caldera as well as external factors such as opportunities and threats, the SWOT analysis can be formulated. This simulated a matrix with four possible alternative strategies for empowerment and development of the Pusuk Buhit geosite as shown in **Table 3**.

4. Conclusions

This study emphasizes empowerment which has not been fully implemented in the Toba Caldera community and offers an empowerment model. The data shows that this model can be implemented to support the realization of Sustainable Rural Community Based Tourism (SRCBT) in geosites. Furthermore, the SWOT analysis showed that one of the greatest strengths of the selected geosites is the geotouristic heritage of Mount Pusuk Buhit. This historical relationship as well as the local culture preserves the local wisdom of the Gunung Raja Mountain. This culture is made up of the Batak people who inhabit the crater of the supervolcano. Therefore, they are highly recognized and can increase the number of visitors who come to Pusuk Buhit Geosite. Tour packages can also help to announce the geological features and advantages.

The main strategy involves geotourism based on itineraries through Geotrack Maps. This enables tourists to discover geosites, landscapes, and cultures, and enjoy unique experiences of knowledge and sustainable development. This is a practicable alternative to stimulate regional development while maintaining the environment. Furthermore, this strategy can contribute to improving the quality of life in the local community, thereby making the Toba Caldera an area with Sustainable Rural Community Based Tourism.

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I have the pleasure of sending you the manuscript entitled "**Geotourism As A 16-Geosite Empowerment Strategy For Tourism Sustainability In Toba Caldera Geopark, North Sumatra Province**" authored by Said Muzambiq to be

considered for publication as a research article in your prestigious in Geography Sustainability Journal which has been funded by the Research and Development Agency of the University of North Sumatra, through a research grant agreement for PTN lecturers: Number: 485/UN5.2.3.1/PPM/SPP-1 TALENTA USU/2022.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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