

The Impact of Geopark Recognition on Kilim Karst Geoforest Park, Langkawi

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The impact of geopark recognition on Kilim Karst Geoforest Park, Langkawi

Potential public policies on spatial planning for sustainable urban forms

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Abstract: Geoheritage refers to areas of geodiversity that have been specifically identified as having conservation significance. Nowadays, heritage and tourism have significant impacts on the ecotourism sector. Geoparks have a clear vision to develop and manage a geological heritage site using concepts such as protection, education and sustainable development. However, geoheritage tourism will impact the ways Geopark recognition affects the surrounding environment which, in the case study area, is the Kilim Karst Geoforest Park (KKGFP). The study used an in-depth interview method, with the target respondents being experts and professionals in this field. All the interview structure and questions were strategically arranged into a smaller number of aspects and elements. The results were analysed using the Atlas.ti software version 8. The qualitative data analysis was transferred into a Conceptual Model Network (CMN). Based on the Conceptual Model Network, it was recognised that positive and negative impacts were affected by several factors. Geotourism activity resulted in the most disturbances in KKGFP; proper management planning could solve these problems. This study hopes to organise and produce precise and accurate data concerning the impact of Geopark recognition on the Kilim Karst Geoforest Park (KKGFP), Langkawi. The findings also will inspire further Geopark-related studies directed towards potential future Geoparks in Malaysia and other countries.

1. INTRODUCTION

The ecotourism sector in Malaysia has emerged due to the country's natural attractions and unique geographical landscape. The demand for ecotourism has accelerated development and growth and had various impacts on the heritage, environment and socio-economic development of local communities ([Lee and Jayakumar, 2021](#); [Misni, Rasam et al., 2017](#); [R. Zhang, Y. Zhang et al., 2017](#)). According to [Sapari, Shuib et al. \(2013\)](#), Malaysia is one of 12 mega-biologically diverse countries and has numerous species of flora and fauna. Kilim Karst Geoforest Park (KKGFP) is one example of an ecotourism destination that consists of various mesmerising geoheritage and



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natural landscape features. The KKGP area has become famous since Langkawi was accorded World Geopark status by the United Nations Educational, Scientific and Cultural Organization (UNESCO) on June 1, 2007. The island also became a member of the Asia Pacific Geoparks Network and the Global Geoparks Network (GGN) ([LADA, 2016](#)).

The Geopark area is a developed historical geosite that sustainably balances tourism developments, economic activities and the conservation of natural and geopark sites. The assets of the Geopark span a broad spectrum of geological and geomorphological landforms, ranging from active volcanism to Precambrian rock formations, while Karst landscapes are popular tourist destinations worldwide ([Megerle, 2021](#)). As the planning and management are under official control, all developments in the geopark are regulated ([LADA, 2016](#)). However, the term Geoforest Park refers to particular conservation areas that consist of geological features within the forest reserve ([LADA, 2014](#)). According to [LADA \(2016\)](#), Langkawi Geopark is located in the far north-western corner of Peninsular Malaysia, in the northern state of Kedah. It is unique because it is formed from 99 islands that together comprise the legendary Langkawi Archipelago ([LADA, 2016](#)). Langkawi Geopark includes three Geoforest Park areas, known as Mat Chinchang Cambrian Geoforest Park, Dayang Bunting Marble Geoforest Park and Kilim Karst Geoforest Park. Historical evidence has identified the level of identity and originality in the area and offers significant proof of the highly valuable character of the local human history and surrounding environment ([Fauzi, Misni et al., 2017](#); [Fauzi and Misni, 2017](#)). For example, the KKGP became famous as the area is unique: it consists of a karst landscape surrounded by mangrove forests, caves and a vast mesmerising natural view ([Fauzi and Misni, 2017](#)). In the north part of Langkawi Geopark, the KKGP was developed on the oldest limestone in the country, known as the Setul Formation ([Leman et al., 2007](#)).

Some of these limestone rocks that look like mountains were formed 500 million years ago ([LADA, 2016](#)). Meanwhile, since this time, the mangroves have served to protect the shoreline from the sea and prevent soil erosion by forming a barricade. In addition, the KKGP has become a favourite ecotourism destination. The surrounding environment is rich in numerous types of flora and fauna which could become a natural 'living museum' that visitors to the area can explore, as shown in [Figure 1](#). However, given the rapid emergence and growth of ecotourism, there has been increasing demand for facilities and other tourism developments ([Komoo, 2010](#)). Many tourism activities and facilities have been improved to satisfy tourists ([Fauzi and Misni, 2016](#)). Among the tourism activities that have become the main attractions in the KKGP include a mangrove boat ride tour, cave exploration and fish farms, along with eagle and monkey watching and feeding.

The expected growth in geotourism and its related trends can positively contribute to the sustainability of the protected area, the surrounding areas and the local communities ([Štrba, Kolačková et al., 2020](#)). Geotourism can become the main instrument for preserving these areas and raising environmental awareness among the population and visitors. In terms of dissemination of information among visitors, the positive impact of tourism dates to when the increasing interest and attendance of people in protected areas began ([Leung, Spenceley et al., 2018](#)). This positive impact initiated the need to guide visitor movements around protected areas. In this regard, fewer restrictions are required to control the movement of tourists in the area. The purpose was to encourage the visitors to understand nature conservation. Moreover, [Štrba, Kolačková et al. \(2020\)](#) and [Lee and Son \(2017\)](#) stressed that the improper management of tourism development can lead to negative

impacts, which include the loss of aesthetic value; more solid waste and littering; greater deforestation due to building construction; soil erosion; surface, water and air pollution; ecosystem disruption; and the destruction of geoparks due to the use of vehicles and the landscape. For visitors, these changes reduce the attractiveness of a site.

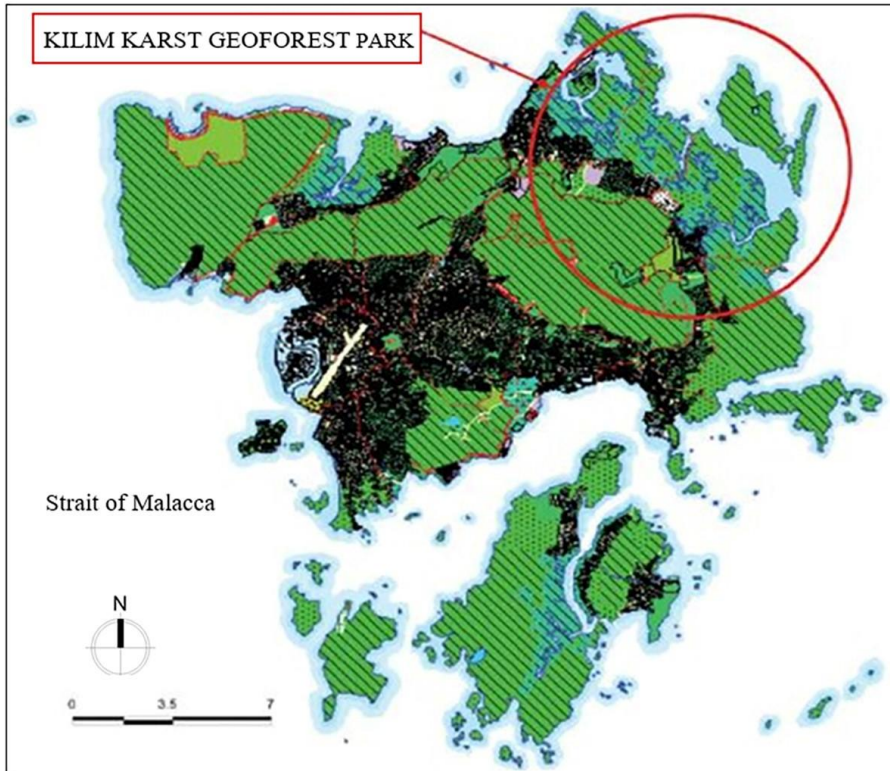


Figure 1. Kilim Karst Geoforest Park location
Source: ([Langkawi Municipal Council, 2005](#))

Therefore, this study conducted in-depth interviews with experts and professionals to obtain primary data regarding the impact of Geopark recognition on the surrounding environment of the KKGP area. This study discovered factors that contributed to the impacts of ecotourism development on the KKGP area.

2. RESEARCH METHODOLOGY

2.1 Study Location

The area of this study is one part of Langkawi Geopark, known as the Kilim Karst Geoforest Park (KKGP), which is on Langkawi Island, as shown in [Figure 1](#). Langkawi is a part of the state of Kedah and is a district and archipelago of 99 islands in the Malacca Strait. It is about 30 km off the coast of north-western Malaysia and adjacent to the Thai border, south of Ko Tarutao. The exact location is 6°21' North and 99°48' East. This study covered the specific parts that had been developed for ecotourism purposes and exposed to mass tourism activities. The study focused on the geology ([Figure 2](#)) and landscape involved in the territory, the geo-conservation elements and the natural heritage around the KKGP.

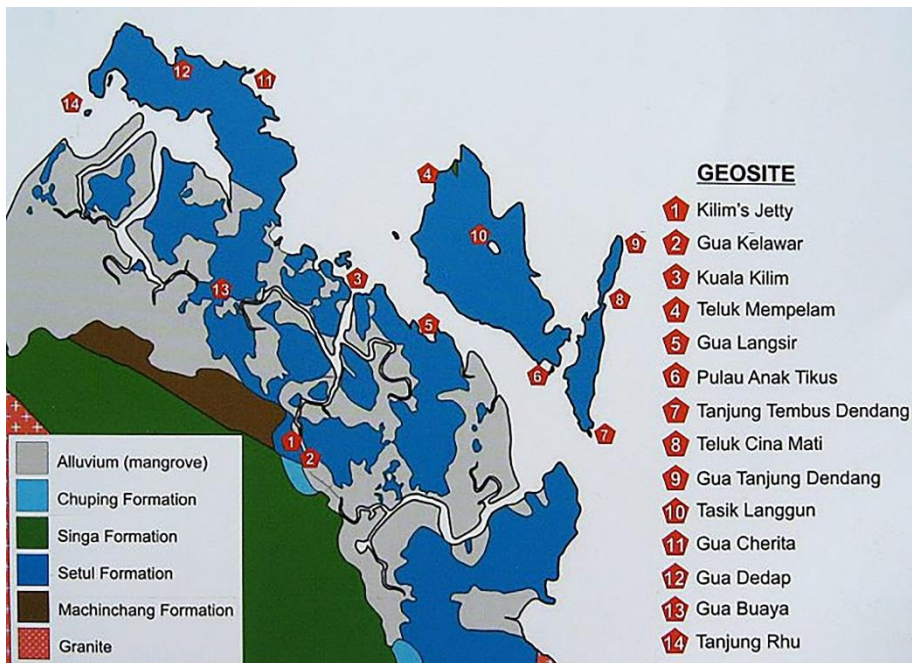


Figure 2. Various types of karst formation/geological features in the KKG
Source: ([The Official Park Manager, 2021](#))

2.2 In-depth expert interviews

This study used a qualitative method involving in-depth interviews. Seventeen professionals and experts were chosen because all of them contributed directly to the management aspect of KKG. All of them had a broad knowledge of the KKG and the natural heritage and environment. They had a better understanding of, and opinion about, conservation and management than the general public. Therefore, the interviews included all the agencies and individual experts with potential roles in, and understanding of, the Geopark, especially the KKG. The professionals and experts were asked about the conservation and management-related issues and problems in the KKG. They needed to answer the interview questions by referring to their roles and expertise. The list of 17 professionals and experts from various agencies involved directly in the KKG is as follows:

1. Four professionals and experts from LESTARI UKM, Langkawi Research Centre.
2. Three professionals and experts from the Langkawi Development Authority (LADA).
3. One professional and expert from Friends of Langkawi Geopark (FLAG).
4. One professional and expert from the Forestry Department.
5. Four professionals and experts from the Cooperative of Kilim Village Community Langkawi Limited.
6. One professional and expert from the local authority - Langkawi Municipal Council Tourism City.
7. One professional and expert from the Local Tourist Guide Association.
8. Two professionals and experts from academia (UiTM).

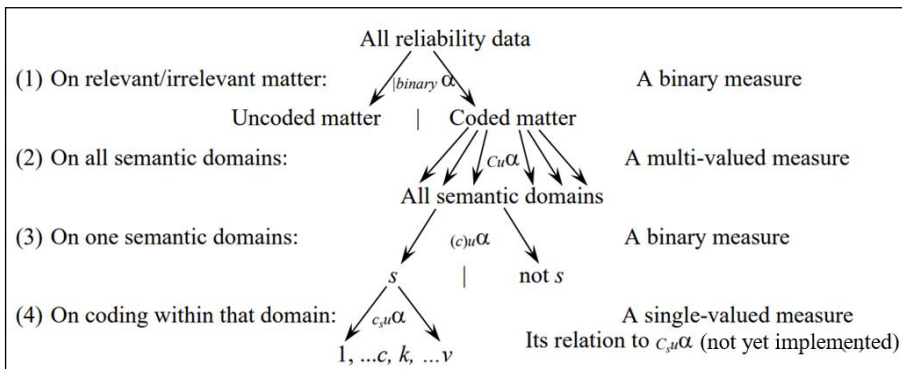
They were asked about the current conditions, conservation, management and situation related to the KKG; all the comments were recorded. The structure of the interview was divided into certain categories by referring to

the indicators and elements of the Geopark and the Geoforest Park. The categories referred to the participants' general understanding of the Geopark and the Geoforest Park; the issues and problems of the KKGP; and the conservation and management aspects of the KKGP.

2.3 Data analysis

The primary data obtained from the many open-ended questions were transcribed and analysed using Atlas.ti software version 8. Atlas.ti is a computer programme used primarily for qualitative data analysis to help researchers to generate a systematic analysis of unstructured data collected from interview sessions (Frieese, 2014). All the results were compared and evaluated systematically using this software to ensure precise and accurate recording. The finalised results from the transcribed documents were visualized through a Conceptual Model Network (CMN).

Krippendorff's family of alpha coefficients offers various measurement to carry out calculations at different levels. The first three coefficients are implemented in ATLAS.ti (Krippendorff, 2018) as follows:



Where:

- Alpha binary indicates the extent to which coders agree on the relevance of texts for the research project.
- $Cu\alpha$ indicates the extent to which coders agree on the presence or absence of semantic domains,
- $(c)u\alpha$ indicates the degree to which coders identify a particular semantic domain s .

3. RESULTS AND DISCUSSION

3.1 Factors attracting visitors to KKGP

The variety of elements found in the KKGP has made the area a favourite heritage ecotourism destination. These elements that have become the major assets to the development of the KKGP are listed below:

- i) Caves - 21 caves.
- ii) Karst - various forms and historical formations of karst.
- iii) Fossil diversity - many fossils have been documented, such as the Setul and Singa Formation, dating from 505 to 286 million years ago.
- iv) Coastal mangrove swamp - 77 out of 114 species of mangrove in the world are found in Langkawi Geopark.

v) The wide Andaman Sea - the blue sea has various karst forms and clear blue sky.

vi) Amazing flora and fauna - the existence of many species of flora and fauna.

vii) Beautiful island - the isolated island at Kilim has become an attraction.

Since the KKGPP is famous for its rich natural heritage assets, it has considerable development potential, and many similar advantages, to become a fantastic and actual living museum as part of a conservation-led approach ([Figure 3](#) and [Figure 4](#)). By conserving this area strategically, the heritage assets and natural elements could be protected with dignity.

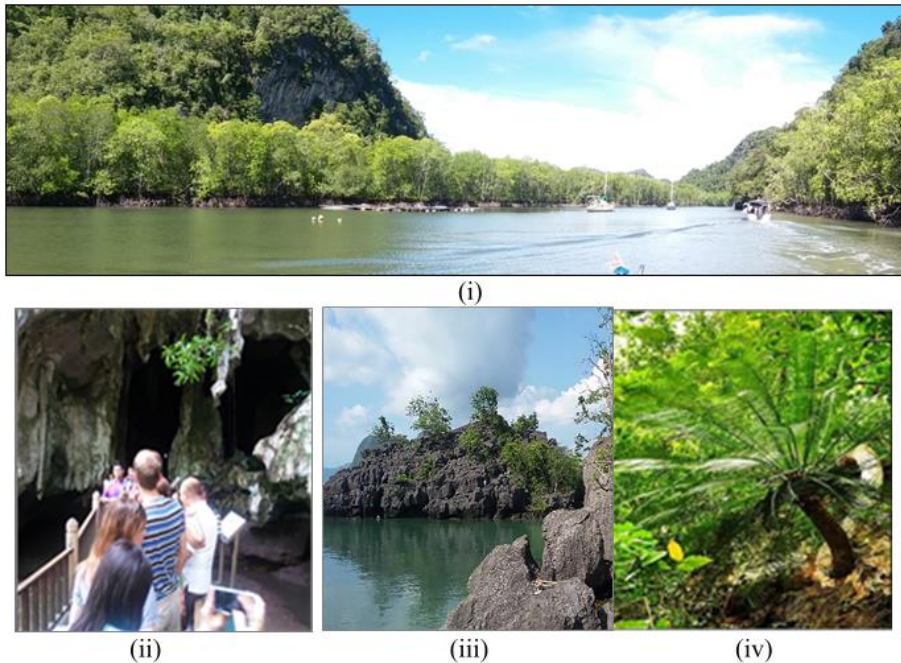


Figure 3. The magnificent historic landscape features in the KKGPP include (i) Extensive mangrove forest, (ii) Various caves and (iii) Breath-taking forms of karsts and (iv) The Cliff-dwelling Cycad attached to a cave wall 280 million years ago

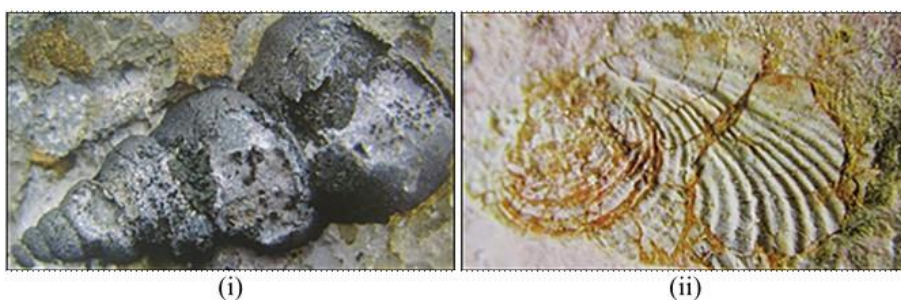


Figure 4. (i) A gastropod fossil embedded in the limestone at Anak Tikus Island, and (ii) A bivalve fossil, *Posidonomya* sp., found in the red sedimentary rock at the northern part of Langgun Island in the KKGPP

Source: ([The Official Park Manager, 2021](#))

3.2 The impact of Geopark recognition on the KKGPP

Currently, as an ecotourism destination, the KKGPP faces many kinds of impact as a result of growing development. The development of new

infrastructure, facilities and various tourism activities has unintentionally affected the surrounding environment. This is normal, since any element poses a benefit or problem when it has a significant impact. It was impossible to create a perfect development or sustainable planning without flaws. The impact of Geopark recognition on the KKGP resulted from several factors.

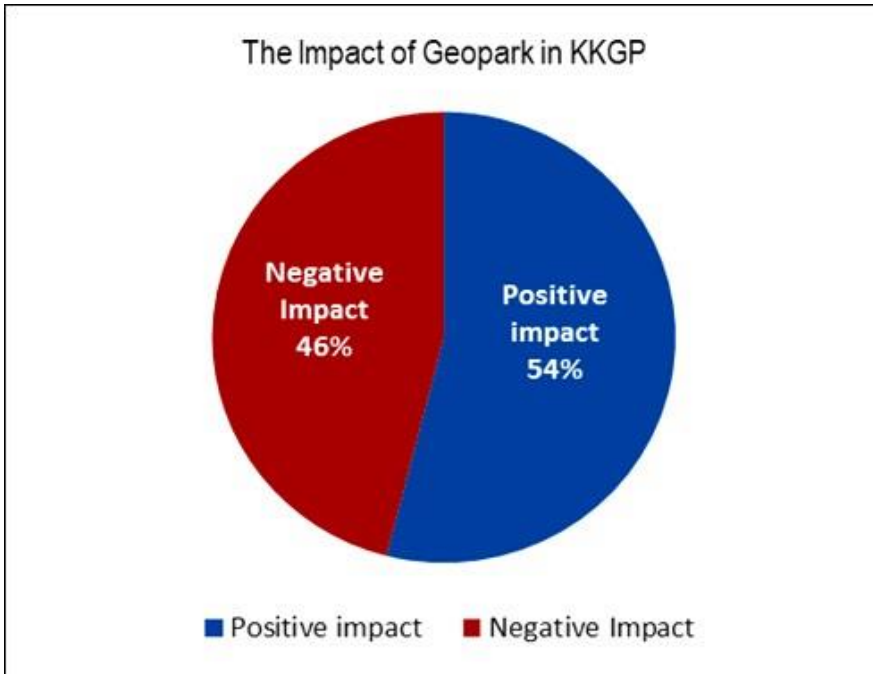


Figure 5. Comparison of the positive and negative impacts of Geopark recognition on the KKGP that have contributed to the sustainability of the protected Geopark areas, the surrounding areas and the local communities

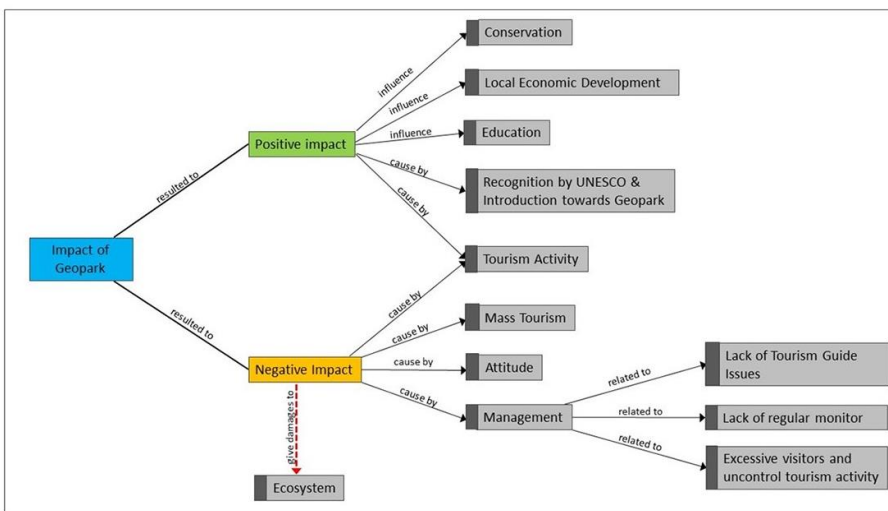


Figure 6. The Conceptual Model Network (CMN) of the impact of Geopark recognition on the KKGP

All the listed comments from the professional experts were recorded and coded; this was based explicitly on the study. From the in-depth professional interviews, the impacts of Geopark recognition on the KKGP could be divided into two, positive and negative. As illustrated in [Figure 5](#), the positive impact results were dominant, representing around 54%, while the remainder referred to the negative impact features, which contributed about 46%. Even though

the area has been developed for ecotourism purposes and is exposed to mass tourism activities almost throughout the year, the positive impact factors, as listed in [Figure 6](#), are still evident in this established World Geopark. In contrast, a negative impact is usually unavoidable as a harmful consequence of tourism activities if not controlled and managed sustainably. Thus, both the positive and negative impacts of Geopark recognition on the KKGP area were affected by several aspects. The similar aspects of both types of identified impact related to tourism activities.

3.2.1 The Positive Impact

As shown in [Figure 7](#), the CMN identified that the positive impact of Geopark recognition on the KKGP resulted from the recognition gained from UNESCO and the introduction of the Geopark concept.

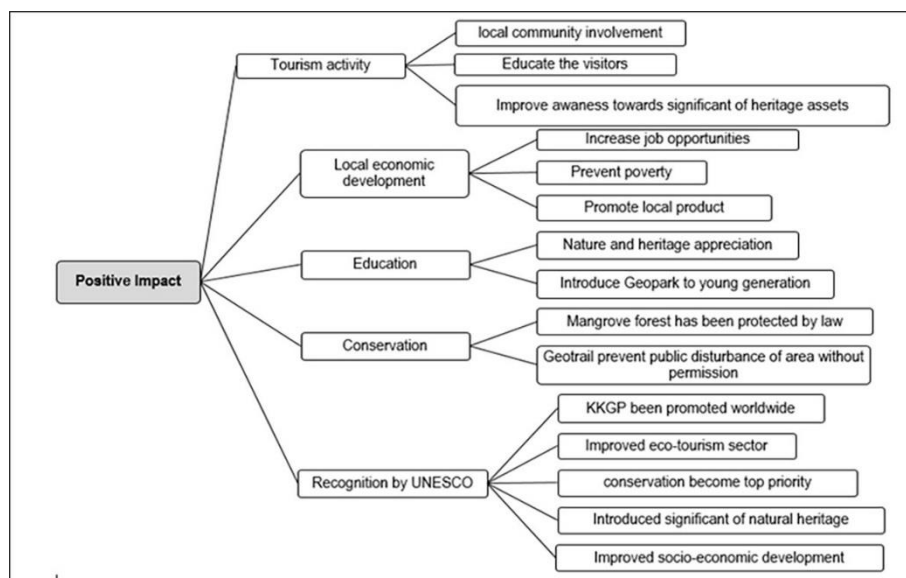


Figure 7. The Conceptual Model Network (CMN) showing the positive impacts of Geopark recognition on the KKGP

Having Geopark status has successfully promoted the KKGP area worldwide. This recognition rapidly increased the number of annual visitors to the KKGP ([Komoo, 2010](#)). Many visitors from developed countries come to the KKGP to seek and explore the breath-taking, natural, rich and beautiful landscape of the KKGP. Meanwhile, the Geopark concept requirements have been fulfilled and continuous assessment/recognition has been gained from UNESCO. Both these aspects have made conservation a key priority in the KKGP. Therefore, these elements have dramatically influenced the aspects of conservation, local economic development and education in the KKGP. The results reveal that the LADA management team has been passionate about improving the conservation aspects. This agenda also aims to meet the UNESCO management requirements while continuously maintaining the originality of the KKGP. Recently, the mangrove forest has been protected and the deforestation of mangroves has become illegal. In addition, the Geotrail activity has become a practical approach to preventing public disturbances in another area of the KKGP. Many areas in the KKGP could be protected from uncontrolled development and outside intervention. The conservation aspect has included geological and natural elements. These elements have been managed wisely and sustainably by LADA, in cooperation

with the related agencies, such as Kedah Forestry Department and Langkawi Municipal Council Tourism City.

Furthermore, geoheritage tourism in the KKGP has become well-established at local and international levels. As a result, the number of tourists is regularly increasing, which improves the local communities' economic development while the natural resources are maintained sustainably. More job opportunities and chances to promote local products have been provided in the KKGP areas (Komoo, 2017). Meanwhile, the worldwide introduction of the KKGP also improved levels of awareness among future generations of the significance of the Geopark and the conservation of its natural heritage. Tourism activities and the mass media have promoted and provided more information and knowledge to the public, thus improving education. This shows that the KKGP has achieved the UNESCO Geopark vision of maintaining heritage conservation, education and tourism, as well as inclusive local community involvement.

3.2.2 The Negative Impact

Several factors related to Geopark recognition have contributed to significant problems and had negative impacts on the KKGP area. Figure 8 illustrates those aspects, which include the KKGP management, tourism activity in the KKGP and the attitude of the community to the KKGP.

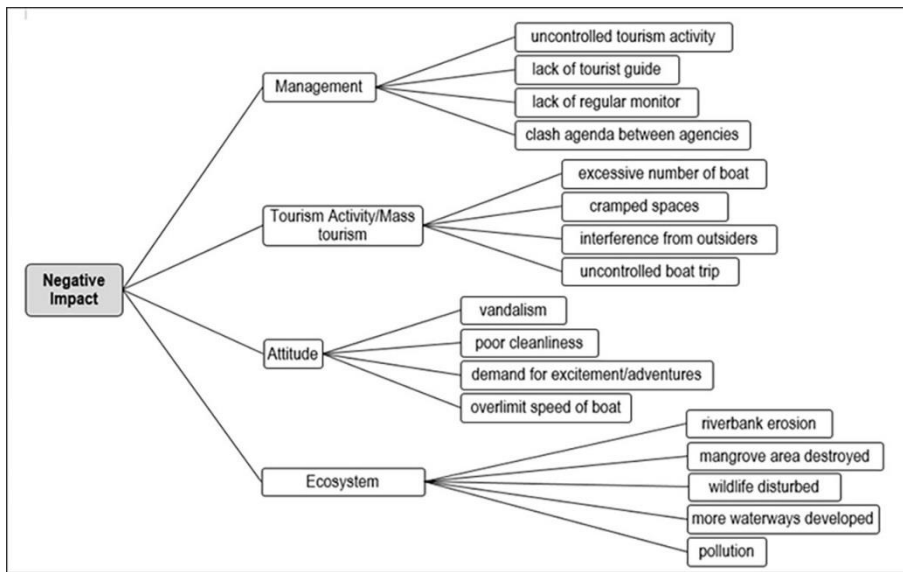


Figure 8. CMN showing the negative impacts of Geopark recognition on the KKGP

Although mass tourism positively impacts local economic development, unfortunately, these aspects also lead to ecosystem disturbance. In management terms, the KKGP is managed jointly. This involves LADA, Kedah Forestry Department and the local community group, which operates a boat tour activity in the KKGP. Thus, this situation has sometimes created an agenda clash. For example, LADA, as the Langkawi Geopark coordinator/manager responsible for preparing the development planning for the KKGP, has taken a progressive approach to managing KKGP. However, as the KKGP includes the Kisap Forest Reserve, the Forestry Department has a significant right to most KKGP areas. Meanwhile, the local community group has managed most tourism activities in the KKGP. Therefore, each

agency may have slightly different perspectives; hence, management misunderstandings might occur.

In addition, mass tourism in the KKGP has led to uncontrolled tourism activity. A lack of tourist guides and regular monitors has exacerbated the issues. Trained tourist guides play a vital role in educating and controlling visitors' attitudes so that they respect the sensitive natural areas, the boatmen and the Geotrail exploration in the KKGP. As stated by the professionals and experts, each boat tour should be accompanied by one tourist guide. Therefore, the visitors could be educated and their attitudes to the sensitive nature areas could be observed along the journey. However, the lack of trained tourist guides has caused a problem, in that when many visitors come to KKGP, this has resulted in uncontrolled activity, including excessive boat speeds and numbers of operations. No expert and trained tourist guide may be available to control the situation and the visitors' behaviour.



Figure 9. The negative impacts of Geopark recognition on the KKGP include (i) riverbank and mangrove erosion and (ii) Vessels going over the speed limit during boat tour activity

Besides, the excessive number of boats has resulted in the space for vessels being reduced, which may cause mangrove riverbank erosion. This has happened because uncontrolled numbers of boats cause massive waves to hit the riverbank area. Erosion will occur, damaging the mangrove forest and making the river in the KKGP shallower as shown in [Figure 9](#). This condition also risks the safety of the visitors. The attitudes of visitors and local communities also harm the KKGP. For example, without regular monitoring by any relevant authorities, vandalism always happens around the KKGP. Without a trained tourist guide and proper supervision, some visitors intentionally destroy the hard-scape facilities such as boardwalks, rubbish bins, signboards and toilets. In addition, wildlife such as plants and animals around the KKGP can be harmed. Other than that, visitor attitudes and judgements could be criticised as issues arise with boat tour activities. Boat tour activities have had negative impacts on the KKGP as a result of the demand for excitement and adventure by visitors on the tours. Some visitors request that the boatman provides the adventure of a full-speed boat tour. Thus, boats speed over the limits in the KKGP area, which could destroy the mangrove ecosystem around the riverbank due to the massive waves from the boats.

[Figure 10](#) shows the professional and expert comments on the negative impacts of Geopark recognition on the KKGP. Based on the results, boat tour activities have contributed significant damage to the KKGP area. According to the experts, without proper planning and monitoring, the KKGP area would be destroyed if the boat tour activities were not controlled. As the boat tour

activity is the main attraction in the KKGP, this should be appropriately managed to sustain the ecosystem and revive the economy of the local communities. Besides, visitor attitudes also contribute to most issues and problems that occur in the KKGP. Visitors, management teams and the local community should be well-educated and it is important to raise the levels of awareness of the significance of natural heritage conservation.

In addition, an uncontrolled number of visitors has also become a significant concern. Although an increasing number of visitors to the KKGP benefits the local communities' socio-economic development, this has disturbed the ecosystem due to the uncontrolled tourism activities and excessive daily tourist numbers. A sensitive area such as the KKGP needs proper guidelines and measures to conserve the area sustainably. Nevertheless, other factors also negatively impact the KKGP, such as the lack of regular monitoring, tourist guide issues and uncontrolled tourism activity such as eagle and monkey feeding. The professionals and experts suggested that these elements should also be significant concerns when preparing a sustainable approach to the conservation of the KKGP.

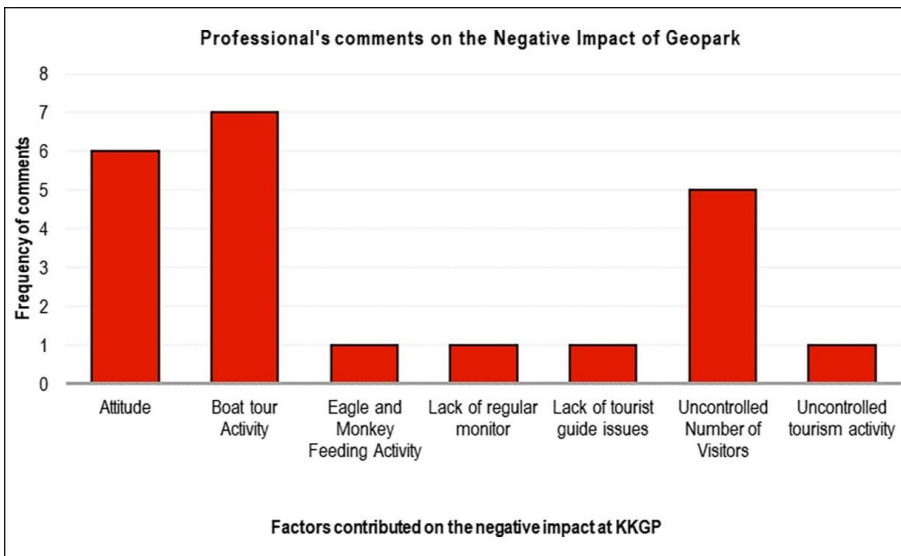


Figure 10. The professional and expert comments on the factors contributing to the negative impact on the Geopark recognition on the KKGP

The results show that the Geopark concept has had both positive and negative impacts on the KKGP. The findings also reveal that the Geopark concept has successfully made a positive contribution to the KKGP. Nevertheless, its impact has become a significant concern in terms of the conservation of sensitive areas and important heritage sites such as the KKGP. The negative impact will lead to more severe problems and place sensitive areas such as the KKGP at risk as it becomes worse.

As the coordinator of all the management in the KKGP, LADA must prepare a comprehensive management/conservation plan to address the endangered geoheritage. The damage to, and loss of, geological and historical assets could affect the protected areas established through gaining World Geopark status. In addition, because of various elements around the Geopark area, there is a crucial need for a conservation plan that is more specific and wisely planned according to each element. Each geological heritage element

has different characteristics, so different problems must be addressed in different ways.

4. CONCLUSIONS

The Geopark concept considers three main aspects: heritage, tourism and conservation. As a thriving Geopark destination, these three concepts must have a significant focus on the development and management planning of the area. Therefore, as one of the areas in Langkawi Geopark, the KKGP should be effectively managed in a sustainable and appropriate manner to sustain the originality and value of the significant heritage elements. The natural geoheritage elements that have been destroyed, such as karsts, wildlife, mangrove, flora and fauna cannot be replaced. The loss of those elements will impact the ecosystem and socio-economic development of the local community, as well as the country's natural historical background. Thus, the value of the magnificent heritage assets in the KKGP should be fully preserved, in addition to being conserved appropriately and sustainably. The Geopark concept and idea has provided structural and basic guidelines for managing a Geopark. The guidelines and criteria set by UNESCO should be used as the basic standards with which to organise and manage specifically the KKGP area. However, the recognition as a World Geopark has had a more positive impact on heritage tourism activities in the KKGP.

Tourism activities have contributed to local community socio-economic development, as well as improving awareness and education among the visitors and local population. The conservation that LADA manages around the sensitive area of the KKGP. Maintains the uniqueness of the natural elements. Similarly, as the negative impacts have been identified, technical and further research should address the problems. The management team should cooperate with experts to study the related factors and long-term impacts of the Geopark on the condition of the KKGP. Each development faces various challenges and risks, as well as having positive or negative impacts on the KKGP area. However, as a sensitive natural area, the KKGP should be effectively conserved through proper development and management planning. Thus, the negative impacts should be progressively addressed with specific measures so that the KKGP can be conserved for the benefit of future generations.

AUTHOR CONTRIBUTIONS

Introduction and conceptualization, N.S.M.F. and A.M.; methodology, N.S.M.F.; software, N.S.M.F. and A.M.; investigation, N.S.M.F.; data curation, N.S.M.F.; writing—original draft preparation, N.S.M.F. and A.M.; writing—review and editing, N.S.M.F. and A.M.; supervision, A.M. All authors have read and agreed to the published version of the manuscript.

ETHICS DECLARATION

The authors declare that they have no conflicts of interest regarding the publication of the paper.

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