ANALYSIS OF ARCHITECTURAL INFRASTRUCTURE DESIGN IN STRENGTHENING GEOTOURISM IDENTITY IN CILETUH–PALABUHANRATU UNESCO GLOBAL GEOPARK (CPUGGp)

Febriani Valentina BR Sihombing* [1], Yumna Alifa [2]
Master of Tourism Planning, School of Architecture, Planning, and Policy Development (SAPPD), Bandung Institute of Technology [1,2]
Email: febriani.valentina113@gmail.com

Abstract

The term 'architectural visibility' is used to describe the extent to which structures are in harmony with their natural surroundings, thereby enhancing both aesthetic appeal and visitor accessibility. Ciletuh–Palabuhanratu UGGp has the potential to become a leading geotourism destination, attracting global visitors interested in exploring its distinctive geological features and diverse natural heritage. This study examines the potential of architectural design to reinforce the geotourism identity of Ciletuh-Palabuhanratu UGGp in Indonesia. By analyzing the existing infrastructure, this study demonstrates that the integration of design with local geological and cultural characteristics is a fundamental aspect of the process. The findings emphasize the significance of selecting local materials, natural hues and architectural forms that are in accordance with the surrounding environment. Furthermore, this study emphasizes the significance of accessibility for all visitors, as well as the pivotal role of interpretation and education in enhancing visitors' comprehension of the area's geological and cultural values. However, this study also identifies several challenges, including the lack of local community involvement in infrastructure planning. In conclusion, this study offers significant recommendations for the sustainable development of geotourism in Ciletuh-Palabuhanratu UGGp, underscoring the necessity for a harmonious integration of natural, cultural, and architectural elements.

Keywords: Architecture visibility; Environmental Conservation; Ciletuh-Palabuhanratu UGGp; Geotourism Identity; Sustainable Infrastructure

A. INTRODUCTION

Geotourism is a nature-based form of tourism that focuses on the unique geological features of an area, with the objective of enhancing tourists' appreciation of both aesthetic values and geological conservation (Herrera et al., 2018). The aesthetic appeal of geological sites is a significant factor in attracting visitors, with changes in landforms and geomorphology serving as the primary attractions (Brilhante, 2016; James et al., 2020). The concept of geotourism emerged in England as a means of conserving geomorphic sites and has since grown to encompass a global approach that integrates conservation, education, and sustainable development (Ólafsdóttir & Tverijonaite, 2018; Ríos-Reyes et al., 2021).

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has established the Global Geoparks Network (GGN) with the objective of preserving and enhancing the value of the Earth's heritage, landscapes, and geological formations. This is to be achieved by promoting collaboration in education, management, tourism, sustainable development, and regional planning

* *Corresponding author*

among GGN members. Ciletuh–Palabuhanratu UGGp situated in Sukabumi, West Java, is one of global geoparks that is home to distinctive geological formations and an exceptional natural heritage. The area's diverse natural landscapes, comprising beaches, cliffs, waterfalls, and various ancient rock formations, present a significant geotourism potential, particularly for visitors with an interest in geological phenomena and nature conservation. The aesthetic appeal and instructive quality of the geological formations found in Ciletuh–Palabuhanratu UGGp offer tourists a more profound experience, wherein they can gain insight into the geological processes that shape the landscape while also becoming more aware of the significance of nature conservation.

The significance of geotourism development hinges on a comprehensive grasp of the identity or defining characteristics of a given region (Dowling, 2013). The identity of a region, which encompasses physical, environmental, social, and cultural characteristics, is of paramount importance in the creation of tourist destinations that are appealing to visitors (Tesfa, 2023). By grasping and accentuating this identity, geotourism management can be adapted to showcase the distinctive qualities of a location, thereby enriching tourists' experiences and enhancing their overall perception of the destination. The provision of adequate interpretative infrastructure at geotourism sites will facilitate visitors' comprehension of the area's identity, thereby enhancing the informative and engaging nature of their journey. Consequently, the advancement of geotourism concentrated on identity not only enhances the appeal of destinations but also fosters the conservation of the environment and local culture, thereby ensuring sustainability and long-term appeal for tourists.

The discipline of architecture plays a pivotal role in the reinforcement of local identity through the consideration of the distinctive attributes of a given locality. This encompasses the examination of the cultural heritage and the needs of the community, in addition to the involvement of those who are affected by the design process (Nooraddin, 2012). Architectural works that reflect local identity frequently incorporate cultural elements, such as building materials and forms that resonate with the cultural and environmental context. This results in the creation of a living landscape, shaped by community efforts over time, which contributes to the formation of national architectural identity. The intrinsic unifying value of geosites results in their emergence as significant tourist attractions, due to the aesthetic, cultural, scientific, and educational contributions they offer (González et al., 2021). It is therefore essential that architectural elements are integrated in a harmonious manner within geotourism areas in order to enhance both aesthetic appeal and accessibility. The thoughtful design of architectural interventions that respect the natural environment has the potential to enhance visual appeal, complement geological features, and serve as indicators of ecological identity, thereby significantly impacting accessibility. Such designs foster a welcoming environment that encourages visitor engagement, thereby facilitating a deeper connection to the landscape and enhancing the overall tourism experience.

Meanwhile, the interconnection between aesthetic appeal and accessibility is of paramount importance, as it serves to promote inclusivity and to encourage the participation of a diverse range of groups in geotourism. Nevertheless, the obstacles to achieving architectural visibility in Ciletuh–Palabuhanratu UGGp are intricate, particularly in light of the difficulties associated with accessibility and the lack of basic infrastructure in regions that are typically isolated. The absence of interpretive facilities and other supporting infrastructure may impede tourists' ability to appreciate and comprehend the natural riches and geological significance of this region. The objective of this study is to analyze and explore the development of more sustainable and contextual infrastructure in the Ciletuh–Palabuhanratu UGGp, with the aim of enhancing the identity of geotourism and supporting the sustainability of the area as an educational and

conservation destination. It is anticipated that this approach will result in Ciletuh–Palabuhanratu UGGp becoming not only a visually appealing tourist destination, but also a hub for environmental education and conservation, offering long-term benefits to local communities and visitors alike.

B. RESEARCH METHOD

This study employs a qualitative case study approach to examine the development of sustainable and contextual infrastructure in Ciletuh–Palabuhanratu UGGp, with a particular focus on the role of architectural design in strengthening geotourism identity and ensuring the sustainability of the area as an educational and conservation destination. Data were collected through direct observation of existing infrastructure, including interpretation facilities, access routes, and architectural elements that support geotourism identity. This was done to assess the suitability of the infrastructure in question with the local geological and cultural context, as well as its accessibility for various visitor groups. A literature analysis was also conducted with the objective of exploring the principles of geotourism and the role of architecture in strengthening geotourism identity. The research instruments included field notes, which were used to collect detailed data on the suitability of infrastructure with geotourism identity and to identify challenges and opportunities in developing this area as an educational and conservation destination. The data were subjected to thematic analysis in order to identify key patterns related to the role of architecture in strengthening the identity of Ciletuh–Palabuhanratu UGGp as a geotourism destination and increasing its attractiveness and accessibility. It is anticipated that this study will make a contribution to the development of sustainable geotourism, the preservation of the geological heritage of Ciletuh–Palabuhanratu UGGp, and provide insights for architectural planning and design that support local identity in the context of geotourism.

C. FINDINGS AND DISCUSSION

In order to ensure the natural and cultural heritage of the Ciletuh-Palabuhanratu UGGp region while promoting sustainable tourism, the geotourism identity of the area must be reinforced. Geotourism emphasizes a region's geological heritage while integrating local identity, community engagement and landscape conservation. In the context of Ciletuh-Palabuhanratu UGGp, the built environment is pivotal in conveying the significance of the area's geological formations, ecosystems, and cultural history. Consistent architectural elements can foster a sense of attachment and ownership among visitors.

This approach enhances visitors' appreciation of the geopark, encouraging long-term conservation. Ciletuh-Palabuhanratu UGGp's geotourism identity can be reinforced through architectural elements that align with the region's natural and cultural characteristics. This integration enhances the geotourism experience and preserves the site for future generations. This analysis assesses how the existing infrastructure and architectural interventions in the Ciletuh-Palabuhanratu UGGp align with the aforementioned conceptual framework. The analysis focuses on two areas: the incorporation of infrastructure into the identity of the region, and future developments.

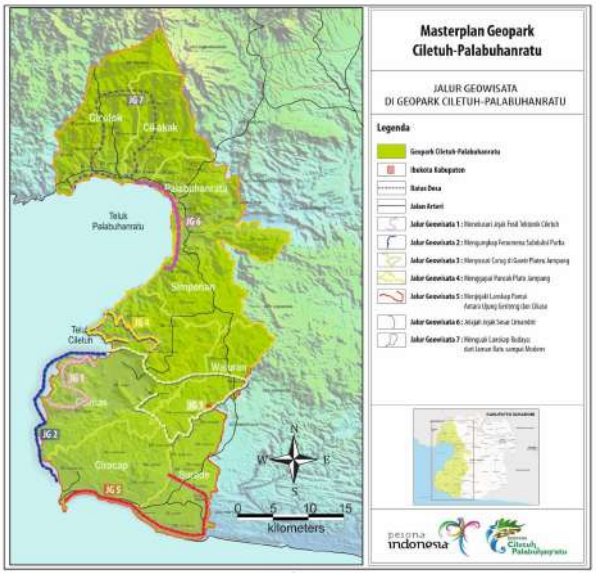

Figure 1. Master Plan of Ciletuh–Palabuhanratu UGGp
Source: wonderfulimage.id, 2022

Figure 1 depicts a master plan map of the Ciletuh-Palabuhanratu UGGp in West Java, Indonesia. The plan entails the development of seven geotourism routes, with the objective of promoting sustainable tourism based on geology and culture. The routes encompass the exploration of tectonic fossil traces, ancient subduction phenomena, the Jampang Plateau waterfalls and escarpments, plateau peaks, coastal landscapes between Ujung Genteng and Cikaso, traces of the Cimandiri Fault, and cultural landscapes from the Stone Age to the modern era. The map is designed to optimize geopark management in order to facilitate conservation, education, and the local economy through geotourism.

Analysis of Architectural Harmony with Local Geological Character

It is of the utmost importance that infrastructure within the area in question reflects its geological character, as this will undoubtedly enhance the geotourism experience. Design inspired by nature has the potential to enhance the visual and emotional experience of users, fostering a profound connection between humans and the environment (Katona, 2020). The utilization of traditional materials that simulate natural forms serves to establish a harmonious relationship between infrastructure and the natural environment. Geotourism flourishes when infrastructure incorporates local materials, such as rocks, to impart authenticity and harmonize with the surrounding landscape. The use of natural colors and textures, such as brown, gray, and green, serves to reinforce this harmony. Furthermore, the incorporation of natural contours and the accentuation of geological features, such as cliffs and valleys, into infrastructure design serves to enhance the area's geological narrative.

Infrastructure in Ciletuh-Palabuhanratu UGGp must be designed sustainably, using materials and forms that harmonize with the natural environment. Local rock formations and natural hues facilitate visual integration with the surrounding landscape. This approach enhances visual harmony and respects the area's geological characteristics.

Figure 2. The entrance to Mount Halimun Salak National Park.
Source: highlandcamp.co.id, 2020

Figure 3. Fence at Cimarinjung waterfall
Source: Author's Documentation, 2024.

Figure 2 illustrates the entrance gate to the Salak National Park Area, which constitutes part of Geotourism Route 1 within the Ciletuh-Palabuhanratu UGGp. The utilization of concrete and stone materials in green, white, and black hues facilitates the harmonious integration of the gate structure into the surrounding environment. Figure 3 illustrates the fence at Curug Cimarinjung, part of Geotourism Route 4, which employs the use of green and black stone, as well as iron elements. The selection of materials and colors enables the fence to harmonize with the geological character of the surrounding rocks and vegetation. Furthermore, the route at Curug Cimarinjung has been designed to follow the natural contour, thus ensuring a seamless integration with the existing natural path.

Figure 4. The entrance to Palangpang Beach
Source: Author's Documentation, 2024

Figure 5. The entrance to Cimarinjung waterfall
Source: Author's Documentation, 2024

Nevertheless, as illustrated in Figures 4 and 5, certain locations, namely the entrance to Palangpang Beach along Geotourism Route 2 and the entrance to Curug Cimarinjung along Geotourism Route 4, exhibit a lack of coherence with the surrounding environmental characteristics. The gate to Palangpang Beach, for instance, employs black ceramic material with a glossy texture that fails to reflect the geological character of the area. Furthermore, the selection of blue for the Curug Cimarinjung gate appears to be discordant with the surrounding landscape, thereby creating an impression of less harmony with the natural environment.

Analysis of Sustainability and Environmental Preservation

The long-term sustainability of geological sites as tourist destinations depends on sustainable practices (Ghazi, 2020). Geotourism, based on environmentally responsible tourism, supports sustainable development through the conservation of natural landscapes. Improving infrastructure for recreational activities is key to maintaining sustainability, focusing on energy efficiency through natural lighting and ventilation, using local or eco-friendly materials that blend

with the geological character of the region, and reducing the carbon footprint while supporting the local economy. Effective waste management and the integration of local ecosystems into the design can conserve natural resources and promote responsible tourism. Sustainable infrastructure becomes an integral part of environmental conservation and education for future generations. The use of geological materials such as granite, marble and clay contributes to the sustainability of construction by reducing environmental impact and increasing functionality (Yalçın, 2024). The energy efficiency of concrete helps to maintain consistent temperatures, while local natural stone reduces the carbon footprint. Clay-based materials provide thermal insulation and recyclability, further supporting sustainability (Johnson & Lee, 2019; Yalçın, 2024). These materials increase durability and reduce environmental impact, promoting long-term sustainability in construction.

Figure 6. Cisolok Geyser
Source: Google Maps, 2021

Figure 7. Pangumbahan Turtle Conservation
Source:jabarprov.go.id, 2024

Figure 6 illustrates the Cisolok Geyser, situated along geotourism route 7. The expansive roof design serves to reduce the energy requirements for cooling by providing a shield against the ingress of heat, while the incorporation of natural ventilation contributes to enhanced energy efficiency. The open-plan structure allows natural light to enter, thereby reducing the necessity for artificial lighting. The building has been designed with sustainability in mind, with the objective of reducing material usage and supporting environmental preservation. Nevertheless, the red color of the structure creates a visual discordance with the natural landscape. A more harmonious integration would be achieved through the use of neutral colors, such as gray or brown.

Figure 7 shows the Pangumbahan Turtle Conservation Centre, along geotourism route 5, with sustainable design elements. The use of natural stone in the pillars is sustainable, reducing the carbon footprint and integrating with the landscape. The elevated roof lets in lots of natural light, reducing the need for artificial lighting. Glass walls may increase cooling demands without adequate ventilation, but the design has openings to facilitate air circulation and reduce the need for cooling. The open-space concept is preserved through natural light and ventilation, reducing the necessity for material utilization. Additional natural colors and materials could reinforce the connection with the surrounding environment and enhance the sustainability of the design.

Figure 8. Ciletuh-Palabuhanratu UGGp Amphitheater Plaza
Source: media.sukabumiupdate.com, 2023

Figure 8 illustrates the Ciletuh-Palabuhanratu UGGp Amphitheater Plaza, where there is a notable absence of significant natural ventilation. In order to advance sustainability, the utilization of local or environmentally friendly materials, such as local stone or minerals, will diminish the carbon footprint and bolster the local economy. Furthermore, the deployment of resilient materials, such as concrete, can assist in maintaining a consistent temperature. Conversely, the use of synthetic turf is less sustainable due to its lack of environmental compatibility. The replacement of such turf with native flora would not only support the local biodiversity but also provide a more authentic geotourism experience. Furthermore, the building has the potential to serve as an educational site related to geotourism and conservation, which would enhance its sustainability value in terms of environmental education. Consequently, the sustainability of this edifice can be enhanced through the utilization of environmentally benign materials, efficacious waste management, and an alignment with the surrounding environment to promote conservation.

Furthermore, the available waste management facilities facilitate the implementation of waste separation and environmental education initiatives. The practice of waste separation serves not only to maintain a clean environment but also to demonstrate a commitment to sustainability and environmental responsibility. Nevertheless, it is crucial to devote greater attention to meeting the requisite operational standards for waste separation and maintaining the cleanliness of waste bins. This will ensure the efficacy of a sustainable waste management system and prevent potential adverse effects on the environment.

Analysis of Accessibility for Various Visitor Groups

The concept of sustainable geotourism emphasizes the significance of engaging with geological phenomena to cultivate comprehension, support local communities and gratify tourists (Dowling, 2011; Henriques et al., 2018). Inclusivity is a fundamental tenet of geotourism, ensuring that all individuals, including those with disabilities, have the opportunity to access and enjoy its offerings. The provision of access for individuals with disabilities serves to enhance public comprehension of geoscience and environmental conservation, while simultaneously stimulating visitor numbers and the growth of local economies. Inclusivity serves to enhance sustainability by creating diverse experiences, thereby increasing the value of geoparks as educational and recreational resources. It is essential that geotourism infrastructure is designed to accommodate a diverse range of visitors, with the objective of achieving universal accessibility. Such infrastructure should include ramps, lifts and wide, level paths for wheelchair users, as well as sensory support elements such as tactile signs, hearing systems and audio cues for visitors with hearing or visual impairments (Darcy, 1998). Information should be made available in a variety of formats, including

Braille and sign language, in order to guarantee inclusivity (Henriques et al., 2018). Furthermore, staff training is of paramount importance in order to gain an understanding of visitors' needs and to provide appropriate support. These elements enable geotourism sites to offer an enriching and inclusive experience for all visitors.

The Ciletuh-Palabuhanratu UGGp area faces significant challenges in terms of inclusivity, especially regarding physical accessibility and support for visitors with disabilities. Most waterfall areas lack proper infrastructure, with narrow, rocky routes and no ramps or wheelchair access. There is also a lack of sensory support facilities, such as Braille signage or sign language guides, and few trained staff to assist visitors with special needs. However, some beach areas within the Ciletuh-Palabuhanratu UGGp have shown promise with more wheelchair-friendly access. Additionally, involving the local community in managing facilities provides economic opportunities for residents. Despite these efforts, further improvements in accessibility and staff training are needed to create an inclusive tourism environment and ensure all visitors can enjoy the geotourism experience.

Analysis of Interpretive and Educational Facilities

The creation of a successful geotourism destination necessitates the preservation of the region's natural and cultural features, coupled with an effective communication strategy that conveys their significance to visitors. The Ciletuh-Palabuhanratu UGGp has developed a series of interpretive and educational facilities with the objective of showcasing the region's distinctive geodiversity and fostering a more profound appreciation among visitors. A principal element of the interpretive strategy is the extensive network of trails and hiking routes that guide visitors through the landscape, frequently featuring signage and informational panels that contextualize the geological, ecological, and cultural significance of the area (Ruhimat et al., 2021). To illustrate, the Ciletuh-Palabuhanratu UGGp has installed a number of information boards at key locations, providing detailed explanations of specific geological features, their ecological importance, and the region's cultural heritage.

Furthermore, the printed materials have been developed with the intention of being accessible to a diverse range of audiences. They present complex topics in a manner that is straightforward and comprehensible. The educational materials refrain from utilizing overly technical terminology, employing straightforward descriptions and analogies to elucidate intricate geological and ecological phenomena. This approach enables both casual tourists and those with a more scientific inclination to derive enjoyment from the experience. The location of interpretive facilities within the geopark is of great importance in order to guarantee that they are readily accessible and situated in a way that optimizes the visitor experience. Information boards and signage are positioned at pivotal points along walking trails, in the vicinity of geosites, and at key viewing platforms. This allows visitors to promptly access pertinent educational material as they traverse the various sections of the park.

Analysis of Aesthetics and Visual Integration with the Natural Environment

Aesthetic principles pertaining to form, shape, scale, and proportion are of paramount importance in landscape design, as they serve to enhance the visual appeal and emotional impact of a given space. Effective visual integration, which concerns the manner in which human-made structures interact with the natural environment, depends on the thoughtful placement of buildings, the use of landscaping, and the manipulation of light and shadow. By taking into account factors such as building orientation, material selection and vegetation placement, designers can

enhance visual quality while simultaneously reducing environmental impact. Aesthetic elements exert a significant influence on well-being and spatial behavior, as people are naturally drawn to harmonious and attractive environments (Ghomeishi, 2020). Therefore, it is incumbent upon designers to ensure that the forms and shapes in a built environment align with the organic patterns and textures of nature, thereby fostering a sense of balance and harmony (Carlson, 2001).

The primary strategy at Ciletuh-Palabuhanratu UGGp is based on the concept of context-sensitive design, which aims to integrate the built environment with the surrounding landscape in a harmonious manner. In contrast to the use of large, obtrusive structures, the infrastructure is designed to integrate harmoniously with the surrounding natural topography, incorporating local materials wherever possible. This approach ensures that the built environment enhances, rather than detracts from, the natural beauty. Construction techniques are employed that have a minimal impact on the environment, with smaller building footprints to minimize overcrowding and land alteration. The use of local materials like wood, stone, and bamboo allows the structures to blend seamlessly with the landscape, while pathways and viewing platforms are designed to minimize soil erosion and preserve the environment's integrity.

Figure 10. Local materials used in infrastructure development at Curug Cimarinjung (trail 4), showcasing sustainable construction practices in harmony with the natural environment
Source: Author's Documentation, 2024

The selection of textures and colors in the infrastructure is another crucial element that contributes to the overall aesthetic harmony of the geopark. The design palette is characterized by the predominance of neutral and earthy tones, with muted browns and greens evoking the hues observed in the natural environment. This decision was made deliberately, as it avoids the introduction of bright or artificial colors that could disrupt the visual serenity of the landscape. The utilization of local stone and wood in construction materials serves to reinforce the connection between the man-made and the natural environments. Furthermore, textures play an equally important role. The use of rough stone finishes, natural wood grains, and textured clay tiles serves to mirror the tactile qualities of the geological and ecological features of the park. These materials not only evoke the feeling of being part of the natural world, but also subtly emphasize the unique geological formations that define the geopark. In doing so, the design reinforces the impression that human intervention is both minimal and respectful of the land's natural textures, contributing to an overall aesthetic experience that feels cohesive and grounded. The infrastructure of Ciletuh-Palabuhanratu UGGp has been designed with the dual objective of preserving the area's natural beauty and enhancing its visual appeal. The design of viewing platforms, walking trails, and rest areas is strategically positioned to showcase some of the most aesthetically pleasing landscapes

within the geopark, offering visitors unparalleled vistas of the cliffs, waterfalls, and coastal panoramas. The configuration of these elements is designed with the objective of establishing visual focal points that enable visitors to appreciate the natural beauty of the environment from diverse vantages without compromising the integrity of the natural setting.

A fundamental objective of the design strategy is to guarantee that the geosites are accessible without being overly developed. For instance, trails are frequently constructed using natural materials such as wood or gravel, while viewing platforms are often designed to be unobtrusive, frequently elevated or camouflaged with vegetation to prevent the interruption of the view. The meticulous placement of infrastructure enables visitors to experience the area without the structures themselves becoming the primary focal point. Instead, the design enhances the natural beauty of the geosites by creating spaces that draw attention to the most dramatic and scenic views.

The infrastructure design at Ciletuh-Palabuhanratu UGGp is oriented towards achieving an integrated and harmonious relationship with the surrounding natural landscape. In contrast to the use of bold, attention-grabbing designs, the park incorporates subtle, organic elements that mimic the natural forms of the environment. Pathways and bridges are designed to curve around trees and rock formations, thereby preserving sightlines and ensuring that the built structures enhance, rather than overpower, the natural beauty. The infrastructure is designed with attention to scale, form, and materials, ensuring that it complements the landscape and supports both environmental conservation and a richer visitor experience.

Analysis of Local Community Empowerment

The development of infrastructure in Ciletuh-Palabuhanratu UGGp raises important questions about the involvement and impact on local communities. Existing research suggests that the level of local community involvement in the planning and development of infrastructure within Ciletuh-Palabuhanratu UGGp has been somewhat limited. The geopark is perceived primarily as an Earth Park focused on conservation and tourism, with less emphasis on directly integrating the cultural heritage and perspectives of the local population. Some scholars have noted a "culture shock" experienced by the predominantly farming communities as the geopark has rapidly developed, indicating a need for better integration of local stakeholders (Rachaju et al., 2023). While the geopark management aims to promote sustainable development, the extent to which local communities have directly influenced the design or conceptualization of new infrastructure remains unclear.

Despite the absence of direct involvement of local communities in the infrastructure development at Ciletuh-Palabuhanratu UGGp, they have been actively engaged in other pivotal areas that are aligned with the geopark's mission. The Paguyuban Alam Pakidulan Sukabumi (PAPSI) plays a pivotal role in conservation efforts, with a particular focus on waste reduction and the supervision of local resource exploration. Another significant organization, Paguyuban Lahan Parahyangan (PALAPAH), is dedicated to the preservation and promotion of the region's cultural heritage, with the objective of fostering awareness at both the local and global levels. Furthermore, in the field of tourism, the Group of Tourists (POKDARWIS) plays a pivotal role in the advancement of tourism services, particularly through initiatives such as the "*Liwet Hanjeli* Package," which showcases traditional local cuisine. The Desa Wisata Hanjeli, located within the geopark, represents Indonesia's inaugural food-based educational tourism village, offering visitors an immersive experience in local food culture. Through these initiatives, local communities play a pivotal role in advancing sustainable tourism, supporting a locally-driven economic model within the geopark.

CONCLUSION

The Ciletuh-Palabuhanratu UGGp area has the potential to become a leading geotourism destination. The design integrates principles of harmony with the natural environment and sustainability, as well as accessibility. This study has identified areas for improvement. Design inconsistencies, limited accessibility for people with disabilities and a lack of community involvement are among the issues. The existing infrastructure is sustainable, but there is a need for more community involvement and a fairer distribution of tourism benefits. This study has limitations, including a narrow focus on infrastructure and a lack of comprehensive socio-economic impact measurement. Further research should be conducted across a wider range of disciplines and with the involvement of the local community. This will facilitate a more comprehensive understanding of geotourism and inform the development of more effective policy recommendations. The infrastructure design in the Ciletuh-Palabuhanratu Geopark has facilitated the development of geotourism; however, there is still scope for improvement. By facilitating access, providing information and adopting more sustainable practices, the UGG has the potential to serve as a model for responsible geotourism.

REFERENCES

Ansori, C., Setiawan, N. I., Warmada, I. W., & Yogaswara, H. (2022). Identification of geodiversity and evaluation of geosites to determine geopark themes of the Karangsambung-Karangbolong National Geopark, Kebumen, Indonesia. International Journal of Geoheritage and Parks, 10(1), 1-15.

Brilha, J. (2016). Inventory and quantitative assessment of geosites and geodiversity sites: A review. Geoheritage, 8(2), 119–134. https://doi.org/10.1007/s12371-014- 0139-3

Darcy, S. (1998). People with a disability and tourism: A bibliography. Online Bibliography, 7.

Dowling, R. K. (2011). Geotourism's global growth. Geoheritage, 3(1), 1-13.

Dowling, R. K. (2013). Global geotourism–an emerging form of sustainable tourism. Czech journal of tourism, 2(2), 59-79.

Ginting, N., Rahman, N. V., & Sembiring, G. (2017, March). Tourism development based on geopark in Bakkara Caldera Toba, Indonesia. In IOP Conference Series: Materials Science and Engineering (Vol. 180, No. 1, p. 012086). IOP Publishing.

Henriques, M. H., Canales, M. L., García-Frank, A., & Gomez-Heras, M. (2019). Accessible geoparks in Iberia: a challenge to promote geotourism and education for sustainable development. Geoheritage, 11, 471-484.

Herrera-Franco, G., Montalván-Burbano, N., Carrión-Mero, P., Jaya-Montalvo, M., & Gurumendi-Noriega, M. (2021). Worldwide research on geoparks through bibliometric analysis. Sustainability, 13(3), 1175. https://doi.org/10.3390/su13031175.

Herrera, G., Carrión, P., & Briones, J. (2018). Geotourism potential in the context of the geopark project for the development of Santa Elena Province, Ecuador. WIT Transactions on Ecology and the Environment, 217, 557–568. https://doi.org/10.2495/SDP180481.

James, E., Hazan-Eva, M., Muhammad-Firdaus, A. K., Awing, E. R., & Zulhazman, H. (2020). The 5th International Conference of Geological Engineering Faculty and Indonesia. Pitakotte: The International Institute of Knowledge Management.

Johnson, L. (2019). Natural stones in modern architecture. Architectural Digest, 21(4), 112-125.

Katona, V. (2020). Relief method: The analysis of architectonic façades by fractal geometry. Buildings, 11(1), 16.

Kubalíková, L. (2019). Assessing geotourism resources on a local level: A case study from Southern Moravia (Czech Republic). Resources, 8(3), 150.

Mauerhofer, L., Reynard, E., Asrat, A., & Hurni, H. (2018). Contribution of a geomorphosite inventory to the geoheritage knowledge in developing countries: The case of the Simien Mountains National Park, Ethiopia. Geoheritage, 10, 559–574. https://doi.org/10.1007/s12371-017-0234-3

Network, G. G. (2010). Guidelines and Criteria for National Geoparks seeking UNESCO's assistance to join the Global Geoparks Network (GGN).

Newsome, D., Dowling, R., & Leung, Y. -F. (2012). The nature and management of geotourism: A case study of two established iconic geotourism destinations. Tourism Management Perspectives, 2-3, 19–27. https://doi.org/10.1016/j.tmp.2011.12.009.

Nooraddin, H. (2012). Architectural identity in an era of change. Developing Country Studies, 2(10), 81-96.

Ólafsdóttir, R., & Tverijonaite, E. (2018). Geotourism: a systematic literature review. Geosciences, 8(7), 234.

Rachaju, K., Fahrudin, A., & Purwanti Basuki, A. H. (2023). The Effectiveness of Tourism Policies in Improving the Community Economy in The Ciletuh Palabuhanratu Geopark Area. *CEMJP*, *31*(2), 1016-1032.

Ríos-Reyes, C. A., Manco Jaraba, D. C., & Castellanos Alarcón, O. M. (2021). Geotourism potential and challenges of the coastal region around Santa Marta (Colombia): A novel strategy for socioeconomic development. Cuadernos de Geografia: Revista Colombiana de Geografia, 30(1), 106–124 24. https://doi.org/10.15446/rcdg.v30n1.81239.

Ruhimat, M., Arrasyid, R., Isya, H. R. M., Darsiharjo, C. U. A., & Logayah, D. S. (2021). Mobile guiding application for tourists in a Geopark area in Indonesia. *Journal of Engineering Science and Technology*, *16*(3), 1898-1915.

Štrba, Ľ., Kolačkovská, J., Kudelas, D., Kršák, B., & Sidor, C. (2020). Geoheritage and geotourism contribution to tourism development in protected areas of Slovakia—theoretical considerations. Sustainability, 12(7), 2979.

Tesfa, C., & Zewdie, M. M. (2023). Assessment and map of geotourism potential sites in Amhara Regional State, Northwestern Ethiopia. International Journal of Geoheritage and Parks, 11(4), 634-651.

Tičar, J., Tomić, N., Breg Valjavec, M., Zorn, M., Marković, S. B., & Gavrilov, M. B. (2018). Speleo Tourism in Slovenia: balancing between mass tourism and geoheritage protection. Open Geosciences, 10(1), 344-357.

Tomić, N., Marković, S. B., Antić, A., & Tešić, D. (2020). Exploring the potential for geotourism development in the Danube region of Serbia. International Journal of Geoheritage and Parks, 8(2), 123-139.

YALÇIN, C. INTEGRATION OF GEOLOGICAL RAW MATERIALS IN SUSTAINABLE SMART BUILDINGS.

Zouros, N. C. (2010, January). Lesvos petrified forest geopark, Greece: geoconservation, geotourism, and local development. In The George Wright Forum (Vol. 27, No. 1, pp. 19-28). George Wright Society.

Zgłobicki, W., Kukiełka, S., & Baran-Zgłobicka, B. (2020). Regional geotourist resources: Assessment and management (a case study in SE Poland). Resources, 9, 18. https://doi.org/10.3390/resources9020018.