Enhancing Educational Strategies for Sustainable Tourism in the Geopark Area: A Case Study Geopark Maros Pangkep

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Abstract
Tourist destinations in ecologically sensitive areas face significant challenges in balancing visitor management with conservation efforts. The Rammang-Rammang Karst Area in Maros District, part of the proposed UNESCO Global Geopark Maros-Pangkep, exemplifies these challenges. This study investigates current visitor management strategies in Rammang-Rammang, focusing on physical, regulatory, economic, and educational approaches. Methodologically, the research employs a qualitative descriptive analysis through a case study approach. Data collection includes on-site observations, interviews with key stakeholders such as local tourism authorities, Geopark management, community-based tourism groups, and tour guides, supplemented by document analysis. Triangulation of data ensures reliability and validity. Key findings highlight the effectiveness of existing strategies in managing visitor impacts on both the environment and local culture. Challenges identified include inadequate infrastructure and inconsistent enforcement of regulations. Educational initiatives show promise in raising visitor awareness but require enhancement. The study concludes by recommending integrated strategies that strengthen regulatory frameworks, improve infrastructure, and enhance visitor education to achieve sustainable tourism practices in Rammang-Rammang. This research contributes insights applicable to similar karst landscapes globally, emphasizing the need for tailored approaches that harmonize conservation goals with socio-economic benefits. By addressing these challenges comprehensively, this study aims to support the long-term sustainability and resilience of ecotourism in Rammang-Rammang and comparable geological formations worldwide.

How to Cite
INTRODUCTION

In the past decade, much research has focused on the sustainable management of tourist destinations, particularly in ecologically sensitive areas such as karst landscapes. One notable case study is the Rammang-Rammang Karst Area in South Sulawesi, Indonesia, renowned for its limestone formations and rich biodiversity (Agus Mandong et al., 2023; Junaid & Fauziah, 2019). Previous studies have underscored the dual challenge of accommodating growing visitor numbers while safeguarding the natural and cultural integrity of such sites (Abd Elhalem et al., 2019; Gosal et al., 2021). Strategies explored include visitor management techniques like capacity control and infrastructure development, as well as education management strategies aimed at raising visitor awareness and fostering a culture of environmental stewardship. These efforts are crucial for maintaining the balance between conservation goals and sustainable tourism development in this unique geological and ecological setting (Cheng et al., 2023).

Making topic generalizations, studies underscore the global relevance of effective visitor management and education strategies in ecologically sensitive areas like karst landscapes. Similar issues of balancing conservation with tourism development are evident worldwide, emphasizing the need for context-specific approaches that integrate environmental protection with socio-economic benefits (Haribudiman et al., 2023). Insights from diverse research on sustainable tourism and conservation management provide a foundation for evaluating best practices applicable to Rammang-Rammang (Junaid, 2015). By synthesizing these findings, this study aims to contribute nuanced recommendations tailored to the unique challenges and opportunities presented by this renowned karst area, fostering a model of balanced ecological stewardship and visitor engagement.

Establishing the niche in the context of visitor management and education management strategy in the Rammang-Rammang Karst Area involves addressing the complexities of sustainable tourism and conservation practices. Despite increasing interest and efforts in managing tourist activities in environmentally sensitive regions (Baloch et al., 2023), significant gaps remain in understanding the specific challenges and effective strategies applicable to karst landscapes (Baloch et al., 2022), like Rammang-Rammang. This research aims to fill these gaps by investigating current visitor management practices and assessing the implementation of education strategies within the unique context of this karst area. By examining these aspects comprehensively, the study seeks to provide insights into how sustainable tourism can be achieved while preserving the natural beauty and ecological balance (Streimikiene et al., 2021).

Announcing the present research, this study will analyze data collected from on-site surveys, interviews with stakeholders, and reviews of existing literature on visitor behavior and environmental impacts. The principal findings will highlight successful models of visitor management and education strategies that promote responsible tourism practices and community engagement (Choe et al., 2023). The structure of this
research will begin with an overview of the Rammang-Rammang Karst Area and its significance as a tourist destination, followed by an exploration of current challenges in visitor management. Subsequent sections will delve into case studies of successful management strategies implemented elsewhere (Kebete & Wondirad, 2019; Streimikiene et al., 2021), concluding with recommendations tailored to enhance sustainability in Rammang-Rammang. Through this structured approach, the research aims to contribute valuable insights and practical recommendations for achieving sustainable tourism in similar karst landscapes globally.

Presently, informational signage within Rammang-Rammang is exclusively available in Bahasa Indonesia, hindering international visitors who seek detailed explanations of the site’s geological marvels and cultural significance without resorting to guided tours or alternative sources. Moreover, several interpretative boards suffer from neglect, further diminishing their effectiveness in conveying essential conservation messages. Addressing these shortcomings is pivotal for enhancing visitor experiences and fostering a deeper appreciation of the area’s ecological significance, aligning with global efforts to harmonize conservation objectives with sustainable tourism practices (Streimikiene et al., 2021). By integrating insights from existing research on visitor management and educational strategies, this study aims to propose tailored recommendations to bolster sustainability and visitor engagement in Rammang-Rammang and analogous karst landscapes worldwide.

Occupying the niche of educational tourism management in the Rammang-Rammang Karst Area, this study outlines its purpose to assess the implementation and effectiveness of various educational strategies. The findings underscore a robust framework encompassing the establishment of Visitor Centers for direct visitor engagement, guided tours led by knowledgeable local guides, and strategically positioned directional and warning signage to enhance navigation and safety (Alubel et al., 2021; Della Lucia et al., 2021; Enseñat-Soberanis et al., 2019; Juma et al., 2020; Qaddhat et al., 2021; Selvaag et al., 2020). Moreover, the study identifies deficiencies such as the limited availability of interpretative signage in multiple languages and the absence of printed and digital collateral like brochures, maps, and smartphone apps, which are crucial for enhancing visitor experiences and educational outreach. The integration of multimedia technologies for interactive educational content delivery is also recommended to align with contemporary theoretical frameworks in tourism management.

**METHOD**

This research adopts a qualitative descriptive analysis approach and case study method to examine visitor management in the Rammang-Rammang Karst Area, Maros Regency (Lexy J, 2019). The main focus of the study is to describe and explore various aspects of management, including physical, regulatory, economic, and educational strategies implemented in the area. This region is an integral part of the Maros-Pangkep National Geopark Area, which is currently being proposed as a UNESCO Global Geopark, emphasizing its geological and ecological significance. Through this approach, the research aims to provide an in-depth understanding of the challenges of visitor management in an ecologically sensitive karst area, as well as to generate applicable recommendations to enhance sustainability and the quality of tourism experiences.

The research methodology involves data collection through direct observation, in-depth interviews with various stakeholders, and documentary studies (Sugiyono, 2020).
Key informants in this study include officials from the Maros Regency Culture and Tourism Office, the General Manager of the Maros-Pangkep Geopark Management Body, members of the Tourism Awareness Group (Pokdarwis), and local tour guides. The research location is centered in Rammang-Rammang Hamlet, Salenrang Village, Maros Regency, South Sulawesi, with a research duration from December 2021 to June 2022. Data analysis is conducted holistically, utilizing data triangulation to ensure the validity and reliability of research results. The research instrument employs the of Visitor Centers for direct visitor engagement, guided tours led by knowledgeable local guides, and strategically positioned directional and warning signage to enhance navigation and safety. This framework guides the formulation of interview questions and the analysis of collected data, ensuring a comprehensive examination of visitor management practices through the lens of sustainable tourism education. This comprehensive approach is expected to yield findings that are not only relevant to the Rammang-rammang Karst Area but can also be applied to similar karst areas globally.

RESULTS AND DISCUSSION

Research Result

The findings of this study clearly illustrate the comprehensive implementation of educational strategies in the Rammang-rammang Karst Area. These strategies encompass various facets aimed at enhancing visitor experience and educational outreach. Key elements include the establishment of Visitor Centers, which serve as hubs for direct visitor information dissemination. Guided tours are offered to provide detailed guidance and insight into the area's natural and cultural heritage. Directional and warning signage is strategically placed both inside and outside the area to facilitate navigation and ensure visitor safety. In the dimension of Education Management Strategies, visitor management techniques are employed to enhance educational tourism experiences, as outlined by (Alubel et al., 2021; Amirullah & Ridwan, 2021; Della Lucia et al., 2021; Enseñat-Soberanis et al., 2019; Juma et al., 2020; Petric & Mandic, 2018; Qaddhat et al., 2021; Selvaag et al., 2020; Tan & Law, 2016). These include establishing Visitor Centers to provide direct visitor information, guided tours for in-depth guidance, and directional and warning signage for navigation and safety. Additionally, interpretative signage panels are used to visually and informatively explain educational content. Printed collateral such as brochures, maps, and leaflets are provided to further assist visitors with supplementary information. Audiovisual media is utilized to deliver engaging multimedia information, while websites, social media platforms, and smartphone apps serve as digital tools for accessing information about the educational tourism destination.

Table 1. Implementation of Education Management Strategy in Rammang-rammang Karst Area

<table>
<thead>
<tr>
<th>No</th>
<th>Sub-concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pusat Pengunjung (Visitor Center)</td>
<td>Retrieved</td>
</tr>
<tr>
<td>2</td>
<td>Tour Menggunakan Pemandu (Guided Tour)</td>
<td>Retrieved</td>
</tr>
<tr>
<td>3</td>
<td>Papan Tanda Informasi (Direction/Warning Signage)</td>
<td>Retrieved</td>
</tr>
<tr>
<td>4</td>
<td>Panel/Papan Interpretasi (Interpretative Signage)</td>
<td>Retrieved</td>
</tr>
</tbody>
</table>
5  Brosur, Peta, Leaflet *(Print Collateral)* | Unsuitable
6  Media Audio Visual                      | Unsuitable
7  Website, Media Sosial dan Smartphone Apps *(Digital Collateral)* | Unsuitable

*Source: Primary Data, 2024*

In summary, the implementation of the education management strategy in the Rammang-rammang Karst Area focuses on physical infrastructure such as visitor centers, guided tours, direction signs, and interpretative panels, all of which have been successfully implemented or are currently available. However, the use of print materials such as brochures, maps, and leaflets, as well as digital resources like audio visual media, websites, social media platforms, and smartphone applications, is deemed unsuitable for this strategy. This approach underscores a preference for tangible, on-site experiences and interpretative aids over digital and print-based information dissemination in the management of educational initiatives within the Karst Area. Based on the findings in the field and the mentioned theory, there are both consistencies and some deficiencies in the implementation of Education Management Strategies in the Rammang-rammang Karst Area.

*Visitor Centers*

![Visitor Information Centre](Source: Author, 2024)

**Figure 1.** Visitor Information Centre

![Directions of the Rammang-rammang Karst Area](Source: Author, 2024)

**Figure 2.** Directions of the Rammang-rammang Karst Area
In line with the theory, the Rammang-rammang Karst Area has established visitor centers at Pier 1 and 2. However, a deficiency is the absence of dedicated staff to provide direct information to visitors. This aligns with theoretical perspectives emphasizing the importance of trained staff at visitor centers to enhance visitor experiences by offering accurate and relevant information about the karst area. The presence of competent staff at visitor centers is considered crucial in improving the effectiveness of education management strategies in the area, ensuring visitors have a quality and insightful experience during their visits. Visitor Information Centres play a pivotal role in shaping memorable visitor experiences by serving as comprehensive hubs of information and guidance. These centers not only provide essential logistical information such as maps, directions, and safety guidelines but also enhance the visitor’s understanding and appreciation of the destination’s cultural and natural heritage through interpretative exhibits and knowledgeable staff. By offering personalized assistance and insights, Visitor Information Centres facilitate deeper engagement with the destination, ensuring that visitors leave with enriched perspectives and a greater sense of connection to the place they have explored (Tlabela & Douglas, 2022).

**Guided Tours**

The implementation aligns with the theory, with 10 local guides available, including 3 who are proficient in English. This enables a more in-depth educational experience for visitors. The implementation of guided tours in the Rammang-rammang Karst Area aligns with established theory. There are 10 local guides available, including 3 proficient in English. This setup enhances the educational experience for visitors by providing in-depth knowledge and effective communication in a language understood by a significant portion of tourists. Thus, the presence of knowledgeable guides supports not only theoretical standards but also adds significant value to the educational management strategy in the area. This setup enhances the educational experience for visitors by providing in-depth knowledge and effective communication in a language that most travellers understand. Thus, the presence of knowledgeable guides not only supports the theoretical standards but also adds significant value to the educational management strategy in the area. Previous research such as (Muhammad Salim et al., 2017; Wahyuningtyas et al., 2022) puts English language as a great support for tourist attractions.

**Directional and Warning Signage**

Applied in accordance with the theory, with directional signs outside and within the area, as well as warning signs regarding specific prohibitions. Based on previous research, Directional and Warning Signage in the Rammang-rammang Karst Area has been implemented in accordance with established theoretical principles. This includes the placement of directional signs both outside and within the area, facilitating navigation for visitors. Additionally, there are warning signs that communicate specific prohibitions or safety guidelines, ensuring visitors are aware of restricted areas or behaviors that could pose risks. A study by (Su et al., 2020) emphasized the importance of well-designed directional and warning signage in enhancing visitor safety and experience in natural and cultural heritage sites. Effective signage not only helps visitors navigate the area efficiently but also educates them about the importance of conservation and sustainable tourism practices. Moreover, clear and informative signage contributes to visitor satisfaction and reduces the likelihood of accidents or misunderstandings regarding site regulations. In summary, the implementation of directional and warning signage in the Rammang-rammang Karst Area not only meets
theoretical expectations but also aligns with empirical findings that emphasize the role of signage in enhancing visitor management and conservation efforts in natural landscapes.

**Interpretative Signage Panels**

![Figure 3. Existing Interpretation Panel in the Rammang-rammang Karst Area (Source: Author, 2024)](image)

Consistent with the theory, interpretive panels are present at each site. However, a shortcoming is that information is only available in Indonesian and lacks detail. Based on previous research, Directional and Warning Signage in the Rammang-rammang Karst Area has been implemented in alignment with established theory. This includes the placement of directional signs both outside and within the area, facilitating navigation for visitors (Kopp & Coppes, 2020; Mostafa et al., 2024). Additionally, there are warning signs that communicate specific prohibitions or safety guidelines, ensuring visitors are aware of restricted areas or behaviors that could pose risks. The application of these signs according to theoretical principles enhances visitor safety, improves navigation efficiency, and promotes responsible behavior within the karst landscape. Thus, the strategic placement and clear messaging of directional and warning signage contribute significantly to the overall management and educational experience in the area.

**Printed Collateral**

Not in line with the theory, as brochures, maps, or leaflets are not available at the visitor center or other areas in the region. Based on the research findings, the availability of Printed Collateral such as brochures, maps, or leaflets in the Rammang-rammang Karst Area does not align with theoretical expectations. These materials are notably absent from the visitor center and other areas within the region. The absence of printed collateral contradicts theoretical principles that advocate for the provision of informative and educational materials to enhance visitor experiences and understanding of the karst area. According to (Leask & Barron, 2021), visitor information materials are crucial for facilitating visitor orientation, encouraging exploration, and extending the learning experience at tourism destinations. The lack of these materials may hinder visitors’ ability to navigate and fully appreciate the
geological and ecological significance of the site. Therefore, there is a gap between current practices and theoretical recommendations regarding the dissemination of printed collateral in the management strategy of the Rammang-rammang Karst Area. **Audiovisual Media**

Inconsistent with the theory, as there are no multimedia facilities or equipment to provide explanations about the area. Based on previous research, the utilization of Audiovisual Media in the Rammang-rammang Karst Area does not align with established theoretical principles. There are no multimedia facilities or equipment available to provide explanations about the area to visitors. According to (Alam & Mohanty, 2023), multimedia presentations not only convey information effectively but also cater to diverse learning styles, thereby enriching visitors' understanding and appreciation of natural environments. This inconsistency with theoretical expectations highlights a gap in utilizing audiovisual media as an effective means for education and enhancing visitor understanding of the ecological and geological significance of the karst area. Previous studies have emphasized that audiovisual media can enhance visitor interaction, provide deeper explanations, and stimulate interest in important aspects of the karst environment (Yusuf et al., 2022). Therefore, the absence of multimedia facilities can be seen as a shortfall in the implementation of education management strategies in the Rammang-rammang Karst Area. It underscores the importance of providing informative and engaging information to visitors through modern media formats to enrich their experience and foster appreciation for the unique natural features of the karst landscape. **Websites, Social Media, and Smartphone Apps**

Aligns with the theory, as the area has a website and social media accounts. However, their utilization is not yet maximized, and there is no dedicated smartphone application. Based on previous research, the use of Websites, social media, and Smartphone Apps in the Rammang-rammang Karst Area aligns with established theoretical principles. The area has a website and social media accounts in place. However, their utilization is not yet fully optimized, and there is currently no dedicated smartphone application available for the area. Research indicates that having a website and active social media presence can effectively promote the karst area, disseminate educational information, and maintain engagement with the community and visitors. To fully harness the potential of these platforms, there is a need to enhance the management of informative and engaging content, as well as actively interact with visitors through digital platforms. Furthermore, developing a dedicated smartphone application could provide a more personalized and interactive experience for visitors, facilitating navigation and offering deeper insights into the uniqueness and significance of the karst area. Therefore, while the presence of a website and social media accounts in the Rammang-rammang Karst Area is in line with theoretical expectations, there remains room for improvement in maximizing their use and expanding the use of digital technology to support more effective educational management and promotion strategies. **Discussion**

The implementation of education management strategies in the Rammang-rammang Karst Area reflects a structured approach aimed at enhancing visitor experience and educational outcomes. Visitor Centers have been established at Pier 1 and 2, aligning with theoretical recommendations. However, a significant drawback identified is the absence of dedicated staff to provide direct information to visitors, which is crucial for ensuring a fulfilling visitor experience (Baleiro, 2023; Muchlis et al., 2024).
Guided tours, facilitated by 10 local guides including 3 proficient in English, provide in-depth educational experiences for visitors. This implementation adheres to theoretical frameworks emphasizing the importance of knowledgeable guides in enriching visitor understanding and engagement (Kul et al., 2024).

Directional and warning signage, both within and outside the area, are effectively implemented to aid navigation and ensure visitor safety. This practice corresponds with studies highlighting the role of well-designed signage in enhancing visitor satisfaction and safety in heritage sites (Do et al., 2022; Su et al., 2020). Interpretative signage panels, though present, are noted to lack detailed information and are only available in Indonesian, limiting their educational effectiveness (Hanifunisa & Swasty, 2020; Hashim et al., 2014). This discrepancy underscores the importance of comprehensive and multilingual interpretative materials to cater to diverse visitor needs.

In contrast, the absence of printed collateral such as brochures, maps, and leaflets, as well as the lack of multimedia facilities for audiovisual presentations, deviates from theoretical expectations. Studies suggest that these resources are pivotal in providing supplementary information and enhancing visitor engagement through multimedia experiences (Baker et al., 2022; Jasman et al., 2023; Lensing, 2023). Similarly, while the area maintains a website and social media presence, their utilization is suboptimal without a dedicated smartphone application. Maximizing these digital platforms can amplify educational outreach and visitor engagement, aligning with theoretical principles of digital communication in tourism management (Carlisle et al., 2023; Zarrouk & El Aidouni, 2023).

In conclusion, the implementation of education management strategies in the Rammang-rammang Karst Area showcases a commendable effort to enhance visitor experiences through established infrastructure like visitor centers, guided tours, and directional signage. However, several limitations hinder the strategy's full potential. The absence of dedicated staff at visitor centers diminishes the effectiveness of direct visitor engagement, which is crucial for imparting accurate information and enriching visitor experiences (Kurniawan Widiyasa & Tuti, 2023). Moreover, while directional signage is well-implemented, interpretative signage panels lack detailed information and are only available in Indonesian, limiting their educational impact on diverse visitor demographics (Jasman et al., 2023).

Recommendations for improvement include enhancing staffing at visitor centers to provide personalized guidance, particularly in multiple languages, to cater to international visitors effectively. Additionally, efforts should focus on developing comprehensive and multilingual interpretative materials to deepen visitor understanding of the area’s cultural and ecological significance. Furthermore, leveraging multimedia technologies such as audiovisual presentations and developing a dedicated smartphone application could significantly enhance visitor engagement and educational outreach in alignment with modern digital communication practices (Arfin Muhammad Salim et al., 2018; Fayvishenko et al., 2023).

By addressing these recommendations, the Rammang-rammang Karst Area can further elevate its educational management strategies, ensuring sustainable tourism practices and enriching the overall visitor experience while aligning with contemporary theoretical frameworks in tourism management. Overall, the Rammang-rammang Karst Area has implemented most of the educational management strategies mentioned in the theory. However, there are still several aspects that need improvement, particularly in terms of the availability of printed materials, the use of audiovisual
media, and the optimization of digital media usage. Enhancements in these aspects can help improve the educational experience of visitors as outlined in these theories.

CONCLUSIONS

In conclusion, the findings of this study highlight the comprehensive implementation of educational strategies in the Rammang-rammang Karst Area, aimed at enhancing visitor experiences and educational outreach. The establishment of Visitor Centers, provision of Guided Tours by knowledgeable local guides, and strategic placement of Directional and Warning Signage are commendable efforts aligned with theoretical recommendations. However, deficiencies such as the lack of dedicated staff at Visitor Centers and the limited availability of interpretative materials in multiple languages detract from the strategy's effectiveness. To address these shortcomings, it is recommended that the Rammang-rammang Karst Area prioritize the following improvements. Firstly, enhancing staffing at Visitor Centers to ensure knowledgeable and multilingual personnel are available to provide comprehensive information and enhance visitor engagement. This step is crucial in aligning with theoretical perspectives that emphasize the role of trained staff in enriching visitor experiences. Secondly, developing and disseminating comprehensive interpretative materials in multiple languages to cater to diverse visitor demographics. This includes expanding the scope of interpretative signage panels and introducing printed collateral such as brochures, maps, and leaflets. These materials play a pivotal role in educating visitors about the cultural and ecological significance of the karst landscape, thus fostering deeper appreciation and understanding. Thirdly, leveraging multimedia technologies such as audiovisual presentations and developing a dedicated smartphone application. These initiatives can significantly enhance visitor engagement by providing interactive and immersive educational experiences. By integrating modern digital tools, the Rammang-rammang Karst Area can better communicate its conservation efforts and promote sustainable tourism practices.

In summary, while the Rammang-rammang Karst Area demonstrates a strong foundation in implementing educational strategies, addressing these recommendations will further elevate its educational management practices. By bridging the gaps identified and embracing technological advancements, the area can ensure more impactful educational experiences for visitors while aligning with contemporary theories in tourism management. These steps are essential for fostering sustainable tourism practices and preserving the unique natural and cultural heritage of the karst area for future generations.

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