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Architectural Sustainability of an Achmad Noe'man's Mosque Design

Abdul Mannan[1✉], Afifah Harisah[2], Ria Wikantari[3], Mohammad Mochsen Sir[4]
Hasanuddin University
Email: mannan123unhas@gmail.com[1✉]

Abstrak

Penelitian ini bertujuan untuk mengetahui dan mengeksplorasi penerapan konsep arsitektur keberlanjutan masjid yang dirancang oleh Achmad Noe'man. Penelitian ini menekankan metode penelitian deskriptif-kualitatif secara eksplorasi. Untuk mendapatkan data kualitatif, ia menggunakan studi literatur dan pengamatan arsitektur masjid yang dirancang oleh Achmad Noe'man sebagai objek kajian. Pengumpulan data yang dilakukan adalah melalui observasi empiris di lapangan, pengambilan foto atau foto, dan wawancara mendalam dengan penekanan pada ekstraksi informasi, terutama fisik bangunan masjid dan aspek lainnya. Data primer adalah masjid yang dirancang oleh Achmad Noe'man. Data sekunder yang dikumpulkan berasal dari berbagai referensi literatur yang relevan. Hasil penelitian ini menunjukkan bahwa penerapan konsep keberlanjutan arsitektur masjid Noe'man mencakup beberapa temuan. Ruangan tersebut dapat menghemat penggunaan energi karena suasana masjid yang sejuk dengan langit-langit yang tinggi, ventilasi silang, bukaan, dan lubang yang mengalirkan udara tanpa menggunakan AC. Ini mengesankan harmoni dan keramahan terhadap alam dengan menghijaukan dan menata halaman masjid dengan balok rumput dan bahan paving yang dapat menyerap air hujan.

Kata Kunci : *Arsitektur, Berkelanjutan, Masjid Ahmad Noe'Man.*

Abstract

4591The study aims to find out and explore the application of the sustainability architecture concept of a mosque designed by Achmad Noe'man. This study emphasizes a descriptive-qualitative research method in an exploratory way. To obtain qualitative data, it employs a literature study and observation of the mosque architecture designed by Achmad Noe'man as the object of study. The data collection conducted is through empirical observation in the field, taking photos or pictures, and in-depth interviews with an emphasis on extracting information, especially the physical building of the mosque and other aspects. The primary data is a mosque designed by Achmad Noe'man. The secondary data collected are from various relevant literature references. The results of this study indicate that the application of the mosque architecture sustainability concepts of Noe'man covers some findings. The room can save energy use due to the cool atmosphere of the mosque with high ceilings, cross ventilation, openings, and holes that drain air without using air conditioning. It impresses harmony and friendliness to nature by greening and structuring the mosque courtyard with grass blocks and paving materials that can absorb rainwater.

Keyword: *Architectural, Sustainability, Achmad Noe'man's Mosque*

INTRODUCTION

A mosque is the center of Muslim life, the center of Islamic culture. It is more than what people usually mean as a place of prostration. It is where activities begin. A mosque building is expected to support environmental sustainability and preserve natural resources for more durability. An eco-architectural approach is essential for building construction as it relates to high levels of energy and material usage (Ben Ghida, 2024). In the UN Environment's Global Status Report of 2017, building and construction account for more than 35% of global final energy use and nearly 40% of energy-related CO2 emissions (Yana, Nizar and Yulisma, 2021),(Lackenby et al., 2018). According to Achmad Noe'man, the spirit of a mosque building does not actually lie in terms of material, technique, or theory, but rather in what and to what extent a design and its implementation are able to reflect devotion, surrender, and piety to Allah and natural law (Kamali, 2024). On the other hand, the term sustainability in the context of resources (especially natural resources) is an issue that has recently been echoed and can be directly translated as The level of sustainability of the availability of various resources (especially energy) is a concept designed to encourage action to create a better life approach (Boatman et al., 2024) based on the integration of the three main systems of society, economy and environment based on the integration of the three main systems of society, economy and environment (Genovese and Zoure, 2023).

Sustainable development is a form of action that seeks to overcome existing

problems, namely: increasing the prevalence and severity of poverty, decreasing the quality of the natural environment (Bonnedahl, Heikkurinen and Paavola, 2022), (Lopera-Arbeláez and Richter, 2024). Islam has very strong reasons to support efforts to solve environmental problems (Andayani, Hariani and Jauhari, 2021), (Alnaim et al., 2023).

The Nabawi Mosque, which is the center for the spread of Islamic teachings, for example, was built by the Prophet from environmentally friendly local materials (Almasri et al., 2023). As revealed by the global Ummah for Earth movement, the building resources of the Prophet's mosque meet the requirements of a sustainable method (Saada, 2023). This fact becomes an irony when the mosques founded by some Muslims today do not follow the inspiration for the establishment of the Nabawi Mosque. Some mosques actually contribute to environmental problems. The use of air conditioners that produce carbon emissions, the use of courtyard pavements that do not absorb water, waste of ablution water, construction of mosques in congested areas, and excessive use of loudspeakers are some of the issues why mosques are currently adding to environmental (Aksoy, 2024), (Abubakr Ali and Ali Mustafa, 2024). It's time to discuss the integration of mosques into the environment as a central issue of civilization. In this case, environmental preservation contains a spiritual value to the mosque (Farhan, Akef and Nasar, 2020). What is meant by civilization that is relevant today is meeting the targets of sustainable development goals. Integrating mosques into environmental issues can at least accommodate several SDGs targets, such as climate action, affordable and clean energy, clean water and sanitation, and sustainable cities and communities (Vivita et al., 2023),

Sustainable Architecture is a concept that supports environmental sustainability (Legény et al., 2024)namely, the concept of maintaining natural resources to last longer, which is associated with the vital potential of natural resources and the human ecological environment, such as the planet's climate system, agricultural systems, industry, forestry, and of course just architecture (Hendawy, Junaid and Amin, 2024). Damage to nature due to exploitation of natural resources has reached the level of destruction globally, so that slowly but surely, the earth will increasingly lose its potential to support human life, as a result of various exploitations of nature. Sustainable is more a way to influence everything to know that the first thing to consider in designing is the environment and global. The concept of Sustainable Development is one of the solutions to address environmental problems.

This concept means that humans in their activities to improve their quality of life will use a minimum of resources . It is intended that the resources on earth can be used and

enjoyed in the long term. This effort requires a response and cooperation from various parties so that the concept of sustainable development can work well. Humans will always need other humans and the natural surroundings (James et al., 2023). One way that can be used to maintain environmental, social and economic balance is to apply the concept of sustainable development, including sustainable architecture. This is the background of the urgency/importance of conducting research on sustainable architecture. Office buildings become case studies to identify and describe the application of sustainable architectural principles.When observing the forms and expressions of early mosque buildings in Indonesia, one can see their resemblance to archetypes such as "gunungan", "meru", and "wantilan". The combination of a square shape with a pyramidal roof signifies the essence of humans reaching towards the presence of the Almighty Perfect God.

The tiered roofs in the tradition of "meru" and "wantilan", which evoke the imagery of "gunungan" or temples, were subsequently adopted as symbols for mosques during the early development of Islam. Although later on, new interpretations were given to these forms, such as Faith (Iman), Islam, and Excellence (Ihsan) for three-tiered mosque roofs. This can be observed in Indonesian mosques over a very long period from the 15th century to the late 19th century, despite the diverse expressions of forms influenced by regional styles across various islands in the archipelago.

Several examples of early Islamic mosques in Indonesia mostly possess the forms and expressions described above, including the Great Mosque of Demak, the Great Mosque of Banten, the Great Mosque of Yogyakarta (17th century), the Old Mosque of Bayan (17th century), and the Lubuk Bauk Mosque from the late 19th century.

Starting from the 19th century, it can be seen that mosques built in Indonesia began to reflect foreign influences. This influence emerged as a result of colonialism, one example of which can be seen in the Great Mosque of Bandung where foreign influences are very apparent, such as in the rows of columns outside the building, as well as the openings in the mosque structure.

However, among the many foreign influences, the most dominant one, even to this day, is what was introduced by the Dutch East Indies government from Middle Eastern and Indian traditions, namely the use of domes and arch elements. These elements later became widely recognized and were considered by most people as mosque architecture. In fact, these elements were not known in the local traditions. The first mosque built in this style was the Baiturrahman Mosque in Aceh, constructed in 1879 and completed in 1881.

Figure 1. Masjid Agung Demak (1474-1478)

Figure 2. Masjid Baiturrahman (1881) Aceh

Starting from the mid-20th century, the Syuhada Mosque (1952) was established in Yogyakarta, the Al-Azhar Mosque (1956) in Kebayoran Baru and the Istiqlal Mosque in Jakarta (1961). The three mosques were built with a dome roof on the main building, in fact the entire design, including the openings, was heavily influenced by Middle Eastern styles as permitted by the previous Dutch colonial government.

Each design of the Achmad Noe'man mosque has its own character which is clearly different from other mosque architectural works in Indonesia. The focus of this research is to provide an overview of the characteristics of Achmad Noe'man's mosque in the period 1964-2010 as an architect who had a big role in giving color to the architecture and environment, where the involvement of a mosque building designer, especially Architect Achmad Noe'man, was able to giving influence to the style and direction of architectural development which always develops over time.

METHODOLOGI RESEARCH

This study emphasizes a descriptive-qualitative research method in an exploratory way. To obtain qualitative data, it employs a literature study and observation of the mosque architecture by Achmad Noe'man as the object of study (Abubakr Ali and Ali Mustafa, 2024) . The data collection conducted is through empirical observation (Rosti, Rota and Penna, 2022) in the field, taking photos or pictures, and in-depth interviews with an emphasis on extracting information, especially the physical building of the mosque and other aspects that follow such as ornamentation. The primary data is a mosque designed by Achmad Noe'man. The data identification and analysis concern the most prominent parts or aspects of architecture, namely roofs, building shapes (Sadick, Kamardeen and Vu, 2023), and other aspects. The secondary data collected are from various relevant literature references. The data analysis technique applies that of the descriptive analysis toward the mosque building concept. The results of field/empirical observation and interviews are

integrated as explanatory material in its analysis. Meanwhile, the exploratory qualitative method by Purba (2011) is a method for analyzing and looking for ideas that have new correlations with the phenomenon currently being discussed. Exploratory research is usually unbound and still open in nature. Exploratory research is open-ended so that a lot of information is collected, so researchers need to understand the theory more deeply to get maximum results.

Exploratory research is a type of research whose aim is to discover new or applied knowledge, as well as new problems. Two orientations in exportative research in looking at the first phenomenon are flexibility in looking at data and openness in thinking in finding data.

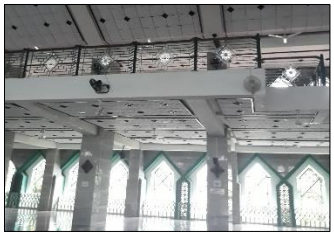
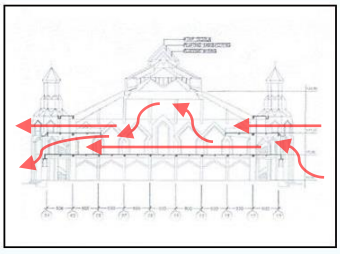
To obtain data, direct observation and literature study were carried out on mosque architecture by Achmad Noe'man as the object of study. Data collection was carried out by empirical observations in the field, taking photos or drawings, as well as in-depth interviews with an emphasis on extracting information, especially about the physical nature of the mosque building and its accompanying aspects. The results of field observations in the form of empirical observations along with the results of interviews are integrated with each other as explanatory material. As the locus of study, this research is directed at mosques by Achmad Noe'man which are spread throughout Indonesia and abroad.

In this research, the mosque architecture by Achmad Noe'man is studied and analyzed in depth and focus. Each study case was analyzed and interpreted on its architectural form, then the results of the analysis and interpretation were compared between one study case and another.

RESULT AND DISCUSSION

The area study was carried out on three mosque architectures by Achmad Noe'man with the consideration that the building is planned to be implemented and operated with adjustments to regional conditions, resources and social conditions. The following is a table of analysis of the architectural matrix of the Achmad Noe'man mosque:

Tabel 1: Masjid Al-Markaz Al-Islami, Makassar.

No	Object Analysis	Photo	Form	Material	Sustainable concept
A	Main Building				
1	Roof		• Limasan bud roof • Using shapes triangular base	copper or Italian tegola	There are several attempts to minimize artificial energy use and maximize the use of natural energy Like there are as many openings as possible in the walls and the use of a kerrawang rooster that functions for
2	Wall	 	• Indented concrete • Arranged ornaments by columns and beams geometric concrete vertical and diagonal form a triangle • Columns and beams concrete works as main structure building	Openwork concrete and roster karawang	include natural light building during the day. As well as setting ventilation crosses, this ceiling elevation can be useful for entering ventilation natural fresh air into the building.

			• Mosque walls maximize openings without glass windows		
3	Floor		• Flat • Prayer room/space main column free • Floor elevation building from the front basic land	Ceramics and granite	
4	ceiling		• The shape of the ceiling follows the roof • Ceiling height reaches 16 m	Patterned Gypsum	
B	sites and facilities				
5	Land Use		• Mosque building area of 6,932 m2 • Apart from the main prayer room, there is also a	grass block	In terms of achieving Al-Markaz Al-Islami Makassar has an advantage, namely the ease of access that can be passed by the

			school, library, function room, and a very spacious yard with a total area of around 10 ha.		congregation either by using public or private modes of transportation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation by using Grassblocks and the use of paving block materials for parking and motor vehicle circulation routes, existing greening areas are more dominant than pavement areas to increase water absorption.
6	Parking	 	All parking areas use paving blocks with an area of vehicle capacity for 10,000 worshippers.	Paving block	

The concept of sustainable at the Al Markaz Al Islami Makassar mosque was found there are several attempts to minimize artificial energy use and maximizing the use of natural energy Like there are as many openings as possible in the walls and the use of a kerrawang rooster that functions for including natural light building during the day. As well as setting ventilation crosses, this ceiling elevation can be useful for entering ventilation natural fresh air into the building.

In terms of achieving Al-Markaz Al-Islami Makassar has an advantage, namely the ease of access that can be passed by the congregation either by using public or private modes of transportation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation by using Grassblocks and the use of paving block materials for parking and motor vehicle circulation routes, existing greening areas are more dominant than

pavement areas to increase water absorption.

Tabel 2 : Al-Furqon Mosque, UPI Bandung

NO	Object Analysis	Photo	Form	Material	Sustainable concept
A	Main Building				
1	Roof		• The pyramid roof has three levels	Concrete and Enameled Steel Panels	This building minimizes artificial energy use and maximize the use of natural energy There are openings in the walls and the use of filigree rosters that work for include natural light building during the day. As well as setting ventilation crosses, this ceiling elevation can be useful for entering ventilation naturally into the building.
2	Wall	 	• Indented concrete • Geometric ornament vertical and horizontal, square box • Columns and beams • concrete works as • main structure building • Mosque walls	Concrete wall, with brick layer of natural stone, roster karawang	

			maximize openings		
3	Floor		• Flat • Basic rectangular shape • Prayer room/space • main column free • Floor elevation • building from the front • basic land	wood	
4	ceiling		• The shape of the ceiling follows the roof • The ceiling height reaches 17 m	Patterned Gypsum	
B	sites and facilities				
5	Land Use		• mosque building area of 6,912 m2 • very spacious	Grass land	Al-Furqon Mosque has easy access that can be passed by the congregation either by

			yard with a total area of about 1.4 ha.		using public or private modes of transportation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation and the use of paving block materials for parking and vehicle circulation routes.
6	Parking		All parking areas use paving blocks with an area of vehicle capacity for 10,000 worshippers.	Paving block	

The concept of sustainable at the Al-Furqon Mosque, UPI Bandung mosque was found this building minimizes artificial energy use and maximize the use of natural energy There are openings in the walls and the use of filigree rosters that work for include natural light building during the day. As well as setting ventilation crosses, this ceiling elevation can be useful for entering ventilation naturally into the building.

Al-Furqon Mosque has easy access that can be passed by the congregation either by using public or private modes of transportation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation and the use of paving block materials for parking and vehicle circulation routes.

Tabel 3 : Salman Mosque, ITB, Bandung

No	Object Analysis	Photo	Form	Material	Sustainable concept
A	Main Building				
1	Roof		• Dak concrete • curved with	Reinforced concrete	The areas of the sheathing walls apart from acting

		• flat corner		as a shade for the passage also act as a rainwater catchment and for cross ventilation for natural lighting and ventilation of the building.
2 Wall	 	• Flat • Column ornaments and concrete blocks form a line vertical geometry and horizontally • Columns and beams concrete works as main structure building • Mosque walls maximize openings	Brick Wall with overlaid parquet, roster filigree, and glass as lighting	to minimize artificial energy use and maximize the use of natural energy. So that without fans or air conditioners, this mosque still feels cool and shady inside
3 Floor	 	• Flat • Basic shape facets four • Prayer room/space main column free • Floor elevation building from the front flat ground	Teak wood parquet in the room pray while the porch and the spaces around it made of	

			• Basic shape facets four • Prayer room/space main column free	granite	
4	ceiling		• Shape flat ceiling • Ceiling height reaches 6.5 m	Wood and wooden planks	
B	sites and facilities				
5	Land Use	 	• mosque building area of 1,225 m2 • yard with a total area of about 7,800 m2.	Grass land	Salman Mosque, ITB, has an advantage, namely the ease of access that can be passed by the congregation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation and the use of paving

6	Parking		All parking areas use paving blocks with an area of vehicle capacity for 1,500 worshipers	Paving block	block materials for parking, greening areas that are comparable to pavement areas to increase water absorption.

The concept of sustainable at the Al-Furqon Mosque, UPI Bandung mosque was found the areas of the sheathing walls apart from acting as a shade for the passage also act as a rainwater catchment and for cross ventilation for natural lighting and ventilation of the building to minimize

artificial energy use and maximize the use of natural energy. So that without fans or air conditioners, this mosque still feels cool and shady inside

Salman Mosque, ITB, has an advantage, namely the ease of access that can be passed by the congregation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the presence of plants for reforestation and the use of paving block materials for parking, greening areas that are comparable to pavement areas to increase water absorption.

CONCLUSION

The results of the analysis show that Achmad Noe'man's architectural work has been designed with the concept of sustainable architecture because it can reduce the use of fossil energy and switch to using renewable natural energy such as sunlight, wind, and so on. In terms of achievement, the mosque has an advantage, namely the ease of access that can be passed by the congregation either by using public or private modes of transportation. In terms of efforts to preserve and green the environment, there are several basic elements that have been implemented, such as the existence of plants for reforestation by using Grassblock and the use of paving block materials for parking and motor vehicle circulation routes as well as greening areas that are more dominant than pavement areas to increase water absorption.

The design optimization produced in the architectural work of the Achmad Noe'man mosque emerged as an answer to the problems underlying the realization of a mosque architecture. Then the solution to the problem is transformed into an architectural form

and presents a different new image. The image is formed from the results of intellectual contemplation which is translated through rational-religious and sustainable concepts. Namely the concept of human life based on Islam, habluminaAllah and habluminannas, which is then rationalized and becomes a guide for architectural design concepts. The overall concept of this building presents simplicity and gives the impression of purity of an object from each of its supporting elements. All supporting elements are realized according to their function and aesthetic needs, which cannot be separated from the strong influence of modernity principles.

Sustainable architecture, is an example of the concept of implementing architecture which in addition to paying attention to the sustainability of its users, also pays attention to nature and the environment where the building stands. The principle of sustainable architecture, is one of the principles currently needed by our earth, there needs to be a shared awareness to further realize sustainable architecture. Actually sustainable architecture can provide long term benefits for all of us and this can be achieved without losing the essence beauty and aesthetics of a building. Those are all goals for the recovery of the earth and the environment in which we live today.

Sustainable Architecture is an applied concept in the field of architecture to support the concept of sustainability, namely the concept of maintaining natural resources to last longer, which is associated with the age of vital potential natural resources and human ecological environment, such as the planet's climate system, agricultural systems, industry, forestry, and of course architecture. Damage to nature due to the exploitation of natural resources has reached a global level of destruction, so that slowly but surely, the earth will increasingly lose its potential to support life. Sustainable architecture promotes the management of natural resources and protects the health, safety and welfare of society through a responsible approach to creating the built environment.

As a sector that is close to nature, it is undeniable that in it the process of architectural activities contributes to environmental degradation such as excessive consumption of natural resources, waste or pollution. Therefore, the concept of sustainability must be applied in all architectural products including mosques.

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