Malaysian Journal of Sustainable Environment
Vol.12.No.1 (2025) 205-224
doi: 10.24191/myse.v12i1.1695

IMPLEMENTATION OF ECO-PESANTREN THROUGH GREEN BUILDING CONCEPT AT PESANTREN MODERN INSHAFUDDIN, BANDA ACEH, INDONESIA

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Received: 14 June 2024
Accepted: 12 September 2024
Published: 31 March 2025

ABSTRACT

Green building is the key to reducing negative impacts on the environment, as well as playing a role in encouraging environmental awareness and producing environmentally friendly behaviors. It is important to review the building facilities at Pesantren Modern Inshafuddin (PMI) to support the activities and implementation of eco-pesantren, so that they can become an example of an environmentally friendly Islamic boarding school model. This research aims to see the potential and formulate strategies for improving building quality and environmentally friendly practices to support the Eco-pesantren concept at PMI. Data collection techniques were by using observation methods, questionnaires, interviews and documentation. The research method uses Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis techniques. The research results show that PMI has potential strengths and opportunities in terms of development to support the implementation of the eco-pesantren concept. Strategies that can be implemented are: 1) carrying out plans to repair and increase the quality of buildings in order to achieve environmentally friendly building concept standards, such as providing rainwater storage, providing used water waste

treatment for recycling, greening the PI environment, utilizing renewable energy, and re-providing waste banks; 2) empowering all students in environmentally friendly practices in daily activities to increase awareness and realize environmentally cultured character; 3) utilize existing land to support the implementation of the Eco-pesantren concept for planting activities, such as creating a living pharmacy garden as an area for teaching materials and environmental practice and creating biopore wells to manage rainwater.

Keywords: *Green building, Greenship, Pesantren modern inshafuddin, Eco-pesantren, Environmentally friendly building*

INTRODUCTION

One of the most serious development problems currently is related to the environment and global warming. The building sector is one of the sectors that contributes to carbon emissions, which affect the environment and worsen global warming (GBCI, 2010; Rahmawati, 2015). Apart from that, human actions and behavior are also factors that cause environmental problems (Aulia et al., 2019). Sustainable development that focuses on sustainable architecture will see development as part of collaborations with nature, and pay attention to local character and conditions, both based on the environmental and cultural properties (Muchlis et al., 2020).

Every planning and development we do now will have impacts on the future generations. Environmentally friendly buildings or green buildings are the key to reducing negative impacts on the environment and optimizing energy use and are expected to be able to answer current development challenges (Komalasari et al., 2014; Ali and Suwardo, 2019; Muchlis et al., 2020) because the design elements in the environmentally friendly building concept emphasize the importance of environmental sustainability for now and the future (Muchlis et al., 2020). The standard for environmentally friendly buildings in Indonesia is called Greenship, developed by the Green Building Council Indonesia (GBCI), which was founded in 2009. GBCI is an independent (non-governmental) institution that evaluates environmentally friendly buildings (green buildings) and is a member of the World-GBC (Green Building Council) based in Canada.

Eco-pesantren is an Islamic educational institution which contributes to the environmental protection and preservation (Diavano, 2022). Eco-pesantren is an educational model that seeks to produce students who have a balanced knowledge between the worldly and hereafter so that they can balance between mahdhah and ghairu mahdhah worships. Consequently, they are able to apply the complete concept of Islam, namely rahmatan lil'alamin. The eco-pesantren program is a collaboration between the Ministry of Environment and the Ministry of Religion in Indonesia which was initiated in 2008 (Aulia et al., 2017). Eco-pesantren-based education carries out activities that make Islamic boarding schools environmentally friendly through various forms of activities such as improving environmentally friendly lifestyles, developing health and environmental units in Islamic boarding schools, including environmental curriculum in Islamic boarding schools and taking real action in waste management, clean water, and sanitation.

The Ministry of the Environment of the Republik Indonesia has initiated the implementation of green building through the Eco-pesantren program in 2018. This is one of the government programs to empower the role of Islamic boarding schools in environmental management. One of the assessment points for the implementation of eco-pesantren is its environmentally friendly supporting facilities and infrastructure such as land use, use of renewable energy, waste processing, and processing of clean and used water. This is closely related to the principles of the green building concept. One effort to realize eco-pesantren is by implementing the concept of environmentally friendly buildings (Fikri, 2022). Environmentally friendly buildings also play a role in encouraging environmental awareness and producing environmentally friendly behaviors (Xie, Qin, Gou, & Yi, 2020). In implementing eco-pesantren, the building facilities owned by Islamic boarding schools support learning activities. Environmentally friendly schools are not only characterized by their green physical appearance, but also by the existence of educational programs and activities that encourage awareness of protecting the environment (Kamil et al., 2019). Positive attitudes towards greening are also increasingly popular and important in Malaysia, where students at UiTM Bandaraya Melaka significantly chose to carry out greening activities rather than attending green conferences (Bashirun et al, 2016).

Pesantren as Islamic schools, can be opportunities for approaches to increase environmental awareness through their curriculum and operations (Larson, 2010; Fua, 2013; Herdiansyah, 2016; Aziz, Budianto, Ahmad, and Suhartini, 2021; Pujianto et al., 2021; Lop et al., 2016). This can be a big contribution to preventing environmental damage for the continuity of the next generation so that it does not threaten future generations. Aceh was selected as a pioneer in the eco-Islamic boarding school program involving several Islamic boarding schools in 2011, but progress has not continued (Bakri, 2021).

Based on the description above, a study is needed on the potential and strategy for implementing the eco-pesantren concept at the Pesantren Modern Inshafuddin (PMI) in Banda Aceh. This Islamic boarding school is in great demand by parents to send their children to school. In 2018 and 2019, PMI won first and third places in the Adiwiyata Award from the Banda Aceh City Environmental Service, in terms of management and cleanliness of the Islamic boarding school environment. This concrete building its has land covered with various vegetation to create good air quality on a micro-scale, which will impact the surrounding area. Based on this potential, the benefits will be greater if this Islamic boarding school applies other eco-pesantren principles. Next, urban areas such as Banda Aceh City have high levels of pollution and increasingly few green open spaces. Therefore, PMI meets the requirements as an object for a study on the application of the eco-pesantren concept, because it has the potential to implement it. In addition, a study needs to be conducted on the potential of the Islamic boarding school so that eco-pesantren can be implemented optimally. Thus, the area around the research object will gain greater benefits from the existence of eco-Islamic boarding schools.

This research aims to identify the application of greenship-GBCI standards to PMI (existing building) architecture. The research focuses on the physical and environmental aspects of PMI buildings, as well as user behaviors in supporting the green building concept. Next, we can formulate improvement strategies that support the green building concept at PMI. This article has the potential to reduce environmental impacts in maintaining human health and natural conditions.

LITERATURE REVIEW

Environmentally Friendly Building

According to the Minister of Environment Regulation No. 8 of 2010 concerning Criteria and Certification for Environmentally Friendly Buildings (green buildings) are buildings that apply environmental principles in their design, construction, operation and management and are important aspects of handling the impacts of climate change. The environmental principles in question are principles that prioritize and pay attention to the elements of preserving environmental functions. Meanwhile, according to Green Building Council Indonesia (GBCI, 2011), green building can be applied to new buildings, as well as to buildings that have been built, its operations take into account environmental ecosystem factors and fulfil performance: wise land use, water saving, energy saving, material saving, reducing waste, indoor air quality.

GBCI is an independent (non-government) institution that evaluates environmentally friendly buildings (green buildings). Greenship Existing Building criteria version 1.1, is used to evaluate existing buildings that have been established for more than 5 years, namely: appropriate site development, energy efficiency and conservation, water conservation, material resource and recycling, indoor air health and comfort, and building and environmental management.

Awareness and Behavior of Environmentally Friendly Practices

Environmental education is crucial and has the potential to bring the relationship between humans and their environment closer, resulting in sustainable development (Pujianto et al., 2021). Schools act as strategic places to instil these values in the younger generation. Environmentally friendly behavior includes actions that consider environmental sustainability and can be carried out repeatedly (Sugiarto and Gabriella, 2020).

There is an increase in environmentally friendly attitudes through increased environmental awareness and knowledge, although not all

behaviors change significantly (Owens & Halfacre-Hitchcock, 2006). Students at the secondary school level in Selangor, Malaysia have a high level of environmental awareness based on the principles of sustainable development, and students in urban schools have a higher level of awareness than students in rural schools (Hasan et al., 2010).

Eco-Pesantren

Eco-Islamic boarding schools are a continuation of the cooperation agreement between the Ministry of Religion and the Ministry of the Environment concerning the Development of the Role of Islamic Education Institutions in Environmental Management (Pradini. et al., 2017). Eco-pesantren can be defined as an effort to provide an "environmentally friendly" identity by applying sustainability principles in educational activities, economic development and the welfare of the surrounding community (Mangunwijaya, 2012). Eco-pesantren is an Islamic boarding school management concept that integrates sustainable environmental principles into daily practices and activities, namely energy-saving practices, use of renewable energy, waste management, reuse of waste products and wise use of natural resources (Fikri, 2022).

Several activities that can be practiced by users to make them relevant to Eco-pesantren, namely providing waste banks, creating water and waste treatment installations, carrying out environmentally friendly activities, encouraging environmentally friendly lifestyles, developing health and environmental units, and integrating the environmental curriculum in Islam (Bakri, 2021; Herdiansyah, 2017 and Fua, 2013).

METHODOLOGY

This research was conducted in the Banda Aceh City area, at the Pesantren Modern Inshafuddin, which is located on Jalan Taman Ratu Safiatuddin, Lambaro Skep. PMI is a modern Islamic boarding school, and it has a formal school curriculum.

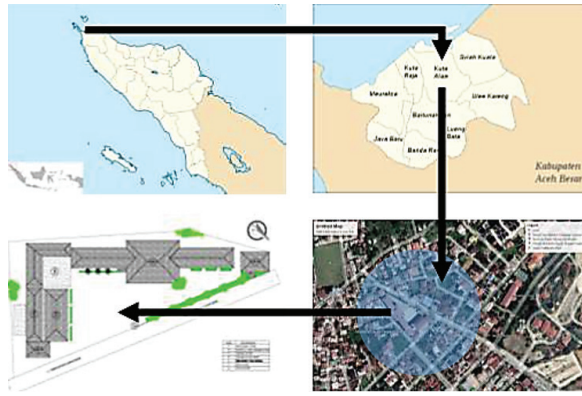


Figure 1. Research Location

Source: Google Earth, (2024)

Measurements were carried out based on Greenship-GBCI standards through direct observation and verification interviews. To measure the level of environmental concern by students, a Likert scale calculation with five alternative levels was used, namely: totally agree (SS), agree (S), neutral (N), disagree (TS), and totally disagree (TSS). Data processing uses Microsoft Excel software with quantitative descriptive presentation. Next, the data obtained was evaluated to determine the level of environmental concern of the respondents (Nawawi, 2017). Assessment criteria: Ideal score x 100%, namely 0%-20% = Very Low; Figure 21%-40% = Low; Figure 41%-60% = Enough; Number 61%-80% = High; and Figures 81%-100% = Very High. After obtaining data regarding the students' level of concern, they were interviewed regarding environmentally friendly practices which were implemented to support the concept of environmentally friendly buildings.

According to Sugiyono (2016), the Likert scale is used to measure the attitudes, opinions and perceptions of an individual or group of people about social phenomena. With the Likert scale, the variables to be measured are described into variable indicators, to measure positive or negative responses to a statement or question. In this case, respondents were asked to choose the option that best suits their feelings about the researcher's question. Generally, the Likert scale has a gradation from strongly agree (number 5) to strongly disagree (number 1).

Measurements were made based on observations, questionnaires, and

interviews with students, where researchers have determined indicators of environmentally friendly behaviors based on those set out in the GBCI table. This method was used because of the flexibility according to the context of the problems discussed, and respondents can further clarify their answer choices. In addition to being easy to apply, measurement results can be obtained quickly. However, this method can only rank results, it cannot compare results between individuals.

Based on data from identifying existing buildings and evaluating environmentally friendly practices, a SWOT analysis was then carried out to formulate a strategy for implementing the green building concept at PMI. SWOT analysis aims to maximize strengths and opportunities but can minimize weaknesses and threats to a policy being implemented (Nawawi, 2017).

RESULTS AND FINDINGS

Object Description

Pesantren Modern Inshafuddin was inaugurated in 1974. Currently, it has 384 students and 55 teachers. All students live in dormitories provided by the foundation. The public facilities provided by PMI are a public kitchen, canteen, laboratory, sports field, laundry, prayer room, and health unit. PMI's condition is considered good in terms of maintenance. This is demonstrated by the clean environment of the PMI. All Islamic boarding school residents are involved in maintaining the cleanliness of the pesantren environment.

(a) Boys' Dormitory (b) School Building (c) Prayer room and Girls' Dormitory

Figure 2. Environmental Conditions of the Pesantren Modern Inshafuddin

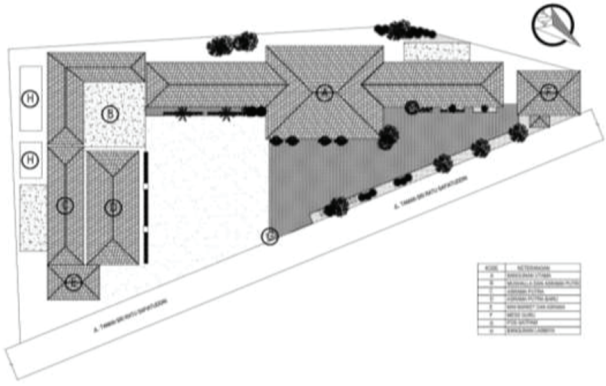


Figure 3. Pesantren Modern Inshafuddin Site Plan
Source: PMI Administration

On the 1st floor, there are a teacher's room, foundation office, computer room, classrooms, prayer room, public kitchen and teachers' lounge. The 2nd floor is devoted to classrooms, student council rooms, laboratories, library, dormitories and teachers' lounge. On the 3rd floor, there are classrooms, laboratories and dormitories. The total building area is 7281.1 m2.

The building masses on the PMI site are not oriented in the same direction. The orientation of the school building has the longest walls facing northeast and southwest. Meanwhile, the orientation of the men's dormitory building, girls' dormitory, prayer room and teachers' mess are facing northwest and southeast.

The physical building is important in supporting the green building concept, assessed based on the criteria and standards in Greenship version 1.1. This is to ensure that the building meets environmentally friendly building requirements and pays attention to environmental sustainability aspects.

Appropriate Land Use Aspects

In the Banda Aceh City Regional Spatial Plan for 2009-2029, the location of PMI is in the center of the area, and the land is designated as a residential, trade and service area.

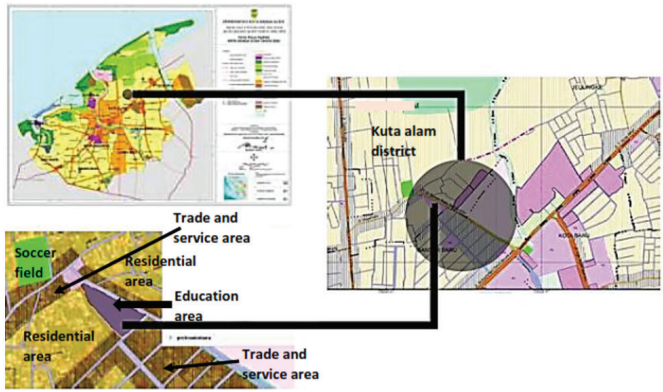


Figure 4. Land use for the Pesantren Modern Inshafuddin
Source: Processed from UPTB-GIS Banda Aceh, (2024)

The appropriate land use aspect consists of the following criteria: community accessibility, motor vehicle reduction, site landscaping, heat island effect, storm water management, site management, and building neighbourhood. Indicators that are met are the availability of public facilities not far from the site, and the presence of local and productive vegetation. Indicators that are still considered to have not been maximally fulfilled are the availability of pedestrians that are safe, comfortable, and free from motor vehicle intersections, the reduction of motor vehicles, and the absence of measures to reduce rainwater runoff. In the community accessibility criteria, there are several public facilities close to the PMI location, as demonstrated in Table 2.

Table 2. Evaluation Assessment Based on Greenship Standards

No.	Object Information	Distance (meter)
1.	Darul Makmur mosque, Lambaro Skep Village	120
2.	Oman mosque	500
3.	Sri Ratu Safiatuddin Park	350
4.	MZ Coffee	450
5.	football field	240
6.	Transkutaraja bus stop	700

Source: Survey, (2024)

The criteria for motor vehicle reduction have not been implemented optimally. PMI only prohibits students from using motorized vehicles,

because students are required to live at the Islamic boarding school location. Meanwhile, teachers are allowed to use motorized vehicles. On the other hand, PMI has not provided a special parking area for bicycles, which could be an environmentally friendly solution to reduce dependence on motorized vehicles. Therefore, PMI can consider providing bicycle parking areas and promoting the use of bicycles as an alternative to motorized vehicles.

In the site landscaping criteria, environmentally friendly building standards have determined the availability of green areas in the form of vegetation (softscape) that are free from garden buildings (hardscape) of at least 30%. Meanwhile, PMI only provides green areas around 4.7% of the total land area and less than 10%. In more detail, the calculation of the PMI footprint area is in Table 3. However, the vegetation in PMI has a diverse vegetation composition. There are local plants such as bougainvillaea (*Bougainvillea*), red shoots (*Syzygium Myrtifolium*), and tamarind (*Tamarindus Indica*). Apart from that, there are also plants with productive value, such as star fruit trees, mango trees, sapodilla trees and jackfruit trees. Having a green area on the site will reduce the temperature, and it creates a shadow effect which gives a cool impression to the surroundings (Bakri, 2022).

Table 3. PMI Land Use Area

No.	Elements	Area (m2)	Percentage
1.	Building	2484,44	38%
2.	Other buildings	68	1%
3.	Softcase	306,89	5%
4.	Open area	3625,38	56%
	Total	6484,71	100%

Source: Analysis, 2024

Storm water management criteria have not yet been applied to PMI. Currently, all rainwater runoff flows into the drainage network without utilizing the potential of the physical PMI building. The roof of this building is equipped with a good gutter system, so it has great potential for rainwater harvesting. To maximize the use of water resources, it is necessary to add rainwater storage tanks that can be used as reserves or for other purposes.

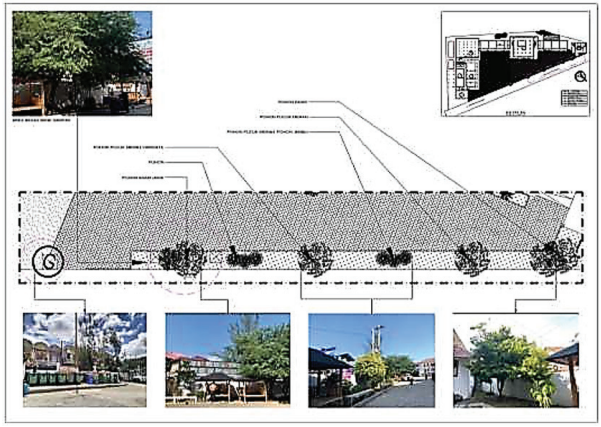


Figure 5. Vegetation Conditions on PMI

Source: Authors, (2024)

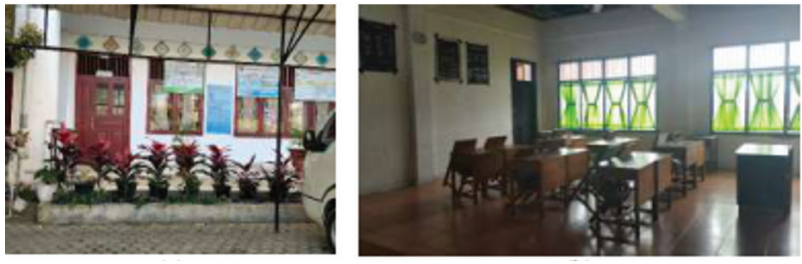
For the building neighbourhood criteria focus on providing open areas for public use (Ramdhani et al., 2017). PMI has paid attention to the surrounding environment by allocating special land for the canteen, which can also be used as a location for students to sell.

Aspects of Energy Efficiency and Conservation

The energy efficiency and conservation aspects focus on reducing energy consumption in buildings, with the criteria: optimized efficiency building energy performance; testing, recommissioning or retro commissioning; energy system performance; energy monitoring and control; operations and maintenance; on site renewable energy; less energy emissions. Indicators that are met are saving energy consumption on room lighting power, having an air conditioning system with natural ventilation, providing a kWh meter. Indicators that are still considered unfulfilled are data regarding the intensity of energy consumption and use of renewable energy. The existence of openings allows optimization of natural lighting and natural ventilation.

All rooms in PMI buildings only utilize natural ventilation, thereby reducing energy consumption and being environmentally friendly. However, classrooms and bedrooms in dormitories are still equipped with fans, to

maintain the comfort of room users.



(a) (b)

Figure 6(a). Condition of Openings on the 1st Floor; (b). Condition of Openings in Classrooms

Source: Survey, (2024)

Water Conservation Aspects

PMI involves all boarding school residents, including students, in managing the building environment. In accordance with research by Aulia et al., (2019), one form of environmental management in Islamic boarding schools is through the implementation of participatory policies for student.

Aspect Material Sources and Cycles

Overall, the land cover uses concrete and paving materials which have a significant effect on rainwater absorption. The use of this material creates a surface that cannot absorb water, so that rainwater cannot seep into the ground. This can result in increased surface water flow, which has the potential to cause flooding and reduce groundwater recharge. Thus, the choice of materials for land cover needs to be considered carefully to maintain environmental balance and prevent negative impacts on the water management system.

Environmentally Friendly Practices in Supporting Eco-pesantren

PMI involves all students, teachers and administrators in managing the building environment. Students have saved electricity to support energy efficiency, water-saving aspects, greening through gardens and hydroponics, weekly mutual cooperation activities, waste sorting, and training in making crafts from recycled waste. Students have a high sense of responsibility to

maintain the facilities they use. In accordance with research by Aulia et al., (2019), one form of environmental management in Islamic boarding schools is through implementing participatory policies for students.

"Recycling paper" was the activity most respondents chose to engage in, while "attending green conferences" was the activity respondents chose least to engage in. The implications of this research are beneficial for student associations; universities and environmental organizations as guidelines for organizing environmentally friendly activities and motivating students to actively participate in environmentally friendly practices (Bashirun et al, 2016).

Formulating a Strategy for Implementing the Eco-Pesantren Concept at the Pesantren Modern Inshafuddin

The strategy for developing the application of the Eco-Islamic boarding school concept at PMI is determined by SWOT analysis which is based on maximizing internal factors, namely strengths and opportunities, as well as minimizing external factors, namely weaknesses and threats.

Strength

PMI has implemented several environmentally friendly concepts in buildings and also environmentally friendly practices by students, although not yet optimal. The strong desire and discipline of all PMI members to maintain the environment of the Islamic boarding school is a good potential. PMI received support from the Education Office regarding the greening efforts carried out.

Weakness

Limited land and physical infrastructure that can be used to support the implementation of environmentally friendly practices. A few environmentally friendly activities that have been implemented so far are tentative and some are no longer implemented, such as waste bank and waste recycling activities.

Opportunity

PMI has a good gutter system in every building that has the potential to collect rainwater to reduce rainwater runoff. There is support from stakeholders such as government agencies in implementing reforestation

for environmental sustainability in the PMI environment.

Threat

PMI has a threat to reduce the involvement of students in protecting the environment so that it can reduce the level of awareness of students. Cost factors, attitude, information, knowledge, awareness, management and government, and technology and training are the factors that mutually influence the intention to adopt environmentally friendly building technology. Meanwhile, management and government factors are the most dominant influencing the implementation of green buildings in Malaysia (Noor et al., 2023).

PMI has a threat because there are several environmentally friendly activities that have been practiced by students, now they are no longer carried out. This condition is feared to reduce the level of awareness of students. Several factors that cause this condition, namely costs, attitudes, information, knowledge, management and government, and technology and training. Meanwhile, management and government factors are the most dominant influencing the implementation of green buildings in Malaysia (Noor et al., 2023).

CONCLUSIONS

Based on the Greenship Existing Building credit score version 1.1., PMI obtained a score of 23 points. This shows that PMI cannot yet be included in the ranking category as determined by the GBCI because it does not reach the minimum standard value. Therefore, steps are needed to improve qualifications and achieve the expected standards in supporting sustainability and efficient use of resources.

Environmentally friendly activities that have been implemented by the majority of students to support the realization of the concept of environmentally friendly buildings are saving water and electricity. Meanwhile, students are still not implementing waste recycling activities, reducing the amount of plastic waste and making compost.

In an effort to maximize the implementation of environmentally

friendly concepts, PMI needs to maximize green areas by maintaining the presence of trees and existing facilities, and adding greenery to spaces where this is still possible. One way is to create a living pharmacy garden as an area for teaching materials and practice in environmental lessons.

ACKNOWLEDGEMENT

The author would like to thank all parties who have supported this master's thesis research (PTM-USK), especially Universitas Syiah Kuala and the Community Service Institute (LPPM) of Universitas Syiah Kuala, Banda Aceh, Indonesia.

FUNDING

This Master Thesis Research (PTM-USK) is funded by PTNBH Universitas Syiah Kuala Banda Aceh with contract number 399/UN11.2.1/PG.01.03/SPK/PTNBH/2024.

AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research, the analysis, and the write-up. The survey, data identification and tabulation were undertaken by the researchers. All authors have read and approved the final manuscript.

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