

PAPER • OPEN ACCESS

## Implementation of geotourism concept in developing natural tourist attraction at parbaba village, Toba's caldera

To cite this article: Nurlisa Ginting and Febriandy 2018 *IOP Conf. Ser.: Earth Environ. Sci.* **126** 012160

View the [article online](#) for updates and enhancements.

You may also like

- [Geotrail development to connect the dots in Muara Caldera Toba, Indonesia](#)  
Nurlisa Ginting and Narosu Siregar
- [Geographic Information System Analysis on Evaluation of Geotourism Potential in Sumbawa West Nusa Tenggara Indonesia](#)  
Muhammad Fatih Qodri, Siti Siah and Okki Verdiansyah
- [Natural Oil Seep in Kora - Significant Locality for Geotourism](#)  
Marian Marschalko, Miloš Duraj, Dominik Niemiec et al.



The Electrochemical Society  
Advancing solid state & electrochemical science & technology



249th  
ECS Meeting  
May 24-28, 2026  
Seattle, WA, US  
Washington State  
Convention Center

# Spotlight Your Science

**Submission deadline:  
December 5, 2025**

**SUBMIT YOUR ABSTRACT**

## Implementation of geotourism concept in developing natural tourist attraction at parbaba village, Toba's caldera

Nurlisa Ginting<sup>1,2</sup> and Febriandy<sup>1</sup>

<sup>1</sup> Department of Architecture, Faculty of Engineering, Universitas Sumatra Utara, Indonesia

<sup>2</sup> Toba Lake & Sustainable Tourism Working Group, Universitas Sumatera Utara

E-mail: nurlisa.ginting@gmail.com

**Abstract.** Toba's Caldera is considered as a unique tourist destination as it was formed by the volcanic eruption of Toba's volcano, with Parbaba Village as its attraction. Geotourism, which consist of the administrator, education, uniqueness, accessibility, supporting facilities, and the increase of local people's economy as it's elements, is one of the concepts which can be implemented in this case. The objective of this research is to find a solution to increase natural tourist attraction in Parbaba village by making a tourist area development recommendation based on geotourism elements above. This research uses mix method, as the qualitative data will be collected by observation and interview with stakeholders, and the quantitative data will be collected by giving out 100 questionnaires to tourists and local people. The data then will be analyzed by using triangulation method. The result of this research is a concept of tourist attraction development recommendation. This research is expected to give benefits in the form of education and travel experience for tourist and also increases the economy of local people as a developer. The uniqueness element of this village is quite strong, whereas the supporting facilities are still lacking.

**Keywords:** geotourism, tourist attraction, parbaba

### 1. Introduction

Nowadays, the dominance of service more than goods in world's economic matters has brought a special attention, especially in tourism field [1]. Tourism has become one of the main element in developing the economic level of a country, especially in developing countries [2][3]. Tourist's attraction is one of the main factors of tourism in a destination. [4].

An attractive tourist attraction will bring more tourists in visiting a destination [5]. Natural attraction is one of the important elements of tourist attraction which needs to be developed [6]. The management and development of this element would likely increase the number of tourist in a destination.

In developing this natural attraction, geotourism is one of the concepts which could be implemented in doing so. Geotourism consists of two words, which are geo (geographical shape, geomorphology and also natural resources) and tourism (tourism area visit for appreciation and education) [7]. The purpose of this research is to find a solution in developing the natural attraction in Parbaba village by implementing geotourism concept.



**2. Tourist attraction and Geotourism**

Tourism is one of the factors used in developing the economic level in a country, especially the developing countries [2], [3]. The more the tourists visiting, the higher the country's income. The economic level of the locals in tourism area management will also increase. The tourism products that need attention in developing tourism area are as follows: tourist attraction, facilities, and accessibility [6]. The tourist attraction is the main factor that motivates the tourist to visit an area [4]. The attraction of a destination reflects sense and opinion of the visitor related to the ability of a destination in satisfying their needs.

Geotourism is one of the tourism development concepts which is still new in the world. Implementation of this concept will make people appreciate more and also conserve geotourism or natural area, which could also increase the economic level of a country [8]. Geotourism consists of two words, which are "geo" related to geomorphology and natural resources such as landscape, fossil, stones, minerals, also focuses on the appreciation of the forming process. "Tourism" itself refers to geosites visits for recreation, involving curiosity, appreciation and learning the forming process of a destination [7]. Factors of developing geotourism in a tourist destination are special characteristics, location, geosites, individual motivation, supporting facilities, the administrator, and promotion [9]. The main focus of geotourism is to promote the natural area to tourists. Geotourim could bring benefits to tourist and local people. Tourist can get a unique travel experience and local people can get economic benefit from tourist's visits [10]. This research has specified six elements of geotourism, such as management, education, uniqueness, accessibility, supporting facilities and increase of local people's economy (see Table 1).

**Table 1.** Geotourism elements in this research

<b>Geotourism</b>	<b>Indicator</b>
Management	Conservation, the administrator, price
Education	Education of forming process, nature
Uniqueness	Geosite, geological form
Accessibility	How to access, distance
Supporting facilities	Information center, accommodation
Increase of local people's economy	Economic level of local people

**3. Methodology**

This research uses mix method. The qualitative method is conducted by doing observation based on the geotourism elements to see the actual condition of the study area. The researcher also did depth interviews with stakeholders such as tourists, local people, and tourism academics to get their opinion on the study area based on geotourism element integration. The quantitative method is conducted by distributing questionnaires to 100 respondents with the ratio of 50:50 (tourists and local people), and these questionnaires are using Likert Scale as its value to get the respondent's perception on geotourism element of study area. All of the data then will be analyzed by using triangulation method to get a general idea of the current condition of Parbaba Village, then crossed with literature studies to get a recommendation of tourist attraction development based on geoutourism . The natural attraction component was integrated with six of the geotourism elements above (see Table 2).

**Table 2.** Integration of natural attraction and geotourism

<b>Attraction</b>	<b>Geotourism</b>	<b>The needed data</b>	<b>How to get</b>
Natural Attraction	The administrator	Who is the administrator, the price range, conservation of area.	Direct observation, questionnaires, depth interview

Education	Availability of nature forming process education.
Uniqueness	Uniqueness of geosite and landscape
Accessibility	Ease of access, access alternatives.
Supporting facilities	Availability of hotel and restaurant, toilet, and information centre
Increase of local people's economy	Utilization of attraction area by local people, increase of local people's standard of living

The main concept of geotourism is learning the process of geology and geomorphology, also to appreciate the formation process of a place [7]. Geotourism is also interpreted as a perspective on the use of geological relics and geodiversity [12]. Therefore, the researcher chose Pantai Pasir Putih area, Parbaba Village as the area of study due to its place formation uniqueness. Toba's Caldera, or also known as Lake Toba, is one of the natural beauties located at North Sumatera province. Toba's Caldera has formed from supervolcano eruption about 75.000 years ago [13]. Pantai Pasir Putih is part of existing geoarea in Samosir island (Figure 1.a). There is a geosite around Parbaba Village, that is Huta Siabiat geosite which is lake sediment in Lumban Suhi-Suhi, consists of volcanic sediment and covered by rocks and mosses (Figure 1.b). However, the area of study in this research is solely Pantai Pasir Putih due to its potential in the natural attraction that could be developed using geotourism concept.

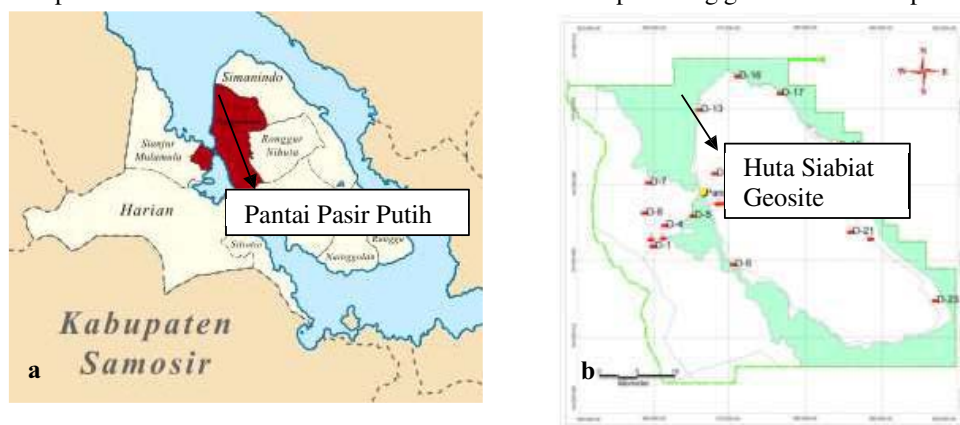


Figure 1. Samosir Province map and Geosite map in Samosir

#### 4. Analysis and Interpretation

##### 4.1. Management

The main purpose of geotourism concept is to maintain the authenticity of the place's character. A good management is needed to preserve the beauty of geotourism area [10] which could make it more sustain for the future. Respondents' perception of the administrator element in Pantai Pasir Putih area can be seen in Table 3.

**Table 3.** Respondents' perception of management element

Num.	Management	Nature		Average Value
		T	L	
1	Attraction of this place is managed by local people	4.35	4.26	4.30
2	The price offered in this place is affordable	4.12	4.37	4.24
3	Conservation of this place is good	2.24	4.28	3.26

T= Tourist, L= Local People

Respondents' gave an average rating of 4,30 for local involvement indicator (Table 3), shows that respondents' agreed that attraction of this place is managed by local people. While doing direct observation, the researcher also found that mostly local people manage the study area. It can be concluded that the criteria of the study area managers have met the principle of local involvement of geotourism concept [7] This is also explained by interviewees.

*"The stakeholders are the government, but the main managers are the local people"* (Main source: Tourism academics).

The price offered indicator in the study area gets an average rating of 4.24, indicating that the price offered in the study area is quite affordable (Table 3). Prices offered in the study area ranges between Rp. 20.000 - Rp. 250.000. Affordable prices will increase the number of tourists visiting, also to provide benefits to local communities as the manager [7], [10], [11]. This is also explained by interviewees.

*"The price offered by the community here is quite low. I think tourists from various age ranges can enjoy this tourist area."* (Main source: tourists).

Respondents rated an average of 3.26, with significant differences in ratings between tourists and local people on conservation indicators of the study area (Table 3). This difference occurs because local people didn't get any education about how to conserve the place. It can be concluded that the management of attraction in the study area still lacks in conservation elements (Figure 2) If conservation indicators are not developed, it is certain that the study area will not be sustainable in the future [7]. This is also explained by interviewees.

*"Conservation of the area is still very low; there is still a lot to do to improve its beauty. Local people still need to be fostered to maintain the beauty of the region."* (Main source: academics).



**Figure 2.** Current condition of Pantai Pasir Putih

It can be concluded that the management of attraction in the study area still lacks in conservation elements. If this conservation indicator is not developed, it is certain that the study area will not be sustainable in the future [7]. The stakeholder needs to review the standards in the effort to conserve the study area. For the administrator and price indicators are pretty good.

4.2. Accessibility

Access to a fairly easy location will increase the number of visits to a tourist area [9], [11] as the ease of access is one of the main factors for tourists in choosing their destination. Respondents' perceptions of the accessibility of natural attractions in Pantai Pasir Putih can be seen in Table 4.

**Table 4.** Respondents' perceptions of accessibility element

No.	Accessibility	Nature		Average Value
		T	L	
1	Attraction of this place is easily accessed	4.76	4.70	4.73
2	This place can be accessed by three alternatives	4.87	4.73	4.80

T= Tourist, L= Local People

Respondents rated an average of 4.73 for the indicator of accessibility to the area (Table 4), indicating that most respondents considered that the study area was fairly easy to access (Figure 3). This element meets the principle of geotourism concept, where the ease of access to the region should be considered to facilitate the tourists in visiting [9], [11]. This is explained by the interviewees

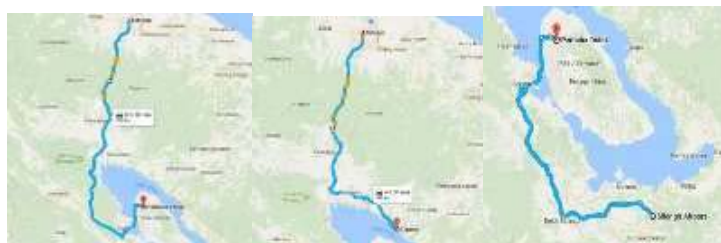
*"This tourist area is quite easily accessed; a good road also makes my trips and family easier."* (Main source: tourist).



**Figure 3.** Access condition in study area

For alternative access indicator of the study area, respondents rated an average of 4.73. Tourists who want to visit the study area have three access options; the first is through the Medan-Brastagi-Tele route, the Medan-Tigaras-Simanindo route ( $\pm$  5.5 hours) and the Medan-Silangit-Tele route ( $\pm$  3 hours) (Figure 5). It can be concluded that the accessibility of the study area is very easy, by the concept of geotourism which says that ease of access to a tourist area is one of important foundation for tourism [9], [11]. This is explained by the interviewees.

*"To access Pantai Pasir Putih; there are three access point; tourists are free to choose which alternative they are going to use"* (Main source: academics).



**Figure 4.** Access alternatives of study area

4.3. Education

Tourism activities in the context of geotourism should be able to provide education for tourists who visit. The education provided can be about the process of establishing a place, how to keep the area to be sustainable, and so on [7]. Respondents' perception toward the education of natural attraction in Parbaba village can be seen in Table 5.

**Table 5.** Respondents' perception of education element

Num.	Education	T	L	Average Value
1	The attraction of this place gives a good education of its nature	2.76	3.35	3.05
2	Education about the forming process of this area is available	2.78	3.25	3.02

T= Tourist, L= Local People

Respondents rated 3.05 for natural education indicator and 3.02 for education indicator of site formation process (Table 5). This indicates that the average respondent thinks that natural education element in the study area still lacks. This is explained by the resource person.

*"The process of forming this place should be more exposed so that tourists can enjoy the history of this place as well, not just its natural beauty."* (Main source: academics).

It can be concluded that the education about the existing tourist attraction in the village of Parbaba is still very less. This education element should be developed again because the concept of geotourism emphasizes on the education process of the formation of a region [7]. Some things that can be done to improve the education of attractions in the village of Parbaba, among others, by making the museum as well as the easiest by providing tour guide facilities in the area of Pantai Pasir Putih.

4.4. Uniqueness

A tourist area needs to have a uniqueness that can distinguish itself with other tourist areas. This special characteristic will certainly add to the tourist attraction of a tourist area [9], [11]. Respondents' perceptions of the uniqueness of natural attractions in Pantai Pasir Putih can be seen in Table 6.

**Table 6.** Respondents' perceptions of uniqueness element

No.	Uniqueness	T	L	Rata-rata Total
1	There are unique geosites in this area	4.54	4.34	4.44
2	The landscape of this area is unique	4.23	4.51	4.37

T= Tourist, L= Local People

Respondents rated an average of 4.44 for geosites indicator and 4.37 for geographic shape indicator (Table 6), indicating respondents considered that the unique element of natural attractions in the study area was interesting because the existing beach in the region formed from the eruption of the volcano and is on the edge of the lake Toba Caldera. Resource person also stated so.

*"Pantai Pasir Putih is indeed unique because it was formed from the eruption that occurred in Toba Caldera, not many know that they are standing on the fossil formation."* (Main source: academics).

It can be concluded that the study area has a lot of potential uniqueness that can be developed, such as the uniqueness of the beach itself which is the result of the eruption of Toba Caldera and its unique landscape form. Uniqueness potential itself has met the concept of geotourism factor, where the study area has a unique geographical and landscape form [9]. How to package this uniqueness into content that can be enjoyed need to be explored again before exposing it out to become a tourist guide for tourists.

4.5. Supporting Facilities

Supporting facilities such as restaurants, hotels, public bathrooms, and information centers are elements that need to be developed in a tourist area. With this element, tourists who visit can enjoy the study area with more comfortable [9], [11]. Respondents' perceptions of existing natural attraction facilities in Parbaba village can be seen in Table 7.

**Table 7.** Respondents' perceptions of supporting facilities element

No.	Supporting Facilities	Nature		Average Value
		T	L	
1	Restaurants/ hotels are available	4,12	4,37	4,24
2	Public bathrooms are available	2,12	3,06	2,59
3	Information centre functions in this area	2,23	2,54	2.38

T= Tourist, l= Local People

Respondents rated an average of 4.24 for restaurant and hotel indicators, indicating that respondents agree that around the study area there is restaurants and hotel (Figure 5). This is also stated by the resource person.

*"The hotels and restaurants that are here are mostly managed by us; there is no private party managing them."* (Main Source: Local People).

Respondents rated an average of 2.59 for public bathroom indicators around the study area (table 6). The difference in ratings between tourists and local people is due to the average of tourists assuming that public bathrooms in the study area are still inadequate (Figure 5). This is also shared by the resource person.

*"The public bathroom here is still not worth using, dirty and has no lights. I think it still needs to be fixed again."* (Main source: Tourist)

Respondents rated 2.54 for the information center function indicator (Table 6). This shows that most respondents agree that around the study area there is no physical information center for visitors, but the function is available. This is also stated by the resource person.

*"The information center in the region does not exist yet. There should be facilities that can notify visitors about what attractions are available in the area for more interesting visits."* (Main source: Tourist).



**Figure 5.** Supporting facilities in study area

Considering that supporting facilities are the important element in developing geotourism [9], [11], elements such as public bathrooms and information centers need to be developed so that tourists can enjoy their visit to the study area more. Sufficient supporting facilities can also be one of the attractions of the study area.

4.6. Increase of Local People's Economy

Application of the concept of geotourism can improve the economy both from local and national level [8]. The contribution of the local community as the main administrator of a tourist area will provide economic benefits to the local community [10]. Perceptions of respondents to the Increase of local people's economy in Pantai Pasir Putih area can be seen in Table 8.

**Table 8.** Respondent's perception of increase of local people's economy element

Num.	Increase of local people's economy	Nature		Average Value
		T	L	
1	People use the attraction area as an income	4,78	4,14	4,46
2	Economy of local people also increased with the attraction of the area	4,88	4,10	4,49

T= Tourist, L= Local People

Respondents rated an average of 4.46 for the indicator of the utilization of the attraction area by the local people (Table 8), indicating that most respondents agree that local people are using the attraction in the study area as a livelihood. At the time of observation, the researcher also saw that there are many local people who use the study area as a field of business. This is also stated by the resource person.

*"Mostly we depend on the business undertaken in this place to live our daily lives. The most are renting tubes, cottage, and also hotels."* (Main source: Local people).

For the indicator of improving the economy level of local people, respondents rated an average of 4.10 (Table 8). This shows that most respondents agree that with the attraction area in this place, the local economy will increase. This is also stated by the resource person.

*"Although our income here is not that much, we are quite grateful for the existence of this tourist area our living economy can be slightly increased. In the future, we expect more from this tourist area."* (Main source: local people).

It can be concluded that indeed with the presence of existing attractions in the study area, the living standard of the community can be increased although it's not significant. Given the number of visits that is not so much, other geotourism elements must be upgraded first to increase the attractiveness of the study area. The increasing number of visits will also improve the standard of living of the local people as the administrator [10].

### 5. Conclusion

Some of the geotourism elements studied in the study area have received good perceptions from local people and tourists. Accessibility of the study area is good enough, the constraint is only a considerable distance, but this is not a big problem if other elements are good and adequate. Study area already has its uniqueness. The uniqueness of the study area has a high potential that can be explored again to be packaged into content that attracts tourists to visit. The living standards of local communities are quite helpful; local people already utilize elements of natural attractions.

Conservation of attraction area is still very low. There are still many things that need to be done to improve this element, such as holding a seminar on how to conserve the natural area. The educational potential of the attraction is so large but still less exposed. This element needs to be explored again on how to package this educational element to be an interesting content, such as building a museum and providing tour guides in the area of study. Regarding supporting facilities, public toilets should be further improved. The unavailability of adequate toilets will make tourists reluctant to re-visit the study area. Information centers also need to be provided so that tourists can find out what attractions can be visited. Researchers recommend doing further research for developing other tourism attraction in Pantai Pasir Putih area.

### Acknowledgements

The researcher would like to thank Mrs. Beny O.Y. Marpaung and Mrs. Putri Pandasari for their contribution on finishing this research, all students of Department of Architecture, and also Sustainable Tourism Group of Universitas Sumatera Utara for their support.

### References

- [1] Sanda G 2016 How To Make A Destination More Competitive In Tourism *Annals-Economy Series* **3** pp 74-77
- [2] Kundu S K 2012 Economic empowerment through rural tourism: The case of Tarapith–A religious tourism destination in Birbhum District of West Bengal, India
- [3] Ginting N 2016 How Self-efficacy Enhance Heritage Tourism in Medan Historical Corridor, Indonesia *Procedia-Social and Behavioral Sciences* **234** pp 193-200
- [4] Ismayanti 2010 *Pengantar Pariwisata* (Jakarta: Grasindo)

- [5] Lopian S Q, Mandey S and Loindong S 2015 Pengaruh Advertising dan Daya Tarik Wisata Terhadap Keputusan Wisatawan Mengunjungi Obyek Wisata Pantai Firdaus di Kabupaten Minahasa Utara *Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi* **3**
- [6] Middleton V T, Fyall A, Morgan M and Ranchhod A 2009 *Marketing in travel and tourism* (Routledge)
- [7] Dowling R K and Newsome D 2006 *Geotourism* (Routledge)
- [8] Heidarian S and Asl A M 2015 Assessment of Geo Tourism Capabilities of the Hargalan Region of the Ajabshir City.
- [9] Calaforra J M and Fernández-Cortés Á 2006 Geotourism in Spain: resources and environmental management *Geotourism* (Oxford) pp 199-220
- [10] Boley B B, Nickerson N P and Bosak K 2011 Measuring geotourism: Developing and testing the geotraveler tendency scale (GTS) *Journal of Travel Research* **50** pp 567-578
- [11] Ginting N, Nasution A D and Rahman N V 2017 More Attractive More Identified: Distinctiveness in Embedding Place Identity *Procedia Environmental Sciences* **37** pp 408-419
- [12] Lima E A, Machado M and Nunes J C 2013 Geotourism development in the Azores archipelago (Portugal) as an environmental awareness tool *Czech Journal of Tourism* **2** pp 126-142
- [13] Chesner C A and Luhr J F 2010 A melt inclusion study of the Toba Tuffs, Sumatra, Indonesia *Journal of Volcanology and Geothermal Research* **197** pp 259-278