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Conservation of Culture Heritage Tourism: A Case Study in Langkawi Kubang Badak Remnant Charcoal Kilns

Chen-Kim Lim [1,*], Kian-Lam Tan [2] and Minhaz Farid Ahmed [1]

[1] Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia (UKM), Bangi 43600, Selangor, Malaysia
[2] School of Digital Technology, Wawasan Open University (WOU), George Town 10050, Penang, Malaysia
* Correspondence: kim@ukm.edu.my

Abstract: Remnants of old charcoal kilns found at Siam Village in Kubang Badak are about 100 years old, from approximately the same time as World War I. However, little research has been conducted into promoting the antiquity of remnant charcoal kilns as a representation of the historical inheritance of the Siamese community and their early settlement on Langkawi Island. This paper reveals the great potential of the abandoned charcoal kilns as a tourist site and shows the role of heritage conservation through reviewing the conditions. Following the methodology, firstly, charcoal kilns in Malaysia are investigated in term of their natural, cultural, and social history. Secondly, interviews were conducted to examine empirically the community life of that heritage area and the impacts of the charcoal kiln as tourist product. The segmentation of the narration into preservation means, sustainable activities, and historical knowledge is exemplified by extracting important data for taxonomic derivation of heritage conservation, economic, and community development. Finally, a set of guidelines including conservation approaches is proposed to support sustainable tourism development. The findings from the interviews conclude that the conservation of remnant charcoal kilns is vital for the long-term sustainability of cultural heritage tourism.

Keywords: case studies; cultural heritage; heritage conservation; geotourism; charcoal kilns; sustainability

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1. Introduction

Cultural heritage is a manifestation of the customs acquired by a community and circulated from generation to generation, including traditions, rituals, places, manners, artistic exercises, and values [1–3]. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), cultural heritage conservation refers to the procedures taken to extend the life of cultural heritage while intensifying communication of its significance and value [2]. In the sphere of influence of cultural places, the objective of conservation is to uphold the physical and cultural attributes of the object to guarantee that its appreciation is maintained and that it will endure over time.

It is important to conserve cultural heritage to keep us allied with our ethnicities, beliefs, way of life, civilizations, and community identities. Cultural heritage is what gives each community and a country their overall and individual identities. It is also something that gives people a feeling of harmony and helps them recognize their ancestries [4,5]. However, heritage objects are frequently threatened by various factors such as development, socio-political changes, terrorism, or natural hazards, making it difficult to conserve cultural heritage. Heritage sites that are not properly conserved will decay, even though they are quite worthy of becoming locations for cultural heritage tourism [6,7]. One of the ways to conserve cultural heritage is by producing high-quality documentation, involving gathering data about the history of the heritage objects to be conserved and learning how to conserve them [8]. If proper documentation is carried out and achieved, it could be passed as a guide or manual for future generations, as valuable knowledge or for reconstruction purposes.

Cultural heritage, geology, and tourism correspond well, in a context also known as cultural heritage geotourism [9,10], which the National Trust for Historic Preservation defines as "traveling to experience the places, artifacts and activities that authentically represent the stories and people of the past and present" [11,12]. Cultural heritage tourism offers multiple social and economic benefits to the local environment [13]. This paper concentrates on the case study of Kubang Badak, a cultural heritage site of geotourism product development which is known as BioGeoTrail Kubang Badak [14]. Preserving cultural heritage and its intangible values for future generations not only helps us to gain a better understanding of the evolvement of a particular society over time, but also to appreciate the richness of cultural diversity which contributes to tourism promotion and economic development. Consequently, it can benefit the people of Langkawi in terms of increasing the social economic status and living standards of the community by offering more job opportunities and boosting local businesses.

Langkawi Island is an archipelago of 99 islands in the Andaman Sea. It is a well-known tourist destination in Malaysia by virtue of its breath-taking landscapes, geologically rich area, biodiversity, and culture heritage. Millions of tourists each year are attracted to enjoy its natural beauty, culture, heritage, and recreational activities. As shown in Figure 1, Kubang Badak is in the northeast section of Langkawi. It has a diverse demographic profile compared to Langkawi, with Malay Muslims being the main population in the island. The total population of Langkawi is approximately 100,000 people, and there is also a significant population of Chinese and Indians who contribute to the island's cultural diversity. Geologically, Kubang Badak is in the center of a rock formation which creates different types of forests [15]. In recent years, Kubang Badak has developed as an attractive tourist spot because of its natural beauty, sandy beaches, cultural diversity, and economic activities such as tourism, recreational activities and fishing that have been significant contributors to the island's economic growth. These factors made have the island with its unique identity an attractive and important location for tourists and researchers.

Figure 1. Pinning BioGeoTrail Kubang Badak, Langkawi with its Routes and Pit Stops that Contribute to its Economic Activities (Photo by Muhamad Albarr Che Omar).

Conservation and preservation of natural and cultural heritage have long been recognized as crucial responsibilities for sustainable development. The United Nations has also recognized the importance of sustainable development and has taken measures to promote

it through various international agreements and initiatives. On 25 September 2015, at the United Nations Summit on Sustainable Development, 193 member states formally adopted the 2030 Agenda for Sustainable Development, which defines 17 sustainable development goals (SDGs) and 169 targets for 2030. The SDGs represent a comprehensive and integrated approach to sustainable development, encompassing social, economic, and environmental dimensions. Target 11.4 of sustainable development goal 11 (SDG 11) aims to "strengthen efforts to protect and safeguard the world's cultural and natural heritage" [16]. The 2003 Convention declared that adopting and protecting ICH would be "an assurance of sustainable development" [17–20]. Thus, there is an urgency to understand and the community's cultural heritage and incorporate this into conservation activities, andalso to conserve old Siamese charcoal kilns as a representation of the historical heritage of early settlement on Langkawi Island. To add to the statement of the current problem, the deterioration in the number of visitors in Kubang Badak from year 2017 to 2021 is presented in Table 1 for analysis. Table 1 also shows that Kubang Badak is the least popular and least visited area as compared to fifteen other geotourism sites in Langkawi.

Table 1. Number of visitors in Kubang Badak and fifteen other geotourism sites in Langkawi from 2017–2021 (Statistics from Langkawi Development Authority (LADA)).

NO	PRODUCT	YEAR				
		2017	**2018**	**2019**	**2020**	**2021**
1	LANGKAWI SKYCAB	1,264,635	1,221,395	1,274,033	533,462	115,348
2	UNDERWATER WORLD	426,099	433,046	436,274	185,537	38,539
3	TASIK D. BUNTING	462,725	403,143	438,532	149,764	22,164
4	KILIM KARST GP	242,841	244,294	292,391	115,129	54,907
5	TANJUNG RHU	196,580	326,607	208,143	41,016	0
6	MAKAM MAHSURI	187,262	195,978	188,048	68,349	20,468
7	LANGKAWI WILDLIFE	153,601	153,571	169,199	73,185	21,929
8	CROCODILE FARM	131,578	109,666	100,894	65,209	4883
9	MARDI ARGOTEK	91,632	96,463	105,674	18,837	1981
10	GALERIA PERDANA	78,807	89,882	108,981	17,149	6
11	TELAGA TUJUH	93,268	99,084	95,697	53,189	440
12	DURIAN PERANGIN	52,849	59,438	74,713	45,399	3021
13	AIR HANGAT VILLAGE	40,649	37,690	23,542	6916	2521
14	LAMAN PADI	56,989	60,527	65,900	14,348	2439
15	KUBANG BADAK	7328	6784	5381	2984	338
16	KOMPLEKS KRAF	71,906	81,745	75,234	45,988	5577
TOTAL		**3,558,749**	**3,619,313**	**3,662,636**	**1,436,461**	**280,093**

In this paper, we investigate a potential strategy and use this to develop a guidelines for preserving the cultural heritage that lies in the remnant charcoal kilns in Kubang Badak, Langkawi. One of the key contributions of this paper is to provide insights into how local

communities can be involved in cultural heritage preservation by the development of initiatives designed and implemented to benefit both the community and the environment. Furthermore, this study can contribute to the literature on sustainable tourism development, cultural heritage management, and community development. Following a qualitative approach, interviews and a focus group discussion were conducted to gather information on local community perspectives on cultural traditions and issues of tourism development. The data gathered were then analyzed to assess tourism activity, demographics, and economic impact.

2. Conditions

A kiln is a thermally insulated chamber that produces temperatures adequate to accomplish certain processes, such as hardening, drying, or chemical changes. In simple words, a kiln is like an oven. There are two main types of kilns, which are known as continuous (tunnel) kilns and periodic (intermittent) kilns [21,22]. Continuous kilns are always firing, so they never cool; the fire travels in a circuit, and the waste heat is used to preheat the raw materials. Periodic kilns are fired on an intermittent schedule and do not fire all the time. They must be filled, heated, cooled, and emptied at each firing.

A huge number of charcoal kilns exist in the world, as charcoal was once an important source for fuel [23–25]. In United States, there are many charcoal kilns in ghost towns and located just beside roadsides that people can visit easily to take a closer look at those kilns. Most of the kilns are beehive shaped and made from local stone and lime mortar [26–29]. One of the benefits of charcoal kilns being in ghost towns is that conservation of the cultural heritage might be secured as the area is huge and probably no development will be undertaken to destroy the charcoal kilns. Some examples of charcoal kilns located in ghost towns are the Piedmont charcoal kilns in Wyoming [30], Wildrose charcoal kilns in California [31], Canyon Creek charcoal kilns in Montana [32,33], the Nicholia or Birch Creek charcoal kilns in Idaho [34], Frisco charcoal kilns in Utah [32], and Panaca Summit [35], Tybo [36], and Bristol Well charcoal kilns in Nevada [32].

In Malaysia, most of the remnant and active charcoal kilns are igloo shaped, as shown in Figure 2. They are potentially impactful for heritage conservation [37] and the economic and community development of geotourism. Nevertheless, there are differences in the materials used and the methods of construction. For instance, the charcoal kilns in Kubang Badak, Langkawi are of two types built in different eras, the earlier of which were made from limestone, sandstone, and mud, while the others were made from red bricks and smeared with mud every 3 days. Similarly to charcoal kilns in Sungai Petani, Kedah [38], there were charcoal kilns in Sungai Merbok [39,40] and Semeling [41], which appear obviously to have been built in different eras. The charcoal kilns in Sungai Merbok are made with bricks and the kiln entrances clearly have a Persian Siamese design. Perhaps this is a follow-up from the design of the entrance to Istana Pulau Tiga, which was there when the kiln was first built [42]. The kilns in Semeling are made with red bricks and are still in good condition. Charcoal kilns in Kuala Sepetang, Perak use materials such as bricks, sand, and red earth [43,44]. According to [45], the charcoal kilns in Gelang Patah, Johor were originally built from earth. After World War II, the construction material for the kilns changed to red bricks, which are more durable. Among all the charcoal kilns stated, those in Kuala Lumpur are the only modern kilns, models CK-4 EURO & CK-1 EKKO produced by GreenPower.

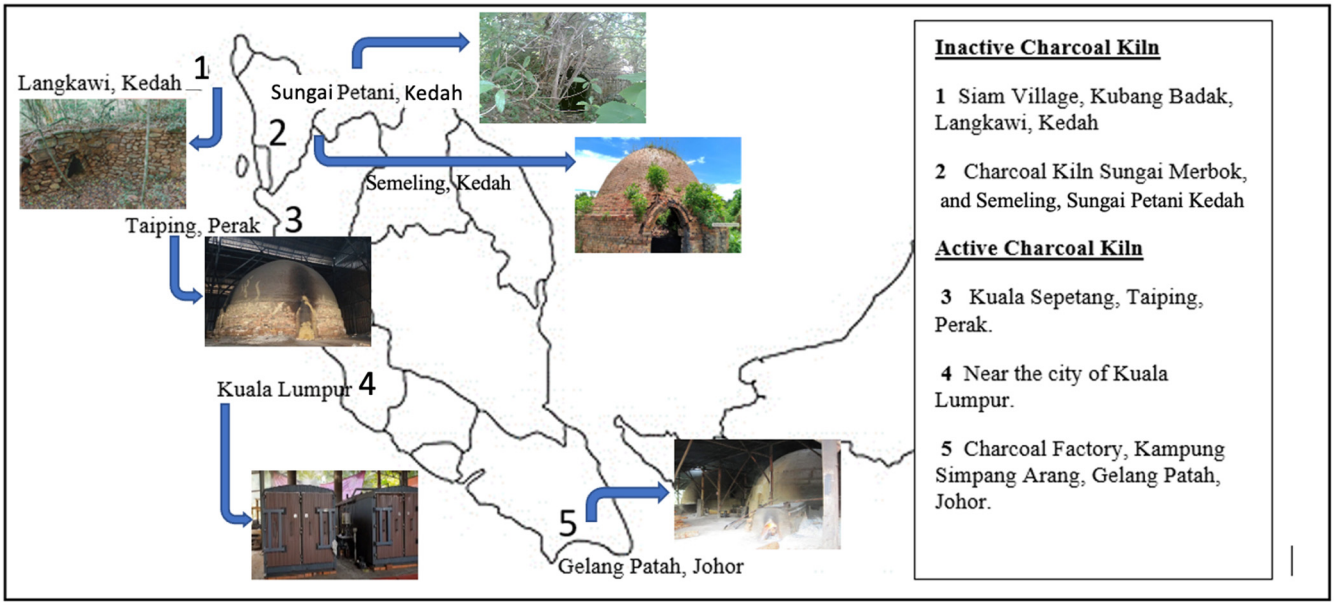

Figure 2. Remnant and active charcoal kilns in Malaysia.

Decades ago, these charcoal kilns were used to make charcoal from mangrove logs. Therefore, all charcoal kilns were built around mangrove areas that had an abundance of supply. After the illegal deforestation of mangrove trees, the supply of wood was depleted. Furthermore, in the 1980s the modernization of cooking sources using the gas as fuel instead of charcoal led to a decrease in traditional charcoal production and therefote the number of active charcoal kilns in many areas. Preserving the charcoal kilns in Kubang Badak as a cultural and heritage asset is undeniably beneficial for promotion of tourism and preservation of local traditions. However, it is crucial to consider the potential challenges and issues that may arise.

One potential challenge in preserving charcoal kilns for their cultural heritage is the issue of sustainability. The process of producing charcoal involves cutting down trees and burning them, with negative environmental impacts such as deforestation and air pollution. Another potential challenge is the issue of managing the increase in traffic, waste, and pollution if there is an over-crowding of tourists. By implementing measures to address sustainable tourism, the preservation of the charcoal kilns can be a positive force for economic and cultural development in Kubang Badak, while also protecting the environment and the local community.

Some parts of Asia such as South Korea and Japan have set good examples in conservation of kilns as tourism products. Gangwon Oak charcoal factory in HoengSeong is South Korea's largest complex of charcoal kilns [46–48]. It actively operates day and night; the charcoal kilns produce charcoal at night and function as saunas by day, because the locals believe that sitting in the kiln can cure disease and refresh their energy [49,50], although no scientific evidence is found stating the activity could cure disease. However, the consequences of carbonaceous aerosol pollution, which is released during the charcoal kiln production and carbonization processes, are of great concern. They may include diseases such as chronic obstructive pulmonary disease, increased respiratory symptoms, and decreased pulmonary function [49].

Terayama charcoal kiln in Kagoshima, Japan has a unique architecture compared to other charcoal kilns around the world. It is now being conserved physically and digitally; the site has been registered as part of the UNESCO World Heritage Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining listing [51]. The charcoal kiln has been conserved digitally by documenting it using augmented reality (AR) and virtual reality (VR) technology [52,53], whereby anyone can visit and tour the charcoal kiln at their fingertips by downloading the required application onto their smartphone [54]. In Wakayama

Prefecture, the abandoned charcoal kilns are conserved in order not to influence the original topography and to avoid disturbing the growth of trees surrounding the kilns.

3. Data and Methodology

It is important to establish clear research questions before conducting research, to ensure that the study is focused, relevant, and can generate useful results. the relevant research questions in this study are as follows:

- What are the perspectives and experiences of local residents regarding the conservation of the Langkawi Kubang Badak charcoal kilns, and how do they relate to the preservation of the site as a tourist place?
- What is the historical and cultural significance of the Langkawi Kubang Badak charcoal kilns, and how can this information be utilized to develop sustainable preservation practices?
- How can the knowledge and perspectives of different stakeholders be integrated into sustainable tourism practices that promote the preservation of the Langkawi Kubang Badak charcoal kilns?

This study was conducted using descriptive methods including field study and empirical semi-structure interviews (non-probabilistic intention) with residents. The guided questions created were simple architecture-form questions that included elements to speak to the hearts of locals and contextualize their feelings and thinking, intending to reduce friction with the residents. Furthermore, interviews were conducted by conversing in the local dialect, to be closer to respondents and allow them to feel comfortable about speaking up. As the education levels of the respondents are relatively low, based on their occupations, the choice of words in the questions were simplified. Despite their low education level, the social status of the community in the area is high. During the interview, participants were asked direct questions, to gain a deeper understanding of their perspectives and experiences related to the conservation of the Langkawi Kubang Badak charcoal kilns. The interview also involved follow-up questions to clarify and explore responses in more depth if the interviewer found it interesting and relevant to the research topic.

In this qualitative research, the researchers aimed to acquire comprehensive information about the particular situation of Kubang Badak charcoal kilns, rather than make statistical inferences. A non-probabilistic purposive sampling method was employed. This type of sampling involves the researcher using their judgement to select a sample that is most useful to the purposes of the research. An effective purposive sample must encompass explicit criteria and justification for inclusion. Thus, only the best suited respondents were selected for the purpose of our study. The respondents are representative of native people who live in the Kubang Badak heritage region. To capture the impacts described, narrative analysis was utilized considering a small sample size with only seven respondents selected. All seven of the participants are involved in tourism. Six out of seven participants have resided in Langkawi for over 20 years, and the remaining one for 5 years. Five of the participants are above 40 years old and the remainder are below the age of 40. The first five respondents are referred to as informants A, B, C, D and E.

Informant A was born in 1994 in Selangor and has been living in Langkawi for about 5 years. He was a mechanic back in Selangor but is currently a tour guide. He has brought tours to the remnants of the charcoal kilns countless times. Nevertheless, informant A is still in the process of researching and obtaining information regarding the charcoal kilns in Kubang Badak to provide his customers with scientific explanations about the place. Informant B was born in 1953; he is local and has lived in Langkawi since birth, and is a fisherman. Informant B's father and grandfather worked at the Kubang Badak charcoal kilns when they were inoperation. He had seen his father and grandfather send mangrove wood to the charcoal kilns. Born in 1978, informant C is a native in the Kubang Badak area who works as a tourist boat driver who had and might still bring tourists to the charcoal kilns. Three generations of his family stay in the area and he himself has resided in Kubang Badak for 44 years. Informant D was born in 2000 and is a native who has lived in this area

since birth. His mother is of Javanese descent and migrated to Penang then to Langkawi, Malaysia. He is the grandson of Tok Sani, who was among the first group of residents in that area. Previously, informant D worked at Langkawi Crocodile Adventureland and he is now a licensed nature tour guide. Born in 1980, informant E has been living in Siam Village, Langkawi for over 20 years. His mother is of Siamese descent while his father is among the first generation from Pulau Tuba, Langkawi. Informant E himself was born and raised in Pulau Tuba for about 15 years. He worked at a cement factory in Langkawi known as YTL Kedah Cement, and currently he is a tourist boat driver and a fisherman during his spare time. He has brought tourists to visit the remnants of charcoal kilns many times.

Out of the seven, one of them is considered the ambassador to Kubang Badak while the other one is the ambassador to Langkawi Global Geopark. To avoid bias, the two ambassadors were interviewed first about the history behind the Langkawi Kubang Badak charcoal kilns. These are the UNESCO Geopark ambassador, who is also a local nature tour guide, and the Sungai Kubang Badak Fishing Cooperative Berhad secretary. These two respondents are the best people to recite the history of charcoal kilns, based on the community recommendations.

The interview was conducted in two parts: (1) the history of the Kubang Badak charcoal kilns, with the two ambassadors; and (2) open-ended questions focusing on the topics of preservation means, sustainability activities, as well as history knowledge, with informants A, B, C, D, and E. Conducting interviews with two ambassadors and then having five people to complete the interview separately, the responses from the different groups were compared to identify any potential biases or variations in the data. Furthermore, the ambassadors can provide a unique perspective on the topic as they may have different roles or responsibilities within the organization or community. They were divided into different groups to ensure that the research findings are robust and reliable. By having multiple informants answering the same questions, the consistency of the responses can be verified for any discrepancies or variations in the data. Additionally, having different groups of informants can help to provide a more comprehensive and diverse perspective on the focused topic, as different groups may have different experiences, opinions, and knowledge.

We wanted also to understand ideas about sustainability that should be applied to preserve the charcoal kilns. The initial selection criteria used was a positive response to the question: "Are you interested in sustaining Kubang Badak charcoal kilns as a tourist place?" Potential respondents who answered with a "No" were immediately excluded from the interview. The third part of the interview asked the following questions, as in Table 2.

Table 2. Interview Questions.

Focus Topic	Questions
Preservation Means	1. Why preserving the old charcoal place is important? 2. What are the activities being carried out for preservation and what elements or sources are important to be preserved?
Sustainable Activities	1. How are the numbers of visitors before, during, and after the breakout of the COVID-19 pandemic? 2. How is the place being taken care of to sustain it? 3. What are the possible issues that will deteriorate or harm the place? 4. What are your thoughts on the sustainability of this place in the next 10 years or in the future?
History Knowledge	1. How much history do you know about the current place? 2. How much knowledge do you know about the charcoal-making site? 3. Do you think the younger generations are well taught about the place? How is the knowledge being transferred to the younger generations?

In this study surveyed the local community in Kubang Badak. It is important to note that the sample size in qualitative research is typically smaller compared with quantitative research, as the focus is on in-depth exploration of experiences and perspectives rather than statistical generalization. Therefore, the low number of testimonies from the interviews in

this research may not necessarily be a limitation, especially if data saturation was reached and the richness and depth of the data collected are deemed sufficient to answer the research questions. In our study, we conducted in-depth interviews with each participant, which allowed us to obtain detailed and comprehensive information about their experiences and opinions. Additionally, we conducted a thorough analysis of the data collected, which provided us with a comprehensive understanding of the research problem. However, it is important to acknowledge the potential for biases, such as researcher bias in selecting which answers to exclude, and transparently to report the methods used to ensure rigor and validity in the data collection and analysis process.

4. Results

After interviewing the ambassadors, it was apparent that there were two generations of charcoal kilns in Kubang Badak, as summarized in Table 3. The first generation started between 100 to 130 years ago, after the war between *Kedah Tua* and *Siam*. The Siam forces won the battle, resulting in expansion of the South Thailand community into North Langkawi. As the demand for charcoal increased, about twelve charcoal kilns were built by the Thai community but owned by the Chinese. The kilns were built using limestone, sandstone, and mud. The locations of the charcoal kilns were close to the fuel source in the mangrove area, and about two kilometers from the charcoal storage which is known as *jong* by the locals.

Table 3. Comparison between first and second generations of Kubang Badak charcoal kilns.

Kiln	First Generation	Second Generation
Age	100–130 years	50–70 years
Location	Near mangrove forest, 2 km from *jong*	Very near to *jong*
Made from	Limestone, sandstone, and mud	Red bricks and mud
Number of kilns	Originally 12 kilns	3 kilns

After about 30 years, the charcoal operation stopped as people were focusing on logging. To allow the lost mangrove trees to regrow, the second generation of charcoal kilns were built about 50 to 70 years ago, a short distance from the first generation and very near to the *jong*. The kilns were made of red bricks and smeared with mud every 3 days to provide better protection to the kilns. Charcoal production then stopped completely around 20 years ago. The authorities have banned the activity as they aim to preserve the mangrove in Langkawi, and the locals are focusing on tourism. As territorial actors, local authorities have an important role in the conservation process, especially in terms of managing and regulating the use of natural and cultural resources. They are responsible for developing policies and strategies aimed at preserving and protecting local heritage sites and ecosystems, as well as ensuring that the community benefits from sustainable development initiatives. Local authorities also play a key role in providing technical and financial support for conservation efforts, as well as promoting awareness and education among the local population. Ultimately, their role is to balance the needs of the community with the need to protect and preserve valuable cultural and natural assets for future generations. To understand and witness these remnant charcoal kilns, a field trip guided by the UNESCO Geopark ambassador was carried out to visit one of the first generation charcoal kilns, as illustrated in Figure 3.

Figure 3. A site visit to one of the first generation's charcoal kiln guided by the Kubang Badak Ambassador. (**a**) Entrance of the remnant charcoal kiln; (**b**) An inlet of a remnant charcoal kiln; (**c**) Remnant charcoal kiln from the inside (Left) and outside (Right) (**d**) The 12th kiln of the first generation (Left) and first kiln of the second generation, made of different types of materials (Right).

The second part of the interview was to investigate the impact of the Kubang Badak Bio-GeoTrail on the preservation of the remnant charcoal kilns in Siam Village, and its importance to heritage conservation, economic, and community development. The one-to-one interviews

were audio-recorded, and each interview was transcribed in 24 h. The feedback given is segmentized into the topics that were narrated by the informants, as shown in Table 4. Based on Table 4, the narration was then compiled into a taxonomy, as in Figure 4, that characterizes heritage conservation, economic, and community development in Kubang Badak, and clearly summarizes the impact and benefits obtained for tourism heritage from the development of remnant charcoal kilns. Table 3 can be interpreted through the common key components that were mentioned by each informant. If a particular informant mentioned the structured topics, aspects, and descriptions during the interview, the table is marked correspondingly and the common key components among the informants can be easily traced.

Although Kubang Badak may have limited tourism activity, Langkawi is a popular tourist destination with a well-developed tourism sector that contributes to the local economy, providing employment opportunities and generating revenue for local businesses. The island's natural beauty, and the recreational activities and cultural attractions on offer make it an attractive location for tourists. The available tourist activities include enjoying the beaches, rainforests, waterfalls, and wildlife. Visitors are also starting to engage with activities such as island hopping, mangrove tours, snorkeling, and kayaking. Moreover, there has also been a recent growth in adventure tourism such as ziplining, jungle trekking, and ATV riding. However, sustainable tourism practices are needed to ensure the long-term viability of the tourism industry and the preservation of the island's natural and cultural resources, to avoid overcrowding and environmental degradation that have negative impacts on natural and cultural resources. Thus, it is vital to work together with local government, business players, and communities to implement sustainable tourism practices that keep a balance between economic development and environmental and cultural preservation.

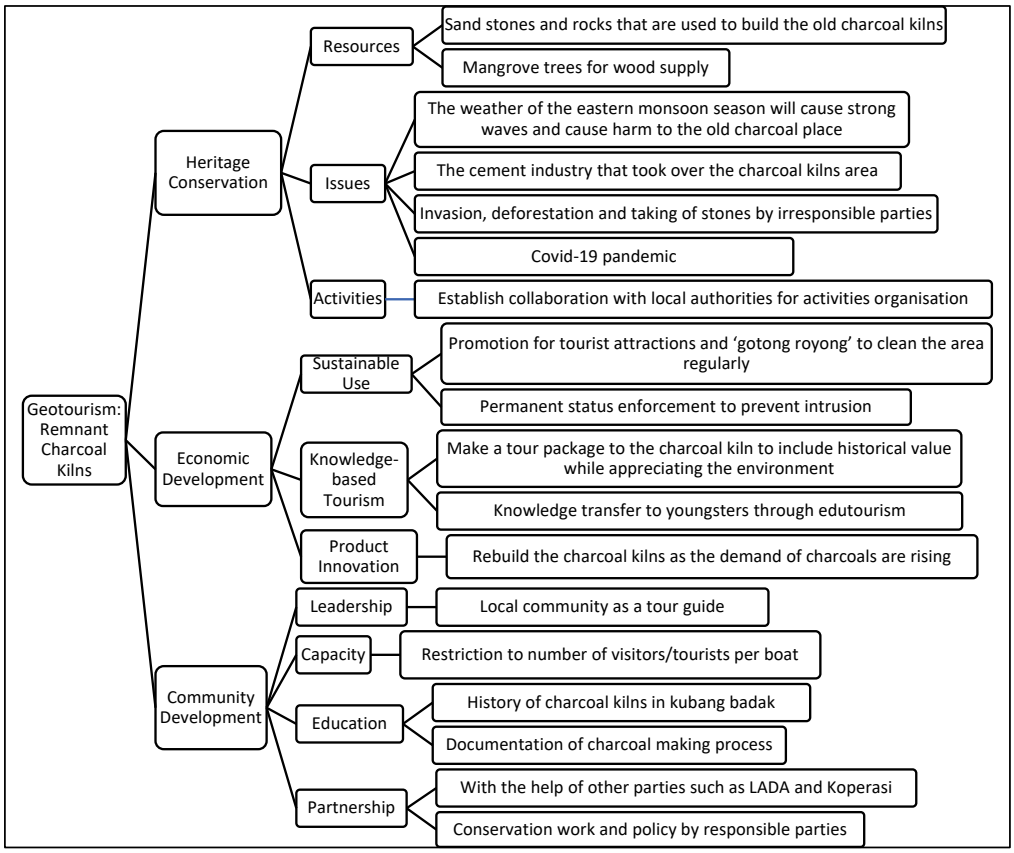

Figure 4. A taxonomy of topics narrated by informants during the interview.

Table 4. Topics that were narrated by informants during the interview.

Topics	Aspects	Description	Informant				
			A	B	C	D	E
Preservation means	The old charcoal kilns	Important to attract tourists and for future generations	/	/	/	/	/
		For the younger generation to know its contribution	/	/	/		
		The place contributed to the history of the formation of Siam Village		/	/	/	/
		Could rebuild the charcoal kilns as the demand for charcoal is rising					/
	Preservation activities	Should apply to the relevant department to preserve	/				/
		Make a tour package to the charcoal kiln to include historical value while appreciating the environment	/	/	/	/	/
	Important element	Sand, stones, and rocks that are used to build the old charcoal kilns should be preserved	/			/	
		No cutting down the mangrove trees				/	/
Sustainable activities	Number of visitors/tourists	Not much difference between before and after COVID-19	/				
		Fewer visitors after COVID-19		/	/	/	/
	Sustainability	With the help of other parties such as LADA and Koperasi	/	/	/	/	/
		Declare this place to have a permanent status to prevent intrusion				/	
		Promotion for tourist attractions and 'gotong royong' to clean the area regularly		/			/
	Issues	The weather of the eastern monsoon season will cause strong waves and cause harm to the old charcoal kilns	/				/
		The cement industry that took over the charcoal kilns area		/	/		
		Inntrusion, deforestation, and taking of stones by irresponsible parties				/	
	In 10 years	Conservation work by responsible parties needs to continue for future generations	/	/	/	/	/
History knowledge	Information about the charcoal kilns	From a tour guide and fellow friend when following a tourist boat	/				/
		From the elders and the villagers		/	/	/	
	History of the place	At a time when the charcoal activities were still active, many residents, including their fathers and grandfathers, worked for wages carrying the mangrove wood for the charcoal chamber and worked in the charcoal chamber. Wages were paid according to the number of yards (a kind of measure) of timber delivered. Apart from taking wood to the charcoal chamber, the residents in Kg Ewa and Kubang Badak worked as fishermen and made boats out of wood.		/	/		
		It happened after the Kedah-Siam war in the 1800s. Kedah lost in the war and Langkawi was colonized. Then, the era of charcoal factories in this charcoal kiln area began.		/		/	
		The villagers say it was the local Chinese who started this charcoal chamber, but it was operated by the local Malays.	/	/	/	/	/

Table 4. *Cont.*

Topics	Aspects	Description	Informant				
			A	B	C	D	E
	Charcoal making process	The wood was brought into the charcoal kiln to be burned for more than a week. After all the wood was burned, the door/hole of the charcoal chamber was closed to put out the fire for a few days until the whole fire was extinguished, before the charcoal was removed. Wage proceeds were taken either as cash or food items.		/	/		
		The mangrove wood was cut to a length of about 2 m, the bark removed and pasted on the wall. The charcoal chamber was closed with about 300–500 sticks in the chamber, which burned for 3 weeks to a month. The villagers always monitored to ensure that the fire was not extinguished. After 2 weeks the fire was extinguished and about 3 days after that the chamber door was opened.				/	
		The charcoal kiln was built by stacking river stones like stacking bricks, without using cement. The roof was laid on top, charcoal put in and a fire was lit from below					/
	Younger generations knowledge	Not many youths know about the history of charcoal kilns in Kubang Badak	/	/	/	/	/
		Only the families that have worked in charcoal kiln industry would know		/	/		
		Not many know; only the ones who live in the area and are involved with tourism	/	/	/	/	/
		Tourist who visit the place may gain knowledge but young people might not be interested					/
	Transfer knowledge to youngsters	Agree if included in the history subject at school	/			/	
		Society and school need to know their role	/		/	/	/
		Promote by social media such as YouTube and Facebook, and make use of gadgets	/			/	/

5. Discussion and Conclusions

In 2018, Malaysia is famous for its islands and coastline, ranked the third-largest economy, with tourism as a key economic pillar [55,56]. Sustainable development goals (SDGs) 9 and 11 recognize tourism as one of the industries central to global development to tackle global challenges, especially with the presence of the COVID-19 pandemic worldwide. Therefore, a sustainable tourism product ensures economic, socio-cultural, and environmental sustainability in many contexts such as continuous tourism income, employability, the utilization and availability of clean water, biodiversity conservation, or preservation of cultural heritage, and many more, for local communities and tourists. Through the mediation of sustainable awareness, an innovation and green tourist product will significantly contribute towards SDG 9 for sustainable tourism. The sustainable development of tourism not only promotes tourism and cultural heritage, but it also creates a link between local needs, natural resources, and tourism. Thus, it is vital to continue to conserve the remnant charcoal kilns. The guidelines are being compiled through the voice and suggestions of the community who lives there, in term of preservation, protection and/or safeguarding, economic development, and educational empowerment, as shown in Table 5.

Table 5. A Guideline of Conservation Approach for Remnant Charcoal Kilns and Cultural Heritage in Kubang Badak According to High, Medium or Low Priority.

	Preservation	Protection/Safeguarding	Economic	Education
High Priority	(1) Some geosites are preserved on-site through appropriate planning and design, protecting them from natural and man-made destruction. (2) There are exceptional geosites present.	(1) Collaborating with landowners to protect geosites within the industry or on individual land. For instance, in the case of Kubang Badak, Gua Pinang was protected through a partnership and consent with Lafarge Cement, while a portion of Pulau Jemurok was protected through a partnership with Hideout Resort.	(1) Geosites are utilized for sustainable tourism, geotourism, and knowledge-based tourism. (2) The empowerment of locals as tour guides is key to establishing the BioGeoTrail. (3) The emphasis on integrated heritage conservation in Kubang Badak makes it a cross-cutting effort. (4) The economic component is closely linked to other preservation, protection/safeguarding, and education efforts.	(1) A set of courses designed for tour guides to learn about the BioGeoTrail. (2) An information panel created for a specific geosite that includes an explanation integrated within it. (3) Establishing a connection between geology, biology, and culture to enhance appreciation and understanding. (4) Organizing school activities through "Geopark Goes to School", especially for children from Sek. Ren. Keb. Kg. Ewa, which is located nearby. (5) During the revalidation process for UNESCO Global Geopark status in 2019, the UNESCO Assessor visited Kubang Badak Heritage Trail as part of the evaluation. (6) The Langkawi UNESCO Global Geopark was able to maintain its green card status for the fourth time during the revalidation assessment.
Medium Priority	(1) Representative samples are collected and preserved at the Langkawi research center for research purposes. (2) Some samples are displayed at the Discovery Geopark Centre or selected information centers, such as the Four Season Geopark Info Center or the LADA Geopark Info Centre. (3) The local community of Kubang Badak has shared numerous significant cultural sites related to family kinship with Siamese relations.	(1) The existing natural resource protection act is utilized for conservation. In the case of Kubang Badak, the geosites are included under the Forestry Department Act 1984 as it is situated within the forest reserve. (2) The purpose of the Kubang Badak Heritage Trail is to promote and showcase conservation initiatives conducted by the Langkawi development authorities in partnership with the local community. Safeguarding natural and cultural heritage resources should be a collaborative effort conducted both from the top-down and the bottom-up.	(1) Establish a BioGeoTrail that links the geological heritage with the biological and cultural heritage of the area. (2) There are ecotourism elements associated with all geological, biological, and cultural heritage, with geotourism activities now emerging at the Kubang Badak Heritage Trail.	(1) A booklet made available to the public on the sites present within the BioGeoTrail. (2) A printed board or sign providing information about the area, located near the fisherman's jetty in Kubang Badak.
Low Priority	(1) Proof of charcoal kilns.	(1) It is crucial to increase and reinforce shared values among the local community, stakeholders, tourists, and others. Improving shared values is an ongoing effort accomplished through engagement processes and education and awareness initiatives.	(1) Local socio-economic activities, including food stalls, a fish market, small handicraft shops selling baskets, and activities that take place at the Kubang Badak Heritage Trail.	

The empirical findings of this research document show that remnant charcoal kilns could potentially serve geotourism to improve the social economy of the local community. For all aspects of geological, biological, and cultural heritage, there are elements of ecotourism and now emerging geotourism activities carried out at the Kubang Badak Heritage Trail. The context is cross-cutting because of the emphasis on integrated heritage conservation in Kubang Badak, with the creation of a BioGeoTrail that connects the geological and biological heritage with the cultural heritage of the area. Similarly, the economic component is strongly linked with other components of preservation, protection/safeguarding, and education [57]. The activities for these components mentioned are undertaken to ensure conservation is carried out alongside any development activities in Kubang Badak, which is important for the entire island of Langkawi.

Furthermore, the use of abandoned charcoal kilns use for sustainable tourism and knowledge-based tourism can empower local community members as tour guides in the establishment of the BioGeoTrail. Local socio-economic activities such as food stalls, a fish market, crab farms, mangrove tours and a small handicraft shop selling handmade baskets, located at the Kubang Badak fishermens' jetty, are well established thanks to the efforts by the different stakeholders to safeguard the physical and cultural heritage resources of the remnant old charcoal kilns. Each stakeholder has a different role and responsibilities in ensuring the sustainability of tourism in Langkawi [56]. The government has developed a sustainable tourism framework and strategy that refers to the Langkawi Tourism Blueprint and National Tourism Policy [58] to address the key sustainability challenges and opportunities related to cultural and heritage preservation, and to provide guidelines and recommendations for sustainable tourism development.

Meanwhile, businesses such as hotel owners are constantly under monitoring and evaluation to track the progress and effectiveness of the sustainability initiatives, based on regular reporting of key sustainability indicators such as economic impact, environmental performance, and social benefits of the cultural and heritage preservation of Kubang Badak. Meanwhile, the local communities are engaged in building capacity and training in sustainable tourism practices, with owners and businesses obtaining guidance on sustainable tourism development and working with tourist guides to promote responsible tourism practices. Hence, it is important to increase and strengthen shared values among the local community, stakeholders, tourism players, and tourists in the context of cultural and heritage preservation in Kubang Badak, to instill continuous collaboration and coordination to achieve sustainable tourism.

From the interview, we can conclude that remnant charcoal kilns have the potential to be conserved for cultural heritage tourism. This conclusion is aligned with other studies on the potential for cultural heritage tourism to promote sustainable development and preserve historical sites. For example, a study of the role of cultural heritage tourism in promoting sustainable development in the historic city of Suzhou, China [59] found that cultural heritage tourism can enhance the conservation and revitalization of historic sites, while also generating economic benefits for local communities. Another study analyzed the potential for cultural heritage tourism to promote sustainable development in the ancient city of Hoi An, Vietnam [60]. The study concluded that cultural heritage tourism can provide economic benefits for local communities, preserve cultural heritage, and enhance social and environmental sustainability. Overall, these studies support the potential for cultural heritage tourism to promote sustainable development and preserve historical sites, including remnant charcoal kilns.

Furthermore, this study has also highlighted the importance of involving local communities and multiple stakeholders in cultural and heritage preservation initiatives to promote sustainable tourism development. In the case of the Langkawi Kubang Badak charcoal kilns, it is particularly significant that the community's insights are being gathered to help determine measures that should be adopted for the preservation and protection of the ecosystem. This is an important step towards ensuring sustainable development that balances economic needs with environmental protection.

Furthermore, by involving the community in the process, a sense of ownership and pride in their cultural heritage can be fostered, which can lead to increased support for conservation efforts and a stronger commitment to preserving their cultural identity. Overall, involving the community in anthropological work is crucial for achieving sustainable double-dimension cultural patrimonial and tourist economic effective conservation efforts that consider the needs and perspectives of all stakeholders involved. We acknowledge that our study has some limitations, including the small sample size, and have addressed this: what matters is the quality of data collected and the richness of the information gathered from the informants. We believe that our findings provide valuable insights into the experiences of the community in this target group, in regard to the specific challenges and opportunities related to cultural and heritage preservation of Kubang Badak. These findings can inform future research and serve as guidelines for sustainable tourism development, cultural heritage management, and community development.

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