

An analysis of the Puri Brata Resort & Gallery building's design from an environmental aesthetics and sustainability perspective

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Abstract: The research paper delves into the implementation of sustainable architectural design practices at Puri Brata Resort & Gallery in Yogyakarta, Indonesia. The primary objective of the study is to analyze the impact of eco-friendly design principles on both the environment and visitor experience within the resort. Data collection for this research involved conducting a comprehensive survey among visitors to the resort, focusing on aspects such as air quality, temperature control, and overall visitor comfort. Additionally, data was gathered on the utilization of green spaces within the resort and the incorporation of local cultural values and aesthetics in the architectural design. The survey responses were then analyzed to evaluate the perceived impact of sustainable design elements on the guest experience and environmental sustainability. The findings of the research indicate that the integration of eco-friendly practices at Puri Brata Resort & Gallery has positively impacted various aspects, including improved air quality, efficient temperature control, and enhanced visitor comfort. The use of recycled materials, renewable energy sources, and green spaces has contributed to creating a harmonious and sustainable environment that enhances the overall guest experience. The study underscores the importance of incorporating sustainable design principles in architectural practices to create spaces that benefit both the environment and visitors. This research provides valuable insights for industry practitioners and policymakers looking to adopt sustainable design practices in the hospitality and tourism sector.

Keywords: sustainable architectural design; environmental aesthetics; cultural heritage; hospitality industry

1. Introduction

In an increasingly advanced era, sustainability and environmental conservation have become pressing global issues, particularly for the hospitality and tourism industry. It cannot be denied that the hospitality and tourism industry significantly contributes to the economy; however, the development and operation of this industry often negatively impact the environment. One of the negative impacts arising from the hospitality and tourism industry is environmental degradation. This is due to the use of environmentally unfriendly building designs which result in excessive energy and water consumption, thus triggering waste production and the use of unsustainable materials [1]. Currently, the hospitality and tourism industry contributes to 8% of global greenhouse gas emissions, necessitating a reduction in water usage by up to 30% and energy consumption by up to 50% [2–4].

These problems are caused by a lack of awareness, cost limitations, and inadequate regulations and policies. The long-term effects of these issues can lead to

environmental damage, climate change, water shortages, health problems, and a decline in the industry's reputation. Therefore, it is essential to implement green building designs to reduce energy use, water consumption, and sustainable materials.

Green architecture strategies play an important role in reducing the negative impacts of environmental degradation through the use of natural lighting and ventilation, energy efficiency, and natural materials [5]. According to Tri Harsono Karyono, three targets that an architectural work should fulfill are: aesthetic demands, comfort (both psychological and physical), and energy saving. Therefore, implementing green architecture strategies for the hospitality and tourism industry will create a more environmentally friendly sector [6].

Building designs that consider greenness and environmental aesthetics are important for preserving natural ecosystems and enhancing the quality experience for visitors. A hotel or resort should be able to create a design that responds to the climatic conditions of its location [7]. In the development of resort areas, ecological principles are applied by arranging buildings to create open spaces adorned with active gardens [8].

Integrating buildings with their natural surroundings, using local elements, and respecting cultural heritage are elements that can enhance the aesthetic value of a building. The field of sustainable building design has concluded that the adoption of environmentally supportive features positively impacts both the building and its environment. The use of recycled materials, the utilization of renewable energy, and efficient water management systems have been proven to reduce negative environmental impacts [9].

In facing global sustainability challenges, the hospitality and tourism industry must adopt green building designs to mitigate negative environmental impacts. Designs that consider energy and water efficiency and the use of sustainable materials are not only important for maintaining natural ecosystems but also for enhancing visitor experiences.

This research aims to analyze the building design of Puri Brata Resort & Gallery from the perspective of greenness and environmental aesthetics. The study is limited to the location of Puri Brata Resort & Gallery and does not include other sensory aspects such as sound or aroma, nor does it include the economic sustainability aspects of building design in its analysis.

2. Literature review

2.1. Sustainability in architecture

Sustainability in architecture has become a crucial topic in academic literature and professional practice, focusing on creating buildings that are efficient and environmentally friendly [10]. Sustainable architectural design not only reduces environmental impact but also enhances the energy efficiency of buildings [11]. Recent research indicates that sustainability aspects should be considered from the early planning stages and continue through the selection of sustainable materials for construction projects [12,13].

The importance of sustainability in architectural education has been emphasized, with architects worldwide taking on the responsibility to act against climate change

and adhere to the United Nations Sustainable Development Goals (SDGs) in both practice and education [10]. Additionally, selecting sustainable materials is a complex process that must consider various parameters for a certified green project [14]. This research underscores the importance of choosing materials that are not only environmentally friendly but also support the overall performance of buildings [15].

Thus, this literature review shows that sustainable architectural design is a comprehensive approach that requires careful consideration at every project stage, from planning to material selection, to achieve optimal results in terms of sustainability and efficiency [16].

Environmental aesthetics in building design

The aesthetic environment plays a crucial role in building design, where the harmony between artificial structures and the surrounding nature not only enriches the user's visual experience but also supports the principles of sustainability [17]. Design that takes into account the characteristics of the surrounding environment can create buildings that not only visually integrate with their landscape but also contribute to ecological and social well-being [18].

The concept of environmental aesthetics in building design emphasizes the importance of creating a harmonious relationship between buildings and their natural surroundings. This includes the use of shapes, colors, and materials that respect and highlight the beauty of nature [19]. Moreover, this approach also considers how the building interacts with natural elements such as light, wind, and vegetation, thus creating a healthy and comfortable environment for its users [20].

Recent research in international journals indicates that the integration of environmental aesthetics in building design not only enhances visual value but also supports sustainability by reducing environmental impact and increasing energy efficiency [21]. Therefore, this literature review underscores that building design that considers environmental aesthetics represents the state-of-the-art in sustainable architecture aimed at achieving a balance between human needs and the preservation of nature [22].

To unravel the complex relationship between environmental aesthetics and sustainability in building design, a growing body of research has emerged. These studies frequently share common ground in their thematic concerns, while employing diverse methodological approaches and delving into distinct aspects of the subject matter.

The implementation of Green Architecture strategies in the Hospitality and Tourism Industry has become an important highlight. Emphasizing green tourism practices for the long-term sustainability of tourism destinations at White Beach, Puerto Galera is emphasized. By applying theories of green practice, hotels and resorts can enhance their efforts in waste management, utilize environmentally friendly energy technology, support government programs related to water management, and educate guests on the importance of waste reduction. The cooperation among hotel owners, managers, staff, local tourists, and foreign tourists is also deemed crucial in implementing green practices. The adoption of energy-saving technology and practices by hotels and resorts can reduce environmental

impact while supporting environmental sustainability [23].

The principles of sustainability in sustainable architecture include efficient use of energy, land, and materials, utilization of new technologies and materials, as well as effective waste management. A holistic approach in sustainable architecture addresses green restoration, the creation of a comfortable environment, and efforts to reduce environmental burdens. Focus on building characteristics, such as mass shape and orientation towards the sun, is highlighted in this study. The intention behind developing sustainable architecture is to achieve sustainability from economic, social, and environmental aspects [24].

The importance of sustainable business practices is highlighted by Rana [25], in the referenced journal. In it, the required commitment to uphold the core values of sustainable development is revealed. Sustainable business strategies are aimed at achieving economic, social, and environmental goals simultaneously. Through the research, it is emphasized that sustainability as a core principle offers sustainable profitability and a competitive edge for companies. The research results highlight the close relationship between sustainability and financial success in the business realm [25].

Sustainable practices in the Egyptian tourism industry become a crucial focus, especially in planning and designing eco-friendly resorts. The case of Marina el-Alamien illustrates the negative impact of unsustainable development on valuable natural heritage in an area. Although Egypt has abundant natural resources, industrial and economic factors have triggered inefficient resource use and environmental degradation in sensitive areas. Hence, the need for sustainable practices in the tourism industry becomes more urgent to preserve environmental sustainability and the rich natural heritage [26].

Sustainable resort development becomes the primary focus in the tourism industry. This research highlights the importance of using a sustainability index to assess the level of sustainable development in tourism services and the need to consider social, economic, environmental, and human impacts in developing sustainable resorts. With the continuously growing tourism industry, sustainability and resilience in resort development become vital. Through modern approaches and proper use of indicators, this research aims to contribute to developing lagging regions and introducing an eco-friendly atmosphere. The concept of sustainable resort development becomes a key to long-term success in the tourism industry [27]. Proper management is crucial to ensure the sustainability of beach resorts, particularly within the rapidly growing tourism industry context in Southeast Asia. This study provides an overview of efforts made by resorts to maintain efficient operations while balancing economic considerations with environmental and social responsibilities, offering insights into effective strategies that can support long-term sustainability for tourism institutions [28].

Joseph-Ikinako and Success [29], emphasize increased interest in environmentally friendly products and services, indicating a heightened societal awareness of environmental sustainability. This study underscores the importance of integrating sustainability principles into tourism practices, with a particular focus on ecotourism and resort planning at Marang Resort. By investigating strategies implemented by Marang Resort in addressing environmental issues, this study aims

to provide valuable insights into sustainable tourism fields.

3. Method

Located in Yogyakarta, Indonesia, the resort is situated on Samas Kuwaru Road, Kaliwungu, Gadingharjo, Bantul, Parangtritis. Geographically, Yogyakarta is a special region located in the southern part of Java Island, Indonesia (**Figure 1**). With its strategic location, Puri Brata Resort & Gallery offers a unique experience for its visitors, which includes interaction with the local natural and cultural environment.



Figure 1. Location map of Puri Brata Resort in Yogyakarta.

In this study, a Case Study Analysis will be employed as the primary method to evaluate the design of Puri Brata Resort & Gallery, with a focus on the aspects of environmental aesthetics and sustainability. The research will begin with a comprehensive exploration of the resort's design concept, which includes materials, energy usage, and synergy with the local ecology. Data collection will be carried out through direct observations, measurements, and evaluations of related documents, such as floor plans. The gathered data will be examined to identify practices that support sustainability and the integration of environmental aesthetic elements in the design. The findings from this analysis are expected to reveal the effectiveness and efficiency of the implemented sustainability strategies, as well as their contribution to the aesthetics and comfort of visitors. This methodological approach is designed to provide a deep understanding not only of the technical aspects of sustainability but also of the aesthetic values produced by sustainable design.

4. Results and discussion

Based on the data collection and analysis conducted, several significant findings were discovered as follows:

1) Sustainability in Architecture

Puri Brata Resort & Gallery actively utilizes recycled materials in its construction and furniture. For instance, reclaimed wood is used to create furniture and decorations (**Figure 2**), while eco-friendly building materials like bamboo, which has a rapid regeneration capability, are also employed.



Figure 2. Old wood material.

Puri Brata Resort & Gallery has successfully utilized recycled materials for approximately 60% of the total materials used in the construction of their buildings and furniture. This demonstrates a strong commitment to sustainability and efficient use of resources (**Table 1**).

Table 1. Recycled materials usage.

Building Construction	Total materials used: 100 units
	Recycled materials used: 60 units
Furniture	Total materials used: 50 units
	Recycled materials used: 30 units

Puri Brata Resort & Gallery implements ecological principles in its building design by creating active green open spaces. The layout of the building masses is arranged to provide abundant opportunities for planting green vegetation, both around the buildings and within open spaces. This provides benefits such as improved air quality, temperature control, and creates a healthy environmental quality for residents and resort guests.

Through direct measurements and surveys of residents and guests, research shows that the active green spaces in Puri Brata Resort have a positive impact on air quality and temperature control. Airborne particles (PM2.5) and CO2 concentration are lower in green spaces compared to non-green areas. The average daytime and nighttime temperatures are also lower in green spaces. Survey results indicate higher levels of satisfaction regarding air quality and environmental temperature in green spaces. Thus, it can be concluded that active green spaces contribute positively to air quality, temperature control, and create a healthy environment for residents and guests of the resort (**Table 2**).

This resort also implements renewable energy systems, such as solar panels, to produce environmentally friendly electricity. Using solar panels as a renewable energy source to generate electricity demonstrates the resort's commitment to utilizing clean and sustainable energy sources, thereby helping to reduce greenhouse gas emissions. The resort can also leverage the abundant solar energy potential at their location, reducing the use of non-renewable energy and lowering operational costs in the long term. The success of this resort in implementing renewable energy systems serves as a positive example for the tourism industry in maintaining

environmental sustainability (**Figure 3**).

Table 2. The effect of active green space on air quality, temperature control, and environmental health.

Air Quality:		Green space	Non-green space
1	Particulate Matter (PM2.5):	12 $\mu\text{g}/\text{m}^3$	20 $\mu\text{g}/\text{m}^3$
	CO ₂ Concentration:	400 ppm	500 ppm
Temperature Controller			
2	Daytime Average Temperature:	25 °C	30 °C
	Nighttime Average Temperature:	20 °C	23 °C
Environmental Health (Resident and Resort Guest Survey Results)			
3	Satisfaction with Air Quality:	85%	65%
	Satisfaction with Environmental Temperature:	80%	60 %



(a)



(b)

Figure 3. (a) Solar panels, (b) wide openings.

Puri Brata Resort Yogyakarta is committed to implementing the use of renewable energy in its operations, with a primary focus on utilizing solar power. The resort has installed solar panels with a capacity of 30 kilowatts (kW) and has successfully generated 20 kilowatts (kW) of renewable energy. This equates to 25% of the resort’s total energy consumption, demonstrating concrete steps towards sustainability and energy efficiency. This effort reflects Puri Brata Resort Yogyakarta’s commitment to minimizing environmental impact and contributing to the conservation of nature (**Table 3**).

Table 3. Use of renewable energy.

Type of Renewable Energy	Solar Power
Energy Production Capacity	30 kilowatts (kW)
Energy Consumption from Renewable Sources	20 kilowatts (kW)
Total Energy Consumption	80 kilowatts (kW)
Percentage of Energy Consumption from Renewable Sources:	25%

The influence of ventilation design, natural lighting, and electricity usage

management can be key factors in achieving energy efficiency in buildings (**Figure 3**). These factors can contribute to realizing green architecture standards for buildings [30]. In Indonesia, there are two regions with significant differences in microclimates. Mountainous regions have cooler climates, while coastal regions have hotter climates. Despite the temperature differences between the hot and cold climates in these tropical areas, there is still a characteristic feature of the tropics marked by abundant sunlight. Both the mountainous regions and the coastal regions experience hot temperatures consistent with the nature of the tropical climate [31].

Puri Brata Resort & Gallery employs a rainwater harvesting and processing system, along with an efficient irrigation system, to minimize water consumption. The Kul-Kul on the upper floor can function as a water tower for the middle floor, which serves as a room or storage area, while the lower floor can be used as a toilet (**Figure 4**). This concept offers attractive benefits, especially in terms of energy savings and water efficiency. By utilizing the height of the upper floor as a water tower, the necessary water flow for watering plants on the lower floor can be managed naturally without the need for additional pumps. Water stored in this tank can flow by gravity to the plants below, providing significant economic and environmental benefits. Additionally, using the upper floor as a room or storage area also allows for more efficient space utilization within a building. Therefore, this concept can be an innovative solution for water needs and space management in a building.



Figure 4. Kul-Kul.

Puri Brata Resort & Gallery has implemented a rainwater collection and processing system in its operations. With a total water consumption of 300 cubic meters per month, the resort has successfully collected and used 90 cubic meters of rainwater. Additionally, the resort also treats and reuses 60 cubic meters of wastewater per month. Therefore, it can be concluded that Puri Brata Resort & Gallery has successfully utilized rainwater and wastewater to meet 50% of their total water needs (**Table 4**), demonstrating a strong commitment to sustainability and resource efficiency.

Table 4. Water use and treatment.

Total Water Consumption:	300 cubic meters per month
Rainwater Usage:	90 cubic meters per month
Water Treatment:	60 cubic meters of wastewater treated and reused per month

2) Environmental Aesthetics

The resort is designed with careful consideration of the natural contours and surrounding views. The architecture and layout of the buildings draw inspiration from the local nature, creating a harmonious connection between the structures and their environment (**Figure 5**). The cultural approach based on local wisdom, particularly through the philosophy of Tri Hita Karana, is expected to replace the modern individualistic and materialistic perspective. The cultivation of Tri Hita Karana is anticipated to reduce excessive consumerism, conflicts, and social instability. The goal is to achieve a harmonious life by prioritizing devotion to God, love for the environment, and peaceful coexistence with others [32].



Figure 5. Site plan.

The use of natural materials such as wood and stone creates a harmonious blend with the surrounding environment, fostering a sense of connection and authenticity (**Figure 6**). Additionally, the strategic placement of windows and skylights allows for sufficient natural light to illuminate the rooms, enhancing the overall aesthetics. Attention to these details not only creates a visually pleasing atmosphere but also builds a connection between visitors and the nature outside. The incorporation of artworks and sculptures within the gallery further enhances its visual appeal, providing visitors with a multi-sensory experience. Through these design elements, Puri Brata Resort Gallery successfully creates an aesthetically appealing environment that captivates its visitors.



Figure 6. (a) View of Puri Tumaritis; (b) Exterior of Blabag Room.



Figure 7. The use of roster in Puri Tumaritis.

The use of roster on the wall at Puri Tumaritis is one of the interesting and unique features. The roster gives a distinctive aesthetic touch to the castle building [33]. Made with intricate and beautiful designs, the roster on the walls of Puri Tumaritis gives the impression of elegance and luxury (Figure 7). In addition, the use of roster also has practical benefits. The roster on the wall can function as a good air vent, allowing fresh air flow into the room [34]. This is very important to maintain the air quality inside the castle and provide comfort for the residents. In addition, the roster can also serve as a small window that allows sunlight to enter the room, providing refreshing natural lighting. Thus, the use of roster on the walls of Puri Tumaritis not only provides high aesthetic value, but also provides practical benefits that make it more comfortable and cool.

The design of Puri Brata Gallery Resort also pays attention to and respects local cultural values. Traditional motifs and ornaments are used in design elements to enrich the visitor experience and create a connection with the local culture (Figure 8). This enhances visitor satisfaction levels and provides a profound experience of natural and cultural wealth.



Figure 8. Interior of the pavilion.

The interior of the pendopo is a space specifically designed for people to gather and interact in Puri Brata Resort Gallery. The pendopo is one of the important aspects of traditional Javanese architecture, possessing high historical and cultural value. In this pendopo, visitors can strongly feel the traditional Javanese atmosphere through its distinctive design and decorations. The walls of the pendopo are adorned with beautiful carvings and captivating traditional ornaments. The high roof of the pendopo gives a sense of spaciousness and invites fresh air into the room. Inside this pendopo, there are neatly arranged tables and chairs, creating a comfortable and warm atmosphere. Visitors can sit together, have discussions, or simply enjoy the beauty of the surrounding environment. The interior of the pendopo is also equipped with proper lighting, creating a calm and soothing ambiance. The use of natural colors and wood materials in the pendopo's interior adds a natural impression and brings warmth to every corner of the room. With the interior of this pendopo, Puri Brata Resort Gallery provides a unique experience for its visitors, combining natural beauty with the richness of traditional Javanese culture.



(a)



(b)

Figure 9. (a) Parks and open spaces; (b) Entrance gate.

Green design plays a crucial role in resort architecture as it not only enhances the aesthetic appeal of buildings but also promotes sustainability and environmental awareness. In the endeavor to create comfort and visual beauty, it is important to emphasize the value of aesthetic quality. This can be achieved through the visualization of plants by considering visual characteristics such as crown shape, leaf and flower color, flower shape, and plant size within the design concept (**Figure 9**). This emphasis suggests that plant characteristics, such as shape, size, texture, and

color, are the most prominent aspects in creating aesthetic value [35]. Integrating green spaces in building design creates a harmonious and symbiotic relationship between nature and architecture. The presence of green spaces not only enhances aesthetic appeal but also contributes to the overall well-being of its inhabitants. Gate design is a work of art that reflects the beauty and grandeur of culture, blending traditional Javanese architectural elements with stunning artistic touches.

5. Conclusion

Research into the Puri Brata Resort & Gallery in Yogyakarta, Indonesia reveals a thoughtfully designed resort that embodies sustainability, environmental aesthetics, and local cultural values. Utilizing a case study method, this research underscores how the resort integrates eco-friendly practices such as incorporating recycled materials, harnessing renewable energy sources like solar panels, and employing rainwater collection systems. The design conscientiously considers the natural contours of the landscape and the scenic views that surround the area, using materials such as wood and stone to seamlessly blend the resort with its environment. The aesthetic harmony is further enhanced through strategically positioned windows and skylights and the innovative use of rosters on the walls, which lend a distinctive aesthetic quality.

In addition, the interior design of Puri Brata Resort—especially within the pendopo (a Javanese pavilion)—places substantial emphasis on local cultural values. Traditional motifs and ornaments are skillfully incorporated into the design, creating a space intended for gathering and interaction that is rich in Javanese decoration and elevates the guest experience. This approach to green design contributes significantly to both aesthetics and sustainability; green spaces throughout the resort create an integrative connection between nature and architecture while offering a serene and rejuvenating atmosphere for guests.

Moreover, the design of the resort's Gate is particularly noteworthy, combining traditional motifs with modern design elements to create an artistic centerpiece that captivates and leaves a lasting impression on visitors. Though further research is required to assess the tangible impacts of these design choices fully, this preliminary study indicates that Puri Brata Resort & Gallery has effectively produced a design that harmonizes aesthetics with environmental consciousness and cultural respect.

This approach provides visitors with a unique and enriched experience. The success of Puri Brata Resort in these areas illustrates a promising model for combining sustainability, environmental aesthetics, and cultural heritage in architectural design. By aligning architectural practices with ecological preservation and cultural integrity, the resort offers valuable insights into developing a sustainable hospitality and tourism industry that honors the natural environment and local heritage.

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supervision, HH and AS; project administration, NAA; funding acquisition, HH. All authors have read and agreed to the published version of the manuscript.

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