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SUSTAINABLE ISLAMIC ARCHITECTURE IN SETTLEMENTS AND THEIR ENVIRONMENT IN SURAKARTA

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ABSTRACT

Islamic architecture is a science that combines architecture and Islam based on the Qur'an and Hadith. It is a built environment based on or applying Islamic basic principles and values, while sustainable architecture is a solution to save the Earth from destruction. Sustainable Islamic architecture is essential and exciting to study for some reasons. Basically, Islamic principles are compatible with sustainable architecture and green building principles. This study aims to determine old and new housings dealing with (1) sustainability through the architectural GBCI table, (2) Islamic architecture through the parameters of Islamic architecture, (3) relationship between sustainable and Islamic architecture. It was conducted using qualitative and quantitative methods based on the Greenship house table version 0.1 and Islamic architecture criteria. Analysis and discussion were carried out according to the research objectives. The study results show Islamic and sustainable architecture in old and new housing. The relationship reinforces each other, synergizes, and shows a positive correlation. It can be seen in the suitability of activities, benefits, and design implementation.

KEYWORDS:
Sustainable; Islamic architecture; Settlements and their environment; synergizes

INTRODUCTION

Islamic architecture is a science that combines architecture and Islamic sciences based on the Qur'an and Hadith. According to Nangkula Utaberta [1], Islamic architecture is an environment built based on Islamic basic principles and values. Sustainable architecture is a solution to save the Earth from destruction. In line with Vikcekova et al.'s opinion [2], this concept is a search for a balance between sustainable buildings and the environment.

The issue of sustainable architecture having a relationship with Islamic architecture will be examined to become sustainable Islamic architecture. Sustainable Islamic architecture is essential and exciting to study because Islamic architecture and sustainable architecture principles are compatible or not contradictory.

It turns out that the principle of nature conservation and all its derivatives which are intensively socialized at present has already been proclaimed by Islam, as stated in the Qur'an Surah Al-Anbiya (chapter 21) verse 107: [3] وَمَآ أَرۡسَلۡنَٰكَ إِلَّا رَحۡمَةٗ لِّلۡعَٰلَمِينَ which means: And We have not sent you, but to (become) mercy to the universe.

The principle of nature conservation is supported by Amany et al. [3], who explain that sustainable architecture is a solution to achieve the goal of continuous sustainability with the increasing number of world needs that are not balanced with limited resources. It can bring benefits in environmental, social, and economic aspects. From an environmental aspect, sustainable architecture helps reduce pollution and environmental degradation. According to Thomas [4], from the economic aspect, it controls water and energy use and maximizes the use of facilities/space. From a social aspect, sustainable architecture shows beauty in design with minimal use of local materials and infrastructure. Kawase [5] conceptualizes sustainable architecture as reducing environmental damage and maintaining & improving the quality of life. Meanwhile, Moughtin [6] conceptualizes architecture with the principles of green building, in harmony with nature, and energy-saving. According to Burcu [7], sustainable architecture has characteristics known as green architecture, eco-design, and environmental architecture, which define the principles of sustainable building design.

The Islamic concept encourages humans to take care of the Earth, in line with the principles of green building. In contrast, the Islamic concept instructs them to harmonize with nature, have the properties that exist in nature, save energy, and not damage nature in line with the sustainable concept. So, in this case, green building and sustainable architecture are two different things in the discussion of Islamic architecture. Islam, as a religion of *rahmatan lil 'alamin* (grace to all nature), puts Islamic values in every aspect

of life, non-destructive, full of grace, and love of life. Allah created humans as caliphs on Earth, meaning humans are leaders, caretakers, and guardians [1]. Therefore, they should protect, maintain, and preserve this nature for the benefit of their future generations. The statement means that Islam is the religion of *rahmatan lil'alamin* so the built environment, in this case, an architectural product, must have the principle of nature conservation, namely harmony-durability-sustainability [8].

Furthermore, Islamic architecture is a form of architectural space based on the Qur'an and the Sunnah of the Prophet. The urgency of the Qur'an has been stated in Surah Al Baqarah verse 2, which means: There is no doubt in this book of the Qur'an, a guide for those who are pious. It is the first clue. The second clue is the sunnah of the Prophet and the Prophet's Behavior as an identification figure (*uswah hasanah*) for his people. This has been stated in Surah Al Ahzab (33) verse 21 [9], which means: Indeed, in (himself) the Messenger of Allah was a role model good for you (namely) for those who hope (grace) Allah and (the arrival of) the Day of Resurrection, and he mentions Allah much.

Why is it necessary to study settlements and their environment? This research was conducted not only on settlements but also on their environment. Based on the GBCI (Green Building Council Indonesia), criteria for measuring environmentally friendly houses (Green Homes version 1.0) have been established [10]. A house serves as a residence and a means of fostering a family. The concept of an environmentally friendly house should meet basic livability by meeting building safety requirements and the minimum adequacy of the building area and the health of its occupants. It is a house that is wise in using land, efficient and effective in using energy and water, pays attention to the conservation of natural resource materials, and is healthy and safe for its occupants.

Safe and environmentally friendly home maintenance is essential because the residents' environmentally friendly behaviour must accompany the sustainability of an environmentally friendly home. Understanding the concept of environmentally friendly homes is the main factor that must be prioritized to avoid misunderstanding the notion that an environmentally friendly home or green home is a house that requires high maintenance costs or is a house that only has a lot of green land. The type of house that can be assessed is a single landed house, namely a single residential house built attached to the ground, whether in the form of a new or built house design. Categories are the main issues relevant to Indonesia's condition in realizing environmentally friendly homes.

The research object was chosen in the Surakarta area, which has a typical Muslim core settlement that has existed for a long time, namely in Kauman Surakarta and the newer Muslim settlements. The selected settlement sample is a relatively large number of settlements inhabited by Muslims, so there is a link between Islamic values and their sustainability. It is necessary to examine the existence of sustainable and Islamic architecture in settlements and their correlations. The location of the old housing that fits the criteria for Muslim settlements is Kampung Kauman Surakarta, and housing that is relatively new and inhabited by Muslims is Griya Sakinah housing, Surakarta, built by the Muhammadiyah University of Surakarta.

Research on measuring Greenship's new buildings has been carried out by Ardiansyah [11] using the Greenship New Building Ver tools. 1.2. The results of his research show that new buildings in the Indonesian Atsiri House area are not eligible to be declared green buildings because they fail to meet the minimum points required by the Green Building Council Indonesia (GBCI).

Naufal, K [12] studied the Indrokilo Botanical Garden. The results of his research fulfilled 17 out of 26 maximum scores in the MAC category, and the percentage of visitor satisfaction was 45%. There is an effort to implement green architecture in the Indrokilo Botanical Garden area by the manager. It can be seen from the MAC assessment of green ship applied by KRI reaching 13% of the 21% maximum percentage in that category. Still, there must be a synergy between applying greens and its efforts to educate society.

Research on GBCI has been carried out by Khuluk, N, Riyadi, IC [13]. This study analyzes Appropriate Land Use in implementing Green Building in the Metropolitan Tower Building. This study uses a descriptive analysis method, namely analyzing and describing the condition of the implementation of the ASD Greenship criteria in the Metropolitan Tower Building.

Diniari, A., Wijayaningtyas, M., Hidayat. S [14] analyzes Green Building Criteria Based on Greenship Homes V1.0 in Housing in Malang. The results of the third Greenship ranking study housing is included in the GOLD category with a housing percentage of Housing C at 71%, Housing B at 70%, and Housing A at 65%.

Researchers have tried correlating Islamic architecture with sustainable architecture but have yet to research the correlation. The research object was selected based on the criteria of Muslim settlements in Surakarta, including settlements (old) and housing (relatively new), to obtain varied data.

The novelty of the research lies in the substance of the relationship between Islamic and sustainable architecture. Settlements are long-lasting if they have high standards of sustainability for posterity. The urgency of research is essential because research conducted by selecting new substance materials is expected to produce findings that will enrich the knowledge of sustainable architecture in general and the science of Islamic architecture.

This study aims to determine the relationship between Islamic and sustainable architecture in settlements/housing. In more detail, it can be described as follows:

1. To find sustainability through the architectural GBCI table in old and new housing.
2. To find out about Islamic architecture in old and new housing through the parameters of Islamic architecture.
3. To find out the relationship between sustainable and Islamic architecture.

METHODS

The research was conducted using qualitative and quantitative methods based on the Greenship house table version 0.1 and Islamic architecture criteria. The researchers used a mixed method between literature reference and grounded research. Data was obtained according to the Greenship home's table version 0.1 and Islamic architectural criteria.

The data was processed based on the values obtained in the table and from Islamic architecture, and then the correlation between the two is analyzed. There are several theories about sustainable architecture from Kawase, Moughtin, Burcu, and GBCI. Still, researchers will use the latest standards that GBCI has released as tools to be used as a research tool. The research variable used to analyze the research data combines the variable criteria for sustainable architecture based on GBCI, Greenship rating tools version 1.0 (2014), and Islamic architecture research variables.

GBCI developed tools to assess environmentally friendly homes with Green Homes version 1.0. It is used to evaluate new houses, existing houses, and redevelopment of built houses. The criteria for assessing Single Residential Houses consist of 6 categories: (1). Appropriate Site Development, (2) Energy Efficiency and Conservation, (3) Water Conservation, (4) Material Resources and Cycle), (5) Indoor Health and Comfort, and (6) Building Environment Management.[10]. Table 1 shows the sustainable architecture research variable used is Greenship rating tools version 1.0. Meanwhile, the criteria for Islamic architectural research variables are listed in Table 2.

The research object consists of 2 settlement locations, old and new settlements, which met the criteria of Islamic territories. The selected research object for the ancient settlement, considered representative, is the settlement in Kampung Kauman Surakarta. In contrast, the housing, believed to represent a new settlement and has an Islamic character, is Griya Sakinah Housing Complex, Karanganyar Surakarta. The initial step is to explore theoretical references through the Qur'an and Hadith related to the activities and implementation of Islamic architecture in residential areas and studies on sustainable architecture related to residential environments. The second step is to conduct grounded research by surveying predetermined research objects to obtain primary data.

Table 1. Greenship rating tools version 1.0

SUMMARY OF CRITERIA				
CODE	CRITERIA	VALUE maximum		
		credit	bonus	percentase
Appropriate Site Development				
ASD P1	Appropriate Location	P		
ASD P2	Basic Green Area	P		
ASD 1	Green Area	4		
ASD 2	Supporting Infrastructure	2		16,88%
ASD 3	Community Accessibility	2		
ASD 4	Pest Control	2		
ASD 5	Public Transportation	1		
ASD 6	Stormwater Management	2		
		13		
Energy Efficiency and Conservation				
EEC P1	Electricity Metering	P		
EEC P2	Passive Design Analysis	P		
EEC 1	Sub Metering	2		
EEC 2	Artificial Lighting	4		
EEC 3	Thermal Condition	2		19,48%
EEC 4	Heat Reduction	4		
EEC 5	Energy Saving Home Appliances	3		
EEC 6	Renewable Energy Sources		2(bonus)	
		15	2	
Water Conservation				
WAC 1	Water Metering	2		
WAC 2	Water Saving Fixtures	3		
WAC 3	Rainwater Harvesting	3		16,88%
WAC 4	Water Saving Irrigation	2		
WAC 5	Waste Water Management	3		
		13		
Material Resource and Recycle				
MRC P	Fundamental Refrigerant	P		
MRC 1	Non- ODP Refrigerant	1		
MRC 2	Reused Material	1		
MRC 3	Environmental Friendly Source Material	2		
MRC 4	Environmental Friendly Procees Material	1		14,28%
MRC 5	Certified Wood	1		
MRC 6	Prefabricated Material	2		
MRC 7	Local Material	2		
MRC 8	Carbon Footprint	1		
		11		
Indoor and Health Comfort				
IHC P	Asbestos Free	P		
IHC 1	Fresh Air Circulation	5		
IHC 2	Natural Lighting	2		
IHC 3	Visual Comfort	1		16,88%
IHC 4	Pollutant Source Minimalization	3		
IHC 5	Acoustic Level	1		
IHC 6	Spatial Comfort	1		
		13		
Building Environment Management				
BEM P	Basic Waste Management	P		
BEM 1	Sustainable Design and Construction	4		
BEM 2	Home Guideline	2		
BEM 3	Green Activity	1		15,58%
BEM 4	Advanced Waste Management	1		
BEM 5	Save and Security Environment	1		
BEM 6	Innovation	3		
BEM 7	Home Design Development		2(bonus)	
		12	2	
Maximal Value		77	4	100%

Table 2: Islamic Architecture Variables

No	Islamic Architecture Variables
1	*hablum minallah:* In an Islamic residence, there is a relationship between humans and Allah in the form of a monotheistic space to remember Allah
2	*hablum minannas* : There is a room for daily activities
3	*hablum minal alamin:* there is space for interaction with plants, animals, and nature.
4	**The character of residential forms** is increasingly diverse, according to the character and desires of the occupants and developing technology.
5	**The embodiment of the mahram concept of zoning** includes Public, Private, Service, and Zones between: (a) the meaning of public and private zones is based on the concept of mahram, and there is a strict separation.
	(b) inner courtyard as intermediary space, green zone, and climate anticipation;
	(c) the main entrance and side entrance as circulation control for muhrim and non-muhrim
6	**Islamic residential layout** (a) prayer room;
	(b) living room with hijab concept
	(c) Qibla-oriented space
	(d) hidden architecture facade
	(e) tawhid reminder room
	(f) multifunctional room
	(g) *rahmatan lil alamin* is energy efficient and environmentally friendly
7	**Islamic ornamentation art** a. Al Faruqi: the art of monotheism
	b. Sumalyo: Geometric, floristry, calligraphic

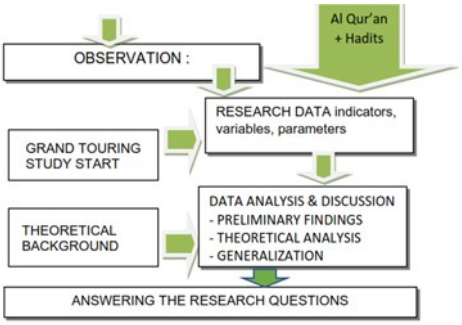

Figure 1: The research procedure

The research procedure is shown in Figure 1. Primary data can be carried out by (1) Questionnaire: respondents are representatives of residents of settlements/housings and their environment and also involve selected housing/housing officials/ administrators; questions can be submitted online via WA or email (2) FGD: in-depth discussions with settlement/housing managers; discussions can be carried out with using two ways: (a) through limited direct discussion with respondents or (b) with online meeting platforms, (3) Secondary data: can use data available online relating to regional data and community social data.

THE RESULT OF THE RESEARCH

SUSTAINABLE AND ISLAMIC ARCHITECTURE IN OLD HOUSING (KAMPUNG KAUMAN SURAKARTA)

The Kauman area is 20.10 Ha, divided into 6 RW and 22 RT, as well as 20 toponyms. Based on urban village data, in 2021, there will be 2,629 people with 840 family cards. The population of Kauman Village is predominantly Muslim, with a percentage of 92%. This number can prove that this area can maintain its tradition as a Santri village. It is also supported by Islamic activities in the socio-religious field carried out according to Islamic law in mosques, *langgar/musholla*, such as systematic Islamic studies. The history of the formation of Kampung Kauman Surakarta grew along with the establishment of the Great Mosque of Surakarta in 1757 AD or the year wawu 1689 Saka, 12 years after the Kartasura Kingdom was moved to Surakarta. The mosque, as a center for Islamic da'wah for the Keraton, was built during the rule of Pakubuwono III (PB III). It is because the Solo Palace is a continuation of the Islamic empire, which began with the Islamic kingdom of Demak, then moved to Pajang, Mataram Islam (Sultan Agung), Kartasura, and then Kasunanan Surakarta. As a royal leader, PB III also became a religious leader with Sayyid Panatagama Khalifatullah, appointed Tafsir Anom, namely Kanjeng Kyai Pengulu (KKP) Mohammad Thohar Hadiningrat. Tafsir Anom was assisted by Ketib or Khatib, Modin, Qoyim, and Merbot in carrying out his duties. Khatib delivers Friday sermons, and the Imam leads the prayers five times a day. The Modin, assisted by Qoyim, is in order of hitting the *bedug* as a sign of the time for the obligatory prayers, echoing the call to prayer and making wedding ceremonies and matters relating to death. Merbot manages the cleanliness of the mosque, provides water, and looks after the mosque's prayer equipment.

Furthermore, the courtiers of the clergy, along with the students, lived around the mosque. Then, it developed into Kauman Village, the village of santri. At that time, Kauman was a particular area called bumi mutihan or pametakan, inhabited only by notable Muslim courtiers (Makmun, et al., 2007). Kauman as a santri village was strengthened by the existence of text number 86 B of Law 1777 AD, for workers and people who lived there with the permission of Sinuhun PB IV emphasized that in the village, it is strictly forbidden to commit immorality and play the gamelan during celebrations. If you do not comply with the rules, you will be punished to cleaning the porch and courtyard of the Agung Mosque for 40 days [16]. Figure 2 shows the Map of Kauman Surakarta Village. Figure 3 shows Activities in Kauman Village.

Figure 2: The Location Map of Kauman Surakarta Village (source: Kauman sub-district, Surakarta, 2022)

Figure 3: Activities in Kauman Village (source: survey, 2022)

Figure 4 shows the building façade in old housing, and Figure 5 shows detailed floral ornament.

Figure 4: Building facade (source: survey, 2022)

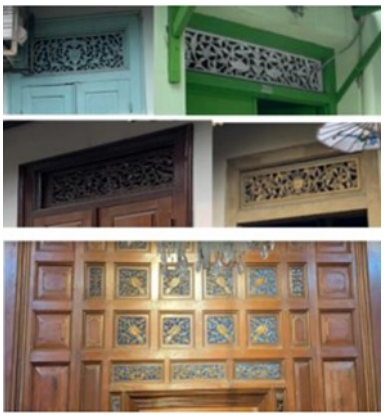

Figure 5: Detailed floral ornament (source: survey, 2022)

Figure 6 shows the street furniture in old housing, and Figure 7 shows public facilities, roads, alleys, drainage, and green land.

Figure 6: Street Furniture (source: survey, 2022)

Figure 7: Public facilities, roads, alleys, drainage, and green land (source: survey, 2022)

The research results of sustainable and Islamic architecture in old residential housing in Kampung Kauman Surakarta are shown in the following data in Table 3 and Table 4.

Table 3 shows sustainable architectures on six criteria with sufficient values between 26% to 53%. There are (1). Appropriate Site Development: less value is found in green areas & handling rainwater (2) Energy Efficiency and Conservation: air conditioning has not been maximized and has not used renewable energy sources (3) Water Conservation: has not used water-saving output devices (water saving pictures), (4) Material Resource And Recycle: already using local materials and pre-fabricated but not yet using recycled materials. (5) Indoor Health and Comfort: using natural lighting and minimizing pollutant sources is still lacking, and (6) Building Environment Management: not using sustainable design and construction, no innovation, and not using a growing house design.

Table 3. Greenship Homes Analysis Version 1.0 in Kauman Surakarta

CODE	CRITERIA	VALUE				
		S1	S2	S3	S4	Max value
Appropriate Site Development						
ASD P1	Appropriate Location	P	P	P	P	P
ASD P2	Basic Green Area	P	P	P	P	P
ASD 1	Green Area	2	1	1	1	4
ASD 2	Supporting Infrastructure	2	2	2	2	2
ASD 3	Community Accessibility	1	2	1	1	2
ASD 4	Pest Control	1	1	1	1	2
ASD 5	Public Transportation	1	1	1	1	1
ASD 6	Stormwater Management	2	2	0	0	2
		9	9	6	6	13
Energy Efficiency and Conservation						
EEC P1	Electricity Metering	P	P	P	P	P
EEC P2	Passive Design Analysis	P	P	P	P	P
EEC 1	Sub Metering	2	2	1	1	2
EEC 2	Artificial Lighting	3	2	1	1	4
EEC 3	Thermal Condition	0	0	0	0	2
EEC 4	Heat Reduction	3	2	2	2	4
EEC 5	Energy Saving Home Appliances	1	1	1	1	3
EEC 6	Renewable Energy Sources	0	0	0	0	2(bonus)
		9	7	5	5	15
Water Conservation						
WAC 1	Water Metering	0	0	0	0	2
WAC 2	Water Saving Fixtures	0	0	0	0	3
WAC 3	Rainwater Harvesting	0	0	0	0	3
WAC 4	Water Saving Irrigation	1	1	0	1	2
WAC 5	Waste Water Management	2	1	0	1	3
		3	2	0	2	13
Material Resource and Recycle						
MRC P	Fundamental Refrigerant	P	P	P	P	P
MRC 1	Non- ODP Refrigerant	0	0	0	1	1
MRC 2	Reused Material	1	0	0	0	1
MRC 3	Environmental Friendly Source Material	1	1	0	0	2
MRC 4	Environmental Friendly Procees Material	1	1	0	1	1
MRC 5	Certified Wood	1	1	0	1	1
MRC 6	Prefabricated Material	2	2	0	0	2
MRC 7	Local Material	2	2	0	2	2
MRC 8	Carbon Footprint	0	0	0	0	1
		8	7	0	5	11
Indoor and Health Comfort						
IHC P	Asbestos Free	P	P	P	P	P
IHC 1	Fresh Air Circulation	3	2	0	1	5
IHC 2	Natural Lighting	0	0	0	0	2
IHC 3	Visual Comfort	1	1	1	1	1
IHC 4	Pollutant Source Minimalization	1	1	1	1	3
IHC 5	Acoustic Level	1	1	1	1	1
IHC 6	Spatial Comfort	1	1	1	1	1
		7	6	4	5	13
Building Environment Management						
BEM P	Basic Waste Management	P	P	P	P	P
BEM 1	Sustainable Design and Construction	1	1	1	1	4
BEM 2	Home Guideline	1	1	1	1	2
BEM 3	Green Activity	1	1	1	1	1
BEM 4	Advanced Waste Management	1	1	1	1	1
BEM 5	Save and Security Environment	1	1	1	1	1
BEM 6	Innovation	0	0	0	0	3
BEM 7	Home Design Development	0	0	0	0	2(bonus)
		5	5	5	5	12
Summary ofValue		41	36	20	28	77 (100%)
Percentase		53%	47%	26%	36%	

Islamic architecture in old housing (Kampung Kauman Surakarta) is shown in the following data in Table 4.

Table 4: Islamic Architecture in Kauman Surakarta

NO	Variabel Penelitian Islamic architecture	S1	S2	S3	S4
1	*hablum minallah*: In an Islamic residence, there is a relationship between humans and Allah in the form of monotheistic space to remember Allah	✓	✓	✓	✓
2	*hablum minannas* : There is a room that functions for daily activities	✓	✓	✓	✓
3	*hablum minal alamin*: there is space for interaction with plants, animals and nature.	✓	✓	✓	✓
4	The trend of residential forms is increasingly diverse, according to the character and desires of the occupants as well as developing technology	✓	✓	✓	✓
5	The embodiment of muhrim concept of zoning includes Public, Private, Service, and Zones between: (a) the meaning of public and private zones is based on the concept of muhrim and there is a strict separation.	✓	✓	✓	✓
	(b) inner courtyard as intermediary space, green zone and climate anticipation;	✓	✓		✓
	(c) main entrance and side entrance as circulation control for muhrim and non-muhrim		✓		✓
6	Islamic residential layout (a) prayer room;	✓	✓	✓	✓
	(b) living room with hijab concept	x	x	X	x
	(c) Qibla oriented space	x	X	✓	X
	(d) hidden architecture facade	✓	X	X	X
	(e) tauhid reminder room	✓	x	X	✓
	(f) multifunctional room	✓	✓	✓	✓
	(g) *rahmatan lil alamin* is energy efficient and environmentally friendly	✓	✓	✓	✓
7	Islamic ornamentation art a. Al Faruqi: the art of monotheism	✓	✓	✓	✓
	b. Sumalyo: Geometric, floristry, calligraphic	✓	✓	✓	✓

Islamic architecture is found in old housing. There is the function of *hablum minallah, hablum minannas*, and *hablum minal alamin*, the character of residential forms, the mahram concept of zoning, Islamic residential layout, and Islamic decorative art.

SUSTAINABLE AND ISLAMIC ARCHITECTURE IN NEW HOUSING (GRIYA SAKINAH SYARIAH HOUSING)

Griya Sakinah Syariah Housing is an Islamic housing in Gedongan, Colomadu, Karanganyar, Surakarta. It was first built by the UMS Cooperative (Griya Sakinah 1). The type provided at the start of construction was type 36. Along with the increasing response from the community, the Muslim housing cluster Griya Sakinah 2, 3, and 4 was built by AUM Property (Charity of Muhammadiyah Business), a development of the Cooperative.

In the latest Griya Sakinah Master Plan (2022), there are Griya Sakinah housing complexes 1 to 7. However, what has been established are Griya Sakinah 1,2, 3, and 4, a total of 98 houses used as research objects. While Griya Sakinah 5,6, and 7 are still in progress. The Griya Sakinah Master Plan is shown in Figure 8.

Figure 8: MasterPlan Griya Sakinah [17]

Sharia housing has unique characters (Islamic facilities and infrastructure). The significant potential of Muslims, the tendency of urban (city) communities to obtain a conducive environment for families, and comfortable facilities by Islamic values from the nearest environment become factors that attract the community to choose Islamic housing. This phenomenon allows developers to develop Islamic concept housing. Figure 9 & 10 show an example of the Griya Sakinah Housing Plan and Façade. Figures 11,12, and 13 show activities, Sakinah Mosque, and Green land in Griya Sakinah.

Figure 9: Example of Griya Sakinah Housing Plan and Facade (source: survey, 2022)

Figure 10: Facade of Griya Sakinah (source: survey, 2022)

Figure 11: Activities in Griya Sakinah (source: survey, 2022)

Figure 12: Sakinah Mosque (source: survey, 2022)

Figure 13: Green land in Griya Sakinah (source: survey, 2022)

The results of resea**rch** on sustainable and Islamic architecture in new residential housing in Griya Sakinah are shown in the following data in Table 5 and Table 6.

Table 5: Greenship Homes Analysis Version 1.0 in Griya Sakinah

CODE	CRITERIA	VALUE				
		S1	S2	S3	S4	Max value
Appropriate Site Development						
ASD P1	Appropriate Location	P	P	P	P	P
ASD P2	Basic Green Area	P	P	P	P	P
ASD 1	Green Area	2	2	2	2	4
ASD 2	Supporting Infrastructure	1	1	1	1	2
ASD 3	Community Accessibility	1	1	1	1	2
ASD 4	Pest Control	1	0	2	0	2
ASD 5	Public Transportation	1	1	1	1	1
ASD 6	Stormwater Management	2	2	2	2	2
		8	7	9	7	13
Energy Efficiency and Conservation						
EEC P1	Electricity Metering	P	P	P	P	P
EEC P2	Passive Design Analysis	P	P	P	P	P
EEC 1	Sub Metering	1	1	1	1	2
EEC 2	Artificial Lighting	3	3	3	3	4
EEC 3	Thermal Condition	2	2	2	2	2
EEC 4	Heat Reduction	2	2	2	2	4
EEC 5	Energy Saving Home Appliances	1	1	1	1	3
EEC 6	Renewable Energy Sources					2(bonus)
		9	9	9	9	15
Water Conservation						
WAC 1	Water Metering	1	1	1	1	2
WAC 2	Water Saving Fixtures	1	1	1	1	3
WAC 3	Rainwater Harvesting	0	0	0	0	3
WAC 4	Water Saving Irrigation	0	0	0	0	2
WAC 5	Waste Water Management	2	2	2	2	3
		4	4	4	4	13
Material Resource and Recycle						
MRC P	Fundamental Refrigerant	P	P	P	P	P
MRC 1	Non- ODP Refrigerant	1	1	1	1	1
MRC 2	Reused Material	1	1	1	1	1
MRC 3	Environmental Friendly Source Material	1	0	1	0	2
MRC 4	Environmental Friendly Procees Material	1	1	1	1	1
MRC 5	Certified Wood	1	1	1	1	1
MRC 6	Prefabricated Material	1	1	1	1	2
MRC 7	Local Material	2	2	2	2	2
MRC 8	Carbon Footprint	0	0	0	0	1
		8	7	8	7	11
Indoor and Health Comfort						
IHC P	Asbestos Free	P	P	P	P	P
IHC 1	Fresh Air Circulation	4	2	3	2	5
IHC 2	Natural Lighting	1	1	1	1	2
IHC 3	Visual Comfort	1	1	1	1	1
IHC 4	Pollutant Source Minimalization	2	1	2	1	3
IHC 5	Acoustic Level	1	1	1	1	1
IHC 6	Spatial Comfort	1	1	1	1	1
		10	7	9	7	13
Building Environment Management						
BEM P	Basic Waste Management	P	P	P	P	P
BEM 1	Sustainable Design and Construction	3	3	3	3	4
BEM 2	Home Guideline	2	2	2	2	2
BEM 3	Green Activity	1	1	1	1	1
BEM 4	Advanced Waste Management	1	1	1	1	1
BEM 5	Save and Security Environment	1	1	1	1	1
BEM 6	Innovation	0	0	0	0	3
BEM 7	Home Design Development	1	0	0	0	2(bonus)
		9	8	8	8	12
Summary of Value		48	42	47	42	77 (100%)
Percentase		62%	55%	61%	55%	

Table 5 shows sustainable architectures on six criteria with sufficient values between 55% and 62%. There are (1). Appropriate Site Development: less value is found in green areas & handling rainwater (2) Energy Efficiency and Conservation: air conditioning has not been maximized and has not used renewable energy sources (3) Water Conservation: has not used water saving output devices (water saving pictures), (4) Material Resource And Recycle: already using local materials and pre-fabricated but not yet using recycled materials. (5) Indoor Health and Comfort: using natural lighting and minimizing pollutant sources are still lacking, and (6) Building Environment Management: not using sustainable design and construction, no innovation, and not using a growing house design.

Table 6. Islamic architecture in Griya Sakinah

NO	Variabel Penelitian Islamic architecture	S1	S2	S3	S4
1	*hablum minallah:* In an Islamic residence, there is a relationship between humans and Allah in the form of monotheistic space to remember Allah	✓	✓	✓	✓
2	*hablum minannas* : There is a room that functions for daily activities	✓	✓	✓	✓
3	*hablum minal alamin:* there is space for interaction with plants, animals and nature.	✓	✓	✓	✓
4	The trend of residential forms is increasingly diverse, according to the character and desires of the occupants as well as developing technology	✓	✓	✓	✓
5	The embodiment of muhrim concept of zoning includes Public, Private, Service, and Zones between: (a) the meaning of public and private zones is based on the concept of muhrim and there is a strict separation.	✓	✓	✓	✓
	(b) inner courtyard as intermediary space, green zone and climate anticipation;	✓	✓		✓
	(c) main entrance and side entrance as circulation control for muhrim and non-muhrim		✓		✓
6	Islamic residential layout (a) prayer room;	✓	✓	✓	✓
	(b) living room with hijab concept	✓	✓	X	✓
	(c) Qibla oriented space		X	✓	X
	(d) hidden architecture facade		X	X	X
	(e) tauhid reminder room	✓	✓	X	✓
	(f) multifunctional room		X	X	X
	(g) *rahmatan lil alamin* is energy efficient and environmentally friendly	✓	✓	✓	✓
7	Islamic ornamentation art a. Al Faruqi: the art of monotheism	✓	✓	✓	✓
	b. Sumalyo: Geometric, floristry, calligraphic				

Islamic architecture is found in new housing. There is the function of *hablum minallah, hablum minannas, and hablum minal alamin*, the character of residential forms, the mahram concept of zoning, Islamic residential layout, and Islamic decorative art.

DISCUSSION

SUSTAINABLE ARCHITECTURE FOUND IN OLD HOUSING ON SIX CRITERIA WITH SUFFICIENT VALUES BETWEEN 26% AND 53%

Found in Appropriate Site Development, Energy Efficiency and Conservation, Water Conservation, Material Resource and Cycle, Indoor Health and Comfort, and Building Environment Management for Houses in Kauman Village (green homes assessment results in version 1.0).

Due to the influence of high building density conditions, percentage values are entirely sustainable in old housing. The old village has been formed since 1757 AD. At that time, there were very few vehicles, so the roads were only wide in a few places, while other roads and alleys were narrow, only 2 m or 1.5 m, and insufficient for cars. Another obstacle, since the density of buildings in Kauman Surakarta village has

been optimum, the houses lack of natural lighting and ventilation.

SUSTAINABLE ARCHITECTURE FOUND IN NEW HOUSING ON SIX CRITERIA WITH SUFFICIENT VALUES BETWEEN 55% TO 62%

Found in Appropriate Site Development, Energy Efficiency and Conservation, Water Conservation, Material Resources and Cycle, Indoor Health and Comfort, and Building Environment Management for Houses in **Griya Sakinah Syariah Housing** (Green homes assessment results in version 1.0)

The condition of the new housing built ten years ago has already followed government regulations regarding the width of the road, building regulations, and the provided facilities so the conditions are better. The density of the houses is less dense than those in the old settlements. Sunlight can still enter, and natural lighting and natural ventilation can be applied and are not so limited.

In Greenhomes, the goal is to certify a house to get a specific category. However, in this study, the main focus is not to get Greenhomes certification but to determine the extent of sustainable/green home values.

Environmentally friendly homes are the main factor that must be prioritized to avoid misunderstanding the notion that an environmentally friendly home or green home is a house that requires high maintenance costs or is a house that only has a lot of green land. The type of house that can be assessed is a single landed house, namely a single residential home built attached to the ground, whether in the form of a new house design or a built house. Categories are the main issues relevant to Indonesia's condition in realizing environmentally friendly home.

Islamic architecture is an architectural space based on the Qur'an and the Sunnah of the Prophet. The urgency of the Qur'an has been stated in Surah Al Baqarah verse 2, which means: There is no doubt in this book of the Qur'an, a guide for those who are pious. It is the first clue. In contrast, the second clue is the sunnah of the Prophet and the Prophet's behavior as an identification figure (*uswah hasanah*) for his people. It has been stated in Surah Al Ahzab (33) verse 21: which means: Indeed, in (himself) the Messenger of Allah was a role model good for you (namely) for those who hope (grace) Allah and (the arrival of) the Day of Resurrection, and he mentions Allah much [9].

Islamic principles with sustainable architecture and green building principles are compatible or not contradictory. It turns out that the focus on nature conservation and all its derivatives, which are intensively socialized at present, has already been proclaimed by Islam, as stated in the Qur'an Surah Al-Anbiya (chapter 21) verse 107: ﴿وَمَآ أَرۡسَلۡنَٰكَ إِلَّا رَحۡمَةٗ لِّلۡعَٰلَمِينَ﴾which means: And We have not sent you, but to (become) mercy to the universe [9].

The Islamic concept encourages humans to take care of the Earth, in line with the principles of green building. In contrast, the Islamic concept instructs them to harmonize with nature, have the properties that exist in nature, save energy, and not damage their character in line with the sustainable vision. So, in this case, green building and sustainable architecture are two things in the discussion of Islamic architecture. Islam, as a religion of *rahmatan lil alamin*, places Islamic values in every aspect of life, non-destructive, full of grace, and love of life. Allah created humans as caliphs on Earth. Humans are leaders, caretakers, and guardians [1]. Therefore, humans must protect, maintain, and preserve this nature for the benefit of future generations. The statement means that Islam is the religion of *rahmatan lil alamin* (grace to all nature), so the built environment, in this case, an architectural product, must have nature conservation principles, namely harmony-durability-sustainability [8].

Parameters of Islamic architecture indicate the existence of 3 things, namely: (1) Concept of Islamic Activity: *Hablum minallah*, *hablum minannas* & *hablum minal alamin*; (2) The concept of benefits: *Rahmatan lil alamin* (Al A'raf: 107), and (3) The concept of design implementation: Tawhid as the essence of Islamic teachings [18].

SUSTAINABLE ARCHITECTURE IN OLD HOUSING (KAMPUNG KAUMAN SURAKARTA) AND NEW HOUSING (GRIYA SAKINAH HOUSING)

The Green Homes assessment version 1.0 showed scores ranging between **26% and 53%** for the houses in Kauman Village, and the scores obtained for the Griya Sakinah housing were almost the same, ranging between **55% and 62%.**

It was due to the influence of building density conditions in old housing, whereas the old village was formed before Indonesian Independence Day. At that time, there were very few vehicles, so the roads were only wide in a few places, while other roads and alleys were narrow, only 2 m or 1.5 m, and insufficient for cars. The problem with the old housing complex, namely in Kauman Surakarta village, is that the density of the buildings is maximized, and there are many narrow alleys, so sunlight doesn't get into the house. Ventilation or airflow is also a problem.

The condition of the new housing built ten years ago has followed government regulations regarding the width of the road, building regulations, and the provided facilities, so that the conditions are better. The density of the houses is less dense than those of the old settlements. Sunlight can still enter, and natural lighting and natural ventilation can be applied and are not so constrained.

In Green Homes, the goal is to certify a house so that it gets a specific category, but in this study, the main focus is not to get green homes certification but to find out the extent sustainable/green homes value found in that house.

In principle, to be healthy and comfortable at home, you can use sunlight for lighting in the house and other health functions, such as killing germs and

sunbathing in the morning to nourish bones. It utilized natural air circulation by using passive design, cross ventilation, and window openings with specific proportions to ensure that the flow of clean air in the room is constantly changing. Comfort can also be obtained by providing an area for plants, such as shade plants, cooling plants, flower plants, grass plants, and other plants that give coolness to the eyes, thoughts, and feelings. It was found in the old housing in Kauman Village and the new housing in Griya Sakinah housing.

Likewise, rainwater, which is very useful for fertilizing plants and greening the land, can be accommodated for reuse, or some rainwater can be channeled back into the soil to maintain circulation and water. It's also good that every house can make infiltration. It has yet to be done much in the two housings. Part of sustainable architecture includes using local materials for building materials. It has been done, for example, using wall materials from local bricks, natural stone, and stone temples.

ISLAMIC ARCHITECTURE IN OLD HOUSING (KAMPUNG KAUMAN SURAKARTA) AND NEW (GRIYA SAKINAH HOUSING)

The findings of Islamic architecture in old and new housing are almost identical; most variables are found, and some are not. A residential house has the function **of *hablum minallah, hablum minannas*, and *hablum minal alamin*.** The *hablum minallah* is the relationship between humans and God in the form of a *tawhid* room (place of prayer) and a room of *tawhid reminders* (a room decorated with reminders of Allah). Residential houses are accompanied with the function of *hablum minannas*: relationships with fellow human beings in the form of space to live. In residential dwellings, there is a function of *hablum min alamin*, for example, outdoor space to interact with plants, animals, and nature.

The character of residential forms is increasingly diverse, not following the natural surroundings but by the character and desires of the occupants as well as developing technology. The state of residential houses in old housing is divided into old housing models, Indish-style dwellings, and old houses that have been renovated. Finally, some houses are also used for business (batik) and other companies. Whereas in new housing, the shape of the house is modern and minimalist by current conditions, and some houses have been renovated.

The embodiment of **the mahram concept of zoning** (public, private, service, and intermediate zone) is not fully present in the two housing estates, including (a) the meaning of public and private zones based on the mahram concept; (b). the strict separation between public and personal zones; (c). inner courtyard as intermediary space, green zone, and climate anticipation; (d) main entrance and side entrance as mahram and non-mahram circulation control.

Most of **the layouts for Islamic residential houses** with the concept of mahram already exist, but some do not have a particular prayer room, use rooms, or multifunctional rooms. For a living room with a hijab, a Qibla-oriented room, hidden architecture, tawhid reminder room, some were found in sizeable old housings or houses. Multifunctional spaces are often found in new housing, and energy-efficient and environmentally friendly *Rahmatan Lil Alamin* rooms are also located in old and new housings.

Islamic decorative art, in the form of the art of monotheism, is found partly in old and new housing, while geometric, floristry, and calligraphic art is often found in old housing in the form of carvings of tendrils of leaves and flowers above the door.

In fact, the objects of research have some parameters of Islamic architecture, namely:

1. The concept of Islamic activity (*hablum minallah, hablum minannas* & *hablum minal alamin*).
2. The concept of human benefits as *rahmatan lil alamin.*
3. The concept of implementing an architectural design based on Islamic teachings, monotheism as the essence of Islamic teachings [16].

THE LINKAGE BETWEEN SUSTAINABLE AND ISLAMIC ARCHITECTURE

An eco-friendly house embodies planning, development, and building management practices that meet People, Planet, and Profit principles. They are realized by doing three important things, namely:

1. Maintaining the health and comfort in the home.
2. Minimizing pollution and damage to nature
3. Increasing the efficiency in the use of resources.

Activities:

1. Providing an area for plants
2. Taking advantage of solar lighting
3. Utilizing natural air circulation
4. Accommodating and reusing rainwater
5. Using local materials

The understanding of eco-friendly homes includes the house and its occupants. It cannot be separated from just the house because it is related to the behaviour of its occupants. It aligns with the Islamic residence, a unity between a house and its occupants based on Islamic activity. Likewise, it is important to the public to use the green land as best as possible. The research results show that all required to achieve sustainability align with Islamic teachings: *rahmatan lil alamin*, in which humans are caliphs to prosper the Earth and everything on it.

COMPATIBILITY BETWEEN SUSTAINABLE ARCHITECTURE AND ISLAMIC ARCHITECTURE

Compatibility lies in the same mindset, namely always prioritizing the interests of the universe. Islamic Activity Concept: *Hablum minallah, hablum minannas* & *hablum minal alamin* by the concept of appropriate land use for activities according to their designations.

Concept of Benefit: *Rahmatan lil alamin* (Al A'raf: 107) is in line with the idea of sustainable architecture, efficiency, energy conservation, water conservation, and material cycles and resources.

The concept of implementing an architectural design based on Islamic teachings by maintaining indoor health and comfort and building environment management.

CONCLUSION

The conclusion of the research objectives is as follows:

1. **Sustainable architecture found** in old housing on six criteria with sufficient values between 26% to 53%, and Sustainable architecture found in new housing on six criteria with sufficient values between 55% to 62%.
2. **Islamic architecture is found in old and new housings**. They have the function of *hablum minallah, hablum minannas,* and *hablum minal alamin*, the character of residential forms, the mahram concept of zoning, Islamic residential layout, and Islamic decorative art.
3. **The relationship between sustainable and Islamic architecture supports each other and is not contradictory.** The suitability of the two lies in the same mindset, namely always prioritizing the interests of the universe in the context of activities, benefits, and implementation, described in:
    a. The concept of appropriate land use for activities according to their designation **in line with** the concept of Islamic activity (*Hablum minallah, hablum minannas & hablum minal alamin*).
    b. Sustainable architecture, efficiency, energy conservation, water conservation, and material cycles, and resources align **with** the Concept of Benefit: *Rahmatan lil alamin* (Al A'raf: 107). The important thing that distinguishes Islamic architecture from others is the concept of design implementation: Tawhid is the core of Islamic teachings and practices.

SUGGESTION

The tools and variables' directions can correct things lacking in both settlements.

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