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Microclimate Control in The Affandi Museum Gallery Yogyakarta

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ABSTRACT

Affandi Koesoema is one of the most internationally renowned Indonesian painters because of his typical expressionist and romantic style. His legendary works are still stored in his private museum, designed with Affandi's design and construction. The building was not originally designed as a museum by Affandi, so in practice, many adjustments were made to the conditional arrangements. Indonesia's tropical climate with relatively high humidity and temperatures requires museum managers to adapt to fluctuating air temperatures. Efforts to preserve the work of Affandi paintings have been made to maintain the sustainability of Indonesian painting art. One of the considerations that should also be given attention is regarding technical aspects, including the engineering of the museum environment, that can be done to protect the invaluable art and cultural assets. Temperature control and room humidity are very important in museums and art galleries; if the room is too hot or cold, too humid or dry, it will affect the quality of the painting. This research aims to find out how environmental engineering is done at the museum to preserve the masterpiece of Affandi's painting art. The aspects of thermal comfort and humidity were one of the considerations in analyzing this study, given the tropical climate conditions that also affected art conservation activities.

Keywords: Climate, Micro, Conservasi, Museum, Affandi

INTRODUCTION

The Affandi Museum was founded by the Indonesian painter maestro, whose construction began in 1962. The museum complex consists of the museum building, its supporting buildings, and the residence where Affandi and his family lived (Tetuko, Diah, 1994). Unlike most museums in Indonesia, which typically utilize colonial buildings converted into museums or new buildings with modern designs, this museum was designed by Affandi himself from the outset as a place to display his works, as well as a study, a source of information, and an exhibition space for other painters. This museum is the first in Indonesia to incorporate the concept of a gallery, a personal museum, and a home. Affandi's idealism is reflected in the building's design, which is based on two main concepts: (1) the banana stem concept, which he took from his memories of his time before he became a painter, and (2) the expressionist concept that is characteristic of his paintings (Hertanti, Tresnaningrum, 2009). The museum building was not originally designed as a museum by Affandi, so in practice, many adjustments were made to the layout. Indonesia's tropical climate, with relatively high humidity and temperatures, requires museum managers to adapt to fluctuating temperatures.

Maintenance of art, historical, or cultural objects can be carried out after understanding the materials used to repair the objects and the type of damage being faced. This is because almost all materials—especially organic objects—are highly sensitive to environmental conditions, such as humidity, air temperature, and light radiation (Subagiyo, Puji Yosep, 2017). The Affandi Museum collection consists of paintings by the maestro, his family, and his friends, using a variety of materials, including oil paintings, pastels, pencil sketches, and watercolors. As cultural assets, paintings have limitations, particularly related to physical deterioration. One maintenance measure that can be taken is to record

climatological data and then monitor the painting's environmental conditions. This can prevent biotic damage, such as fungal and insect attacks. The recommended air humidity is 60–65%, the air temperature ranges from 20–25°C, and the light intensity ranges from 100 lux for oil paintings and 75 lux for watercolors (and similar works); while the ultraviolet radiation is 75 mW/Lm for oil paints (and similar works) and 30 mW/Lm for watercolors (and similar works) (Subagiyo, Puji Yosep, 2017). This study aims to mitigate the vulnerability of Affandi's paintings to natural factors related to hygrothermal damage in the museum building, which is over 60 years old. Hygothermal analysis examines the movement of air and moisture through the building envelope (floors, walls, and ceilings). Architects commonly use this analysis to simulate building performance so that future resilience and risks related to design, materials, and climate can be evaluated and assessed (Marro, Marcy, 2016). The indoor microenvironment is greatly influenced by the local climate and the use of environmental controls. The impact of the outdoor climate can be controlled through several common strategies, such as installing window openings, curtains, partitions, lighting, or fans/air conditioning (Iqbal, Muhammad, 2023).

Research and publications discussing Affandi's works have been extensively researched and written by researchers, art and culture observers, both domestic and international. Based on this research, scientific publications related to Affandi and his works are largely discussed from the perspective of fine arts, and few have examined conservation efforts for the preservation of Affandi's masterpieces. A review of literature sources reveals that research activities on Affandi's painting conservation efforts are still limited, particularly those that highlight the role of museums in preserving and managing painting collections. Saving works of art means preserving/passing on the nation's history to the younger generation, providing them with opportunities to appreciate, gain knowledge, study, and be inspired, encouraging the exploration of discourse and creative techniques, which in turn fosters the development and advancement of Indonesian art (Pustanto, 2020).

A. Affandi's Museum

Affandi chose Yogyakarta as the location for his museum, building it on land he purchased in 1958. The museum complex consists of several buildings located on the Jogja-Solo highway on the banks of the Gajah Wong River. The first building on the site was Affandi's family residence, followed by three galleries, a studio, a restaurant, a living room, and other smaller buildings. The main inspirational element in the design of this complex is the banana leaf, something that played a significant role in Affandi's early life. A particularly poignant incident occurred when Affandi's siblings fell seriously ill as children, and the banana leaves were used to cover their bodies to heal their wounds. Banana leaves are also commonly used for shade from the sun and rain, and were popular as tablecloths in the past. Affandi was deeply inspired by these tropical plant varieties and incorporated them into the art of the museum building he designed.

Affandi designed the museum complex around his residence, based on preliminary sketches that showed several galleries and a residence. Although not all of the buildings were ultimately designed by the artist, Affandi expressed many ideas in sketches and models that allow us to follow the process of evolution from his initial ideas to the museum complex we see today.

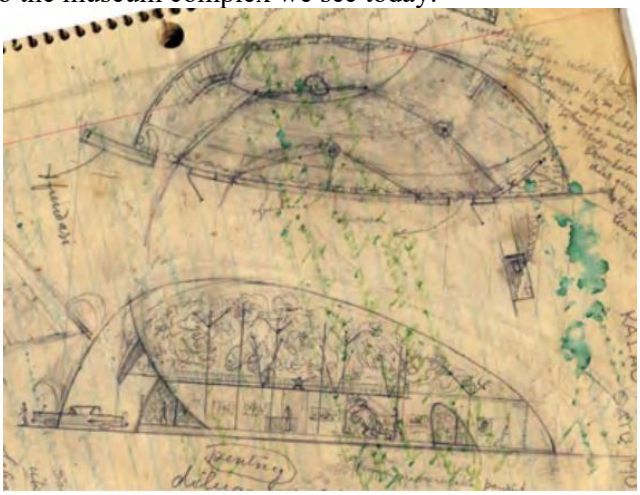

Fig. 1. Affandi's Sketch for 1st Gallery
Source : Affandi's Museum Collection

Today, the Affandi Museum and Gallery complex is more than just a historical heritage; Affandi's choice of Yogyakarta as a location has made the city a center of modern art in Indonesia. In addition to exhibiting his works, the museum also serves as a workplace, a source of information, and a venue for exhibitions by other painters. It is the first museum in Indonesia to incorporate the concept of a gallery, a private museum, and a home.

B. Gallery

- **1st Gallery**

With its unique shape and design, this building, designed by Affandi himself, utilizes natural light as the primary lighting source in its exhibition spaces. The design was inspired by banana leaf stems. The use of a skylight extending through the center of the roof allows natural light to enter the exhibition space. The sufficient lighting entering the gallery provides comfortable viewing for observers in appreciating the artwork. Conversely, from a conservation perspective, artworks

should receive as little light as possible to preserve their preservation. Natural light is excellent for visual activities in exhibition spaces due to its superior color rendering and the most complete color spectrum. However, natural light carries UV rays, which can negatively impact the conservation of art objects (Susanto, Aditya, 2009).

This gallery was built in 1962 in stages, completed and officially opened in 1974. This building can be accessed through 2 doors located at each end of the building, with a metal motif arched door shape. This gallery measures 314.6m2 and contains Affandi's paintings on paper, canvas, watercolor, oil paint as well as personal belongings of Affandi. One of the striking exhibition media of this gallery is a replica of a statue depicting Affandi with his daughter Kartika and his favorite car Mitshubitshi Gallant 1976. This building has undergone several changes related to the conditional layout, considering the climatic conditions including temperature and humidity that have changed since it was first inaugurated. One of the most striking changes or technical engineering is on the roof of the banana leaf-shaped fin, initially light could directly enter through the skylight but now because it affects temperature and humidity, the skylight is then closed to reduce heat that can damage the collection. In addition, the air vents in the walls of the building are also closed to maintain the humidity of the room. Currently, gallery 1 uses more air conditioning and adjusts the lighting to maintain the temperature and humidity of the room.

Fig. 2. Affandi's 1st Gallery Interior and Floor Plan
Source : Affandi's Museum Collection

- **2nd Gallery**

After receiving funding from the government, in 1988 the building was officially opened after a year of construction. Affandi's design and concept are still reflected in this building, similar to gallery 1 in the shape of a banana leaf stem. This building consists of 2 floors where the first floor functions as an exhibition space, and the upper floor functions as a painting storage space. The philosophy of this building reflects the historical value of Affandi's travels which are reflected in his paintings and the items he brought when visiting several countries in the world such as India, France, Brazil, and so on. This building has an area of 352.5 m2 with a high ceiling and has modular walls and columns for exhibition purposes.

Fig. 3. Affandi's 2nd Gallery Interior and Floor Plan
Source : Affandi's Museum Collection

Gallery 2 is an exhibition space for Affandi's collection of paintings for sale, as well as works by painters who were also Affandi's friends, such as Sudjojono, Hendra Gunawan, Barli, Mochtar Apin, and others. In addition to installations and sculptures, Gallery 2 also exhibits works obtained through various means, such as gifts and from painter group events.

- **3rd Gallery**

Gallery 3 was built due to the need for the preservation of artworks, therefore in this gallery there is a conservation room for practical needs related to workshops and restoration of works by Affandi, his family, and also friends. This building was built in 1999 and officially opened by the Governor of the Special Region of Yogyakarta, Sri Sultan Hamengkubuwono X in May 2000. The design and shape of this building is slightly different from the previous gallery, the most visible difference is the presence of two round towers that function as conservation and care rooms for the collection. One form that is still maintained from the previous gallery is the form of ventilation and also the design of the door that uses decorative ornaments made of metal.

Fig. 3. Affandi's 3rd Gallery Interior and Floor Plan
Source : Affandi's Museum Collection

This building consists of two floors, where the first floor displays the works of the Affandi family, such as the works of Maryati (Affandi's first wife), paintings of Kartika (Maryati's daughter), and paintings of Rukmini (Affandi's daughter from his second wife). The second floor is used as a restoration room and the basement as a warehouse. This building has an area of 147.6 m2 and is directly adjacent to the Gajah Wong River.

METHOD

The method used in this study is descriptive quantitative, measuring the temperature and humidity of the exhibition spaces, consisting of Gallery 1, Gallery 2, and Gallery 3. Primary data was obtained directly in the field, along with interviews with the Affandi Museum conservation team, to determine the condition and maintenance history of the paintings in the galleries. This study will focus on hydrothermal analysis and its impact on the quality of Affandi's paintings. Data collection techniques include observations by testing the relative humidity in the exhibition spaces, observing the exhibition spaces, then conducting data analysis by processing the observations. Finally, an explanation stage is the validated integration stage to produce an interpretation of the existing data.

Indonesia's humid climate and high rainfall impact the quality of various types of museum collections. The average temperature in Indonesia ranges from 25-37°C, with a relative humidity (RH) between 50-100% (Sutarga, Amir, 1998). This research was conducted to determine how the microenvironmental engineering in exhibition galleries 1, 2, and 3 in maintaining the Affandi painting collection, the temperature and room temperature aspects became the primary data collected to then analyze and describe the thermal comfort aspects. This research is the development of conservation knowledge and techniques reviewed from the aspect of the conditional layout design of the building.

RESULT AND DISCUSSION

Result

To evaluate the thermal and humidity conditions in galleries 1, 2, and 3, museum managers routinely record the temperature and humidity of the room in real time using a hygrometer. In fact, issues related to the conservation of Affamdi's buildings and paintings have received greater attention from both the government and the private sector. This is evident in a 2019 study conducted by TU Wien and Gadjah Mada University in collaboration with the Austrian government. The study began with a field survey, observations, data sampling related to temperature, humidity, wind speed, and observations of museum visitors. Based on the results of measurements related to physical variables (temperature, humidity, and wind speed), it was revealed that thermal comfort in the Affandi Museum did not meet tropical climate standards (Milatina, Azka Nida, and Syafii, Nedyomukti, 2020). From this study, the Affandi Museum management received assistance from the Austrian government with a Netatmo device that can be used to control temperature, humidity, and wind speed in real time based on Android. However, the device was no longer usable due to component damage. Therefore, the

Affandi Museum management will temporarily continue to use a hygrometer to monitor the room's temperature and humidity as a mitigation measure to protect the valuable asset of Affandi's painting collection. Research conducted by the TU Wien and Gadjah Mada University teams served as the basis for this study.

The documentation and measurement of temperature and humidity in the Affandi Museum galleries in this study was conducted on July 16 and 17, 2024, taking samples from galleries 1, 2, and 3. Measurements were taken three times a day, in the morning, daytime, and afternoon to obtain objective data on real-time temperature and humidity changes in a tropical climate. Buildings in tropical climates generally have relatively high temperatures due to the high amount of solar radiation. Some tropical-style architectural works can be identified by their numerous openings and open ventilation, a strategy that not only circulates air but also reduces solar radiation entering the space. The tropical climate and the increasingly apparent issue of climate change require special attention from the Affandi Museum management in efforts to maintain thermal comfort and conserve the collection's assets. Basically, a museum is a closed building to maintain the durability of the collection objects in the museum, while modern tropical buildings tend to focus on buildings that can respond to tropical climates including rainfall, high humidity and abundant sunlight (Anggina, Eva Gracia and Basuki, Kelik Hendro, 2019).

- **1st Gallery**

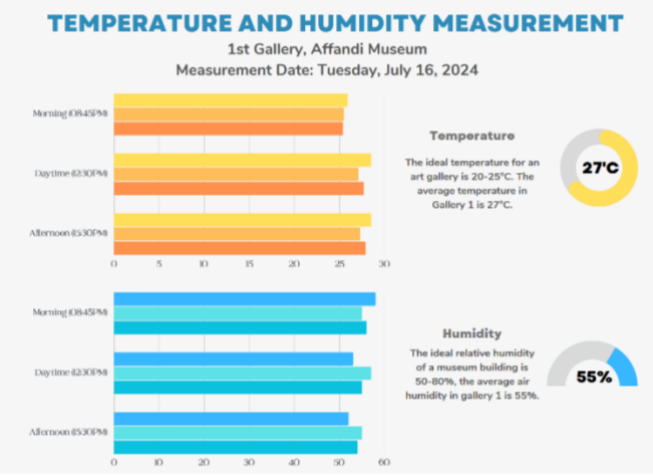

Fig. 4. Results of Temperature and Humidity Measurements 1st Gallery
Source: Danang Febriyantoko, 2024

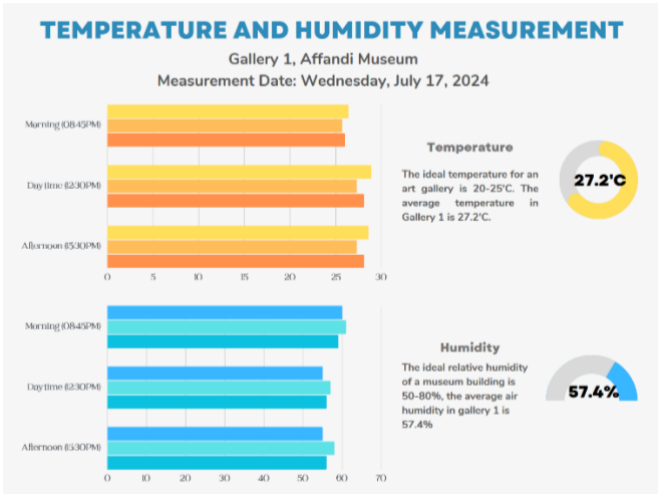

Fig. 5. Results of Temperature and Humidity Measurements 1st Gallery
Source: Danang Febriyantoko, 2024

Based on the results of temperature and humidity measurements in the exhibition gallery 1 of the Affandi Museum conducted on July 16 and 17, 2024, showed an average increase in temperature and humidity. On July 16, 2024, the average temperature of the room showed 27'C. This temperature indicates a less than ideal condition in an art exhibition space, where the ideal temperature for an art exhibition space is 20-25'C. Temperature measurements were then compared with the day after, indicating an average increase in temperature to 27.2'C. Thus, the temperature in gallery 1 is not ideal for an art gallery. Meanwhile, the measurement of room humidity also resulted in an increase from 55% on the measurement on July 16, 2024, rising to 57.4% the day after on July 17, 2024. The ideal humidity in the art exhibition space is at 50%-80%, thus, the measurement of room humidity in gallery 1, although it has increased, is still in ideal conditions.

- **2nd Gallery**

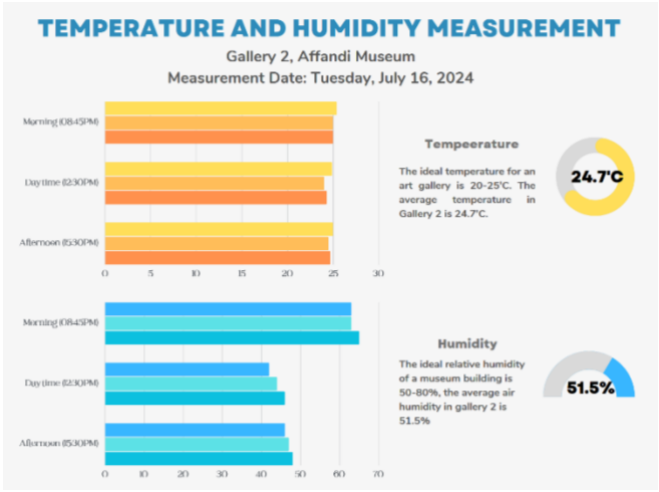

Fig. 6. Results of Temperature and Humidity Measurements 2nd Gallery
Source: Danang Febriyantoko, 2024

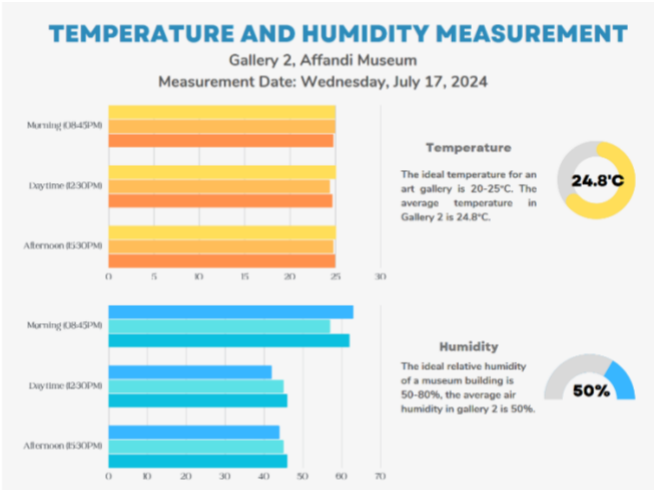

Fig. 7. Results of Temperature and Humidity Measurements 2nd Gallery
Source: Danang Febriyantoko, 2024

Based on the results of room temperature and humidity measurements in Gallery II conducted on July 16, 2024, and July 17, 2024, the room temperature did not increase significantly. The room temperature measurement conducted on July 16, 2024, showed a reading of 24.7°C. The following day, on July 17, 2024, the average room temperature was 24.8°C. This is still relatively ideal considering the average temperature in an art gallery, which is 20-25°C. Conversely, room humidity measurements decreased from 51.5% on July 16, 2024, to 50% the following day. This tends to be ideal for an art gallery, where relative humidity ranges from 50-80%.

- **3rd Gallery**

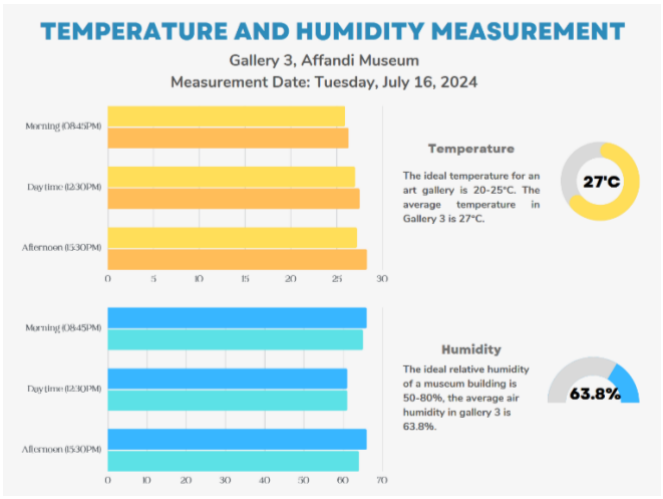

Fig. 8. Results of Temperature and Humidity Measurements 3rd Gallery
Source: Danang Febriyantoko, 2024

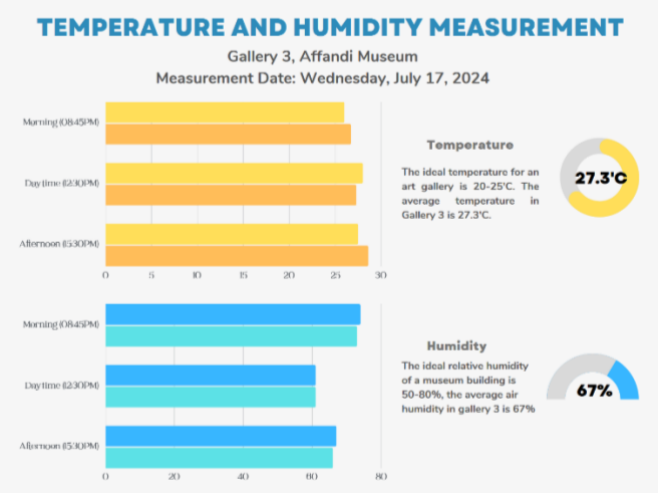

Fig. 9. Results of Temperature and Humidity Measurements 3rd Gallery
Source: Danang Febriyantoko, 2024

Based on the results of room temperature and humidity measurements in Gallery III conducted on July 16, 2024, and July 17, 2024, the average temperature and humidity increased. The average room temperature, based on the measurement conducted on July 16, 2024, was 27°C, while the measurement conducted the following day, on July 17, 2024, was 27.3°C. This indicates a less-than-ideal room temperature for an art gallery, as the ideal temperature range is 20-25°C.

A similar trend was observed in room humidity measurements. The results of the room humidity measurement in Gallery III conducted on July 16, 2024, showed an average of 63.8%. Measurements conducted the following day, on July 17, 2024, showed a significant increase, with an average humidity of 67%. Even though there is a relatively high increase in average room humidity, this condition is still at the ideal humidity level for art gallery rooms, which is at 50% - 80%.

Based on the results of measurements of microclimate conditions related to temperature and humidity of the room in galleries 1, 2, and 3 conducted on July 16-17, 2024, it indicates that the condition of the exhibition space and art gallery is not ideal, especially regarding room temperature. This needs to be a concern for the Affandi museum management to respond to tropical climate conditions that affect human thermal comfort and the maintenance of museum collection assets. Things that need to be given more attention in gallery 1 where the age of the building is more than 50 years old require more consideration regarding responsive strategies to the tropical climate conditions where the museum is located. The gallery space is too humid plus the factor of fluctuating room temperature creates climatological conditions that trigger mold growth more quickly, besides that it can also cause damage to certain collection objects such as sagging canvases on paintings (Sutaarga, Moh Amir, 1997).

Discussion

A study documenting temperature and relative humidity measurements at the Affandi Museum and Gallery was also conducted by Herbig, Ulrike, et al., 2016. Their research, which highlighted the impact of climate change on the Affandi Museum and its artworks, yielded findings regarding energy, particularly in the HVAC system settings, followed by fluctuating temperature fluctuations in several areas of the Affandi Museum. The potential and optimization of achieving effective and efficient energy temperatures are crucial issues that must become increasingly apparent across the globe.

Indonesia is a tropical country characterized by high temperatures and humidity. This impact is increasingly evident as climate change becomes more pronounced, with increasing temperatures and humidity levels. Climate and environmental conditions are crucial factors for the existence of museums, as climate has numerous elements that influence human life and collection maintenance. This research only uncovers facts and phenomena related to changes in temperature and humidity in museum galleries. There are many other climate and environmental factors that can influence the development of museums and art galleries, along with technological advances as alternative solutions for environmental management.

CONCLUSIONS

Based on measurement data that has been carried out in exhibition galleries 1, 2 and 3 of the Affandi museum, changes in temperature and humidity are identified which are relatively less than ideal. This condition has actually been felt by the museum management based on the results of interviews conducted, the temperature of the gallery space tends to rise especially when many visitors come, several strategies that are often carried out by the management include adjusting museum visiting hours and managing the temperature using air conditioning. However, these conditions have not yet obtained optimal results due to budget limitations in managing a relatively high private museum. Gallery 1, which is the original design of maestro Affandi himself, has undergone several changes to the roof structure, this was done because the increasingly hot temperature and solar radiation conditions have an impact on the room temperature. The initial design of the roof and ceiling of gallery 1 which was in the form of a banana stem, has now been slightly modified with several covering elements as an effort to maintain the temperature and temperature of the room.

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