The role of pondok pesantren to develop sustainable muslim settlements in Indonesia

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Abstract. In the vernacular design method, almost every general building standard cannot apply because of its unique condition. There was not any consideration about building design standards in Pondok Pesantren. They developed the group of buildings only based on the fund and land availability, and then the neighbor duplicated their method. The purpose of this paper is to assess the chances and challenges of Pondok Pesantren in Indonesia, to develop sustainable Muslim settlements with Mlangi Muslim Settlement in Yogyakarta as a case study. Sustainable Construction Assessment Tool (SCAT) by the Holcim is used as the assessment tool to calculate sustainability. Three aspects are assessed from the economy, environmental and social to draw the existing condition. The major findings of this research are stated in the environmental aspect; Pondok Pesantren is in a bad state regarding the terrible condition of water, energy, waste and site by the lack of condition of the settlement layout. Pondok Pesantren has chances to improve their environment using some strategies that would encourage the community to take the same action for its improvement as well. Socio-culture challenges need to be solved; the Pondok Pesantren has vowed to prioritize their significant role to make better quality Muslim settlements in Indonesia.

1. Introduction

The research agenda related to sustainable settlements focused on how various criteria of sustainability were implemented on it. Ensuring sufficient supplies of clean and freshwater, properly disposing of wastes, avoiding pollution and safeguarding access to fresh air and sunshine, were some of the earliest concerns [1]. As settlements became bigger and more populated, and nature was marginalized and neglected [2], some assessment tool needed to be created to check how far the sustainability value was implemented in human settlements. Sustainability is concerned with economic, social and environmental protection [3][4]. Sustainable development is key to solving a series of environmental, economic and social problems, including environmental pollution [5][6]; however, in some cases, tools for assessing the settlement cannot apply in a unique settlement condition because usually, such a settlement did not have good basic data about history of management of the environment; otherwise, they are indicated as a closed traditional settlement. A Muslim settlement in some areas in Indonesia is still on the conventional condition, both physical and social. One important actor who can intervene in
the solution to improve the situation is Pondok Pesantren by their Kyais (owner), Santris (students) and teachers. To make them into good role models, Pesantren has to first be a physical role model. Then they could teach the neighborhood how to build a better building that supports sustainable settlement implementation. Being in the early stage of assessment, it needs a very simple tool to check the building and settlement, whether it matches the criteria or not. After that, community could use their role to intervene and give any influence to make their communities an ideal sustainable criterion. If research can obtain data about sustainability value in Muslim settlements, the model of assessment can be used in other Muslim settlements. It is an effort to improve many Pesantren and Muslim Settlements, which spread in many regions of Indonesia. As indicated, there are more than 17,000 Pesantren existing in some Muslim Settlements that need improvement projects for their awareness about sustainable building and communities. This research will draw on a recent condition of Muslim settlement based on the sustainability aspect, by using SCAT as an assessment tool. Research also tries to give any recommendation for the effort in making the community close to the criteria. In the end, the condition and recommendation will conclude how far Pondok Pesantren will contribute and play a significant role in making sustainable settlements.

2. Pondok Pesantren as one of vernacular architecture in Muslim settlements
Pondok Pesantren is the educational building that facilitates the students to live and study in it. Most of the conditions in some traditional Pondok Pesantren are now in bad development planning. The vernacular architecture is built for specific needs such as accommodations, values, economies and ways of life of different cultures; it shows the own initiative conditions and the history of each period in any area [7]. Vernacular architecture is based on local needs and construction materials, reflecting local traditions and those influenced by local culture and climate. It also reflects the environmental, cultural, technological and historical context in which it exists and would say as 'architecture without architects.' Because there was no architect involved in the process, some vernacular homes use various passive strategies to emphasize comfort inside them [8]. Traditional and vernacular homes form the basis of environmentally conscious design [9]. A sustainable future society requires using traditional architecture along with modern technology [10]. In developing countries, where most of the population remains in rural areas using traditional buildings and technologies, the only feasible way to provide them with better living conditions is to improve traditional and vernacular homes [2]. In some cases, the buildings or complex of the building is created by some situations i.e., financial consideration, occupant and social needs and also as the single need of building capacity. Unfortunately, the basic standard of design is sometimes at a nonpriority level; it's only as a complementary requirement, so it can cause some error in building quality and provide some discomfort to the occupant and their neighbor. Pesantren is an important building in the community, as the historical symbol or the building, which has a significant role to theirs, has a good position to elaborate on some environmental issues to improve the physical quality of the community. The need to understand and benefit from both vernacular and sustainable architecture is unequivocal today [4]. The sustainable design in developing countries can be specified in any building. That is not as bad as the average building in terms of its impact on the environment; moreover, it is notably better than the average building compared to its surrounding environment [11].

3. Sustainable approach
Sustainable architecture can identify as all the activities for creating buildings that are characterized by the usage of renewable energy resources, sensitive toward the environment. They use the energy, the water, the materials and the space they are in, which protect the inhabitants' health and provide comfort in any period or season; it's the architecture that consumes less energy and utilizes passive systems [4]. The built environment has a significant impact on the natural environment, human health
and economy. Sustainability in the field of architecture requires environmentally friendly approaches. Thus, sustainable building designing involves integrating environmental, social and economic objectives. Some critical issues to consider include: energy consumption during construction and use, energy efficiency measures, the use of renewable energy; environmental sustainability of building materials; indoor environmental quality; consumption of potable water, water efficiency and recycling measures; waste management and recycling facilities; access to public transport and cycling facilities; atmospheric emissions, wastewater discharges and surface water run-off; land use, local ecology, visual impact, contextual fit and community relations' [12]. There are three sustainable principles in architecture. The first one is the economy of resources, which is concerned with the reduction, reuse and recycling of the natural resources that are input in the building. The second one is the Life Cycle Design, which contains the methodology of analyzing the building process and its impact on the environment. The third principle is Human Design, which focuses on the interactions between humans and the natural world [13]. Sustainable Construction Assessment Tools is one of the sustainable assessments produced by the Holcim Foundation as the first calculation method to indicate how sustainable the community is. These tools can accommodate the qualitative to quantitative assessment.

4. SCAT as an assessment tool
Research in Turkey about the sustainable urban renewal model used the analytic hierarchy process (AHP). This tool is used to evaluate the possibility of built environment design elements to be applied in urban renewal projects and their contribution to the economic, environment and social sustainability in urban areas [14]. Some criteria were assessed by a questionnaire as a qualitative comment from 323 professional experiences in urban renewal. The result was analyzed by AHP to get the weight factor of design elements. In this research, assessments are run through the expert to assess their urban condition. In New South Wales (NSW) the evaluation of sustainability indicators in the settlement was using Healthy Built Environment Program (HBEP) criteria [15]. This tool combines the data of the built environment and beneficial healthy. Primary data of health indicators of communities strongly needed to complete the analysis. The indicator refers to the process of developing indicators as taking the pulse of a matter [16]. Indicators can often be mapped to give easy-to-read graphic and spatial representation, together with a comparison of a matter [17]. For assessing the Muslim settlement, at a very early stage of data collection, research can only do a visual assessment of the research area. For this situation, SCAT is one alternative tool that can be used for visual assessment. For social, environmental and economic aspects of measurement, it can run just in the visual appraisal by checking the indicator of assessment in each aspect. Different from AHP and HBED, which need data from the people and people condition, SCAT only needs to check the existing condition based on the parameter of each aspect. So this tool can be used as a preliminary assessment for sustainability indicators. Assessment goals should set many criteria of various assessment tools, because useful indicators should highlight issues of concern and stimulate discussion for the future action indicator [18].

5. Method
The research used a quantitative method to assess the existing condition of Muslim Settlement using the SCAT parameter by Holcim. Social, economic and environmental factors as the assessment vary. Mlangi Muslim Settlement is the case study of research. The calculation of the assessment was used as the early indicator of how sustainable the area is. From three variables, the lowest value analysed to find out the possible chances for Pondok Pesantren to improve the physical quality in that Muslim settlement. The lack of condition of Pondok Pesantren, would be the pilot project in communities to make sustainable condition in there at its lack factor. The assessment range is divided into three categories: lower, average and good condition. The research tried to group the measurement by Likert
Scale to avoid a confusing assessment because, in SCAT, the range of measurement is very wide from 0-100 points divided into three parts of range <33.3; 33.3-66.6; >66.6 Details and criteria of assessment rank in Table 1.

Table 1. Criteria of the assessment rank (modified by SCAT Tools Measurement Point)

| Type of Point | Value | Range    | Parameter                                      |
|---------------|-------|----------|------------------------------------------------|
| Lower         | 1     | <33.3    | 0 is very bad condition, measurement cannot identified the criteria from SCAT |
| Average       | 2     | 33.3-66.6| 33.3 is bad condition, but some of standard are indicated |
| Good          | 3     | >66.6    | 66.6 is good condition in basic standard indicated |

Based on SCAT, the research variables are divided into three aspects: Social, Economy and Environment related to the primary keys of Sustainable indicators form some theories. SCAT develops three issues by general resume consideration to indicate how sustainable the condition is.
Table 2. Variables, Indicators, Strategies in Data Collection and Analysis

| No | Aspect of Assessment | Variables of Research                      | Indicators                                                                 | Data Collecting Strategies | Data Analysis and Interpretation |
|----|----------------------|--------------------------------------------|----------------------------------------------------------------------------|----------------------------|----------------------------------|
| 1  | Social               | 1. Occupant comfort                        | Daylighting, ventilation, noise, thermal comfort, views                   | Interview                  | Input to SCAT assessment tools and analyze the lack condition by refers Indicative performance measure |
|    |                      | 2. Inclusive environment                   | Public transport, information, space, toilets, fitting & furniture        |                            |                                  |
|    |                      | 3. Access to facility                     | Children day care center, Banking, Retail, Communication, Exercise        |                            |                                  |
|    |                      | 4. Participation and control              | Environmental control, Involvement, Social spaces, Sharing facilities, User group |                            |                                  |
|    |                      | 5. Education, Health & safety             | Education, Safety Awareness, Materials, Accidents                         |                            |                                  |
| 2  | Economy              | 1. Local economy                          | Local contractor, local material, local component, local furniture/ fitting, maintenance | Interview                  | Input to SCAT assessment tools and verify the result to respondents |
|    |                      | 2. Efficiency                             | Capacity, occupancy, space per occupant, communication, materials and component |                            |                                  |
|    |                      | 3. Adaptability                           | Vertical heights, external space, Internal partition, Modular planning, Furniture |                            |                                  |
|    |                      | 4. Ongoing cost                           | Induction, Consumption & waste, Metering, Maintenance & Cleaning, Procurement |                            |                                  |
|    |                      | 5. Capital cost                           | Local need, Procurement, Building costs, Sustainable technology, Existing Buildings |                            |                                  |
| 3  | Environmental        | 1. Water                                  | Rainwater, Water use, Runoff, Greywater, Planting                        | Interview and visual assessment | Input to SCAT assessment tools based |
|    |                      | 2. Energy                                 | Location, Ventilation, Heating & Cooling, Appliances & fittings, Renewable energy |                            |                                  |
|    |                      | 3. Waste                                  | Toxic waste, Organic waste, Inorganic waste, Sewerage, Construction waste |                            |                                  |
|    |                      | 4. Site                                   | Brownfield site, Neighboring buildings, Vegetation, Food gardens, Landscape inputs |                            |                                  |
|    |                      | 5. Material & Component                   | Embodied energy, Material sources, Ozone depletion, Recycled / reuse, Construction process |                            |                                  |

For analysis, the total assessment point is reviewed per level of value, but firstly, the research did quantification from qualitative assessment to quantitative data. The lack of value from each aspect analyzes as the challenges factor for Pondok Pesantren to drive some improvement program, starting from improving the physical quality of Pondok Pesantren. A survey was done in visual surveys and interviews with the community randomly. Five key persons, 15 local residents and ten students of Pondok Pesantren were interviewed to assess the research variables. The average value was calculated
by the entry data from 30 respondents and show in the result value assessment. It was the primary data to analyze what terms and strategy/strategies Pondok Pesantren could have as an important role in the community by running their improvement pilot project at the first stage.

6. Overview for pondok pesantren in Mlangi Muslim Settlements

Mlangi is the old village in Yogyakarta Province, which one of the oldest Muslim settlements since the pre-Independence period of Indonesia. It consists of more than 15 Pondok Pesantrens and the settlement is developed by the Pondok Pesantren existence. As the one significant area to spread and establish Islam in Yogyakarta, Mlangi, until now, it still has the key role of the development of Muslim society in Yogyakarta.

![Figure 1. Existing Condition in Mlangi Muslim Settlement](image)

One symbolic mosque in Mlangi – Pathok Negoro Mosque – is the main symbol and notable building for this settlement. Daily activities of most people are from traders and producers in the textile industry (convection production), teacher of Pondok Pesantren, while the others are the students of Pondok Pesantren. The large area is about 3.49 km2 on the western side of Yogyakarta. Sustainability assessment from SCAT, which we will describe in table 3 below, is in three aspects. This can draw the existing condition of Mlangi and its Pondok Pesantren as a result of the research.

Assessment results indicated that only a few indicators could meet the criteria of evaluation. From the overall performance score of the research, the area is only 3.7 on average, stating that the existing condition in the research area was in a bad situation, in the economic, social and environmental aspects. One can say the sustainable aspect is not implemented, because there is no social and environmental management to push sustainable effort in a settlement. Many actors focus on other policy and management besides sustainable issues.
Table 3. Result of SCAT Assessment.

| No | Criteria | Indicators                                 | Total Points |
|----|----------|--------------------------------------------|--------------|
| 1  | Social   | Occupant Comfort                           | 2.5          |
|    |          | Inclusive Environments                     | 3.3          |
|    |          | Access to Facilities                       | 3.7          |
|    |          | Participation and Control                  | 4.5          |
|    |          | Education, Health and Safety               | 4.1          |
| 2  | Economy  | Local Economy                              | 5            |
|    |          | Efficiency                                 | 4.3          |
|    |          | Adaptability                               | 2.75         |
|    |          | Ongoing Cost                               | 3.1          |
|    |          | Capital Cost                               | 3.4          |
| 3  | Environmental | Water                                        | 1.3          |
|    |          | Energy                                     | 2.14         |
|    |          | Waste                                      | 1.6          |
|    |          | Site                                       | 1.8          |
|    |          | Materials & Component                      | 2.1          |

7. Discussion

From three aspects assessed, the environmental criteria are the potential chances to Pondok Pesantren in Mlangi to take the leading role in improving the quality of physical conditions. Whether the lacking value is in this aspect, the research indicated the priority aspect of developing first, which is the next roadmap in the improvement program. Social aspects have a better value in assessment because, in recent context, information technology offers some advantages to the community. It enables sufficient networking i.e., to publish and share their social activities to push the social movement of the community. Sustainable development links the environment, economy and social equity into practices that benefit present and future generations [19]. Research in Pakistan indicated general physical condition the same as Mlangi. Results showed that the environmental factor was the worst condition, although they have been preparing the development by a masterplan of settlements. There is no sewerage treatment, very little water treatment and solid waste management are established/ exercised [20]. In this case, comprehensive planning was missing. In Mlangi, there is no masterplan to drive the development of the settlement. Many Pondok Pesantrens develop their building and complex only
based on their need for the capacity of the building. In building context, ventilation, daylighting and thermal comfort should improve in building standards. In Indonesia, they try to adhere to the Indonesia National Standard about building (SNI in Indonesia term) as a better effort to improve. Regarding the role of Pondok Pesantren to make the settlement in a sustainable condition, person in Pondok Pesantren and communities around there have to take an important role, especially in the environmental aspect first. Management of water and waste, site planning and energy efficiency have to start as a masterplan in sustainable local government policy. Any consideration is done in some aspect to assess the sustainable value from sustainable development agenda adopted in unique communities, because of two patterns: (a) there is something in sustainable development relevant only in certain and limited cases, and (b) there is something about communities that either constraint or enhance their capacity to recognize their relevance and then act accordingly [21]. The research area comprises the unique communities, both traditional and a special character of communities. It looks like the early assessment by SCAT only helps to indicate a preliminary factor that should be improved in the next policy of the local government. Many building is non-standard building criteria especially in environmental condition. Because Pondok Pesantrens have a key role in improving communities, they should improve the quality of their Pesantren building first, and then socialize the effort, method and technical practices to their neighborhood. The adaptation to respond to a sustainable policy in a Muslim settlement by Pondok Pesantren could follow the strategies of 24 cities that made any adoption, which matches with their condition. Those cities develop the level of commitment to sustainability in certain public policies [22], and actually there is no significant statistical relation between how actively sustainable development policies or educational attainment are initiated and located [23]. Because Pondok Pesantren has the main role in communities, every policy and effort that emerge from them will be followed by their communities and gain strong feedback and input to local government. Therefore, this can scale up to legal aspects for higher local authorities to get involved in regulation and guidelines to improve the settlements by sustainable principles. Strong local government can ensure that the needs, customs, urban form, social priorities and environmental conditions of the local area are reflected in the local plan for urban development [24].

8. Conclusion
The environmental aspect has terrible value based on the assessment tools by SCAT. The quality of settlement has some bad effects on its surroundings because each building, both Pondok Pesantren and local houses, did not have any development regulation. They are built up only based on capacity consideration. As a key role in Muslim settlement, Pondok Pesantren can make any plan to help improve this bad condition. Firstly, Pondok Pesantren can begin any improving their physical building and the lack of condition of the environment. Water, waste and energy are repaired in management of distribution and maintenance. Using local and green materials can be one practical effort to give an example for neighborhood communities. Secondly, together with local government, formulate a masterplan of settlements, which can contribute to meet sustainable criteria. Their strong role and influence for the communities in Muslim Settlement can control the implementation of it. Finally, there is the commitment of communities. Pondok Pesantren can try any socialization of a sustainable principle program with environmental aspects first in many religious activities. The activities held by Pondok Pesantren, both as regular religious activities i.e., weekly Islamic preaching or in a big ceremonial of Muslim agenda, represent the strategic plan to push communities toward the sustainable environment plan.

Acknowledgement
Research funded by Fundamental Research Grant for University Excellence (Penelitian Dasar Unggulan Perguruan Tinggi) by Directorate of Research and Technology Higher Education Indonesia,
research entitled: *Moderasi Standar Desain Pondok Pesantren Berbasis Vernakularitas dan Kriteria Bangunan Sehat untuk Perencanaan Masterplan Permukiman Cerdas, Lestari, dan Tanggap Bencana di padukuhan Mlangi, Nogotirto, Sleman, DI Yogyakarta*. Granted from 2017 to 2019. Thank you very much for the full support from Universitas Islam Indonesia and PDUPT Ristek DIKTI, Indonesia.

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