Assessment of Sustainability in Architecture Using The Modification of The Greenship Tools Model

Case Study of Mohammad Hatta Building of Universtas Islam Indonesia

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Abstract

Sustainable development is development that can meet the needs of the present without reducing the ability of future generations to meet their own needs. Educational institutions have an important role in shaping the human character and the future of the world to implement sustainability systems. The Mohammad Hatta UII building is the object of study in research aimed at finding out how much the value of sustainability is applied in development and becomes information for the reader. Now there is an assessment tool that works to assess how high a building's sustainability value is. Green Building Council Indonesia (GBCI) with Greenship Tools was chosen to be an assessment tool to determine the level of sustainability contained in the object of study by modifying some of the criteria therein. In the assessment process the highest results were obtained in the Appropriate Site Development category where all available points were met, while the Water Conservation category did not get any points at all and the Building Environmental Management category was eliminated in the evaluation aspect. The results of the sustainability calculation based on Greenship criteria from the modified Greenship Existing Building assessment type on the study object obtained 52.94%. To increase points in the assessment will be given several recommendations in the form of design concepts that are expected to be used as a reference in improving facilities to support the value of sustainability in the object of study.

Keywords: *assessment, development, Greenship, sustainability*

Introduction

Global environmental issues are environmental problems and the impacts caused by these environmental problems have wide and serious impacts on the world. Global environmental issues that have arisen in the past few decades provoke human awareness of the environment that has been damaged. Global environmental issues that are sticking to the surface of a global nature and the most important in the environment is global warming. Symptoms of global warming result in depletion of the ozone layer, shrinking vast areas of tropical forests, expanding deserts, and melting of ice sheets in the Arctic and South of the Earth can be used as an indication of environmental pollution due to chemical imbalances and energy use (Sitorus, 2004). Among human activities that cause environmental damage as well as the many raw materials and energy used, namely in the field of development (Marques & Loureiro, 2013). Development activities represent about 40% of the earth's energy consumption, so the concept of sustainability is quickly becoming an important issue in the current design and construction process (Harputlugil, 2017).

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Sustainable development is defined as development that can meet the needs of the present without reducing the ability of future generations to meet their own needs (Čeněk, 2013). Sustainable in architecture is applied not only to reduce damage to the environment but also involves biodiversity, using pure and renewable resources, utilizing regional materials that can be recycled, preserving and reviving historic sites and paying attention to the economic and cultural issues of each community (Pourdehqan et.al, 2015). Green architecture is a concept of sustainability that has several common components such as; focus on energy efficiency and in some cases renewable energy; efficient use of water; use of building materials and specifications available in the surrounding environment; minimization of waste and toxic chemicals produced in construction and construction; good indoor air quality; creating "smart building" and sustainable development (Ragheb et.al, 2016). Sustainability is comprehensive because it is a complex subject. This concept aims to make people aware of their nature and not selfish in the use of resources obtained, especially from nature and this concept is very important for everyone because it is related to the survival of humans and almost every living creature on earth (Soerjani, 2016).

Knowledge of sustainability and its application in human life forms the basis of research. The selection of the assessment tools model and the object under study must be following the scope of the study to achieve the desired results. In measuring the level of sustainability in a design there is an assessment tool that works to assess how sustainable a design is. There are many types of assessment tools spread in several countries. The assessment tool was first spearheaded by the SAM (Sustainable Architecture Matrix) which was first published in Progressive Architecture in March 1971. After that it was developed by GBC 98 (Green Building Council 98) which was developed by international teams from 14 countries with the GBTools rating system that rates around 120 sub-criteria. This scheme has been developed for use in GBC 2000, GBC 2002 and 2005 (Waer & Sibley, 2005). This assessment system has been developed by many countries with various names and types of rating tools under the concentration of each country. Some model tools that are used in several countries include; LEED (Leadership in Energy and Environmental Design) from the United States, BREEAM (Building Research Establishment's Environmental Assessment Method) from the United Kingdom, CASBEE (Comprehensive Assessment System for Building Environment Efficiency) from Japan, BCA Green Mark (Building Construction Authority) from Singapore, GBI (Green Building Index) from Malaysia, and many more from several countries (Fauzi & Malek, 2013). Indonesia itself has a GBCI (Green Building Council Indonesia) as an assessment team to find out how high a building's sustainability value is using the Greenship Tools model. (Zainol et.al, 2017).

The architecture of sustainability and continuing education have many things in common. For example they both come from environmental care and the promotion of mutual relations between humans and nature. While sustainability education is mainly developed from previous practices, such as natural studies, outdoor education, conservation education (Chansomsak & Vale, 2016). An educational institution that applies the concept of sustainability to the facilities contained in the environment, especially in buildings supporting activities in education, can be identified through an assessment tool. Educational institutions are believed to have an important role in changing and shaping their human character and the future of the world. Changing an education into education that implements a sustainable system implies systemic thinking and an interdisciplinary approach (Grecu & Ipiña, 2015). The Islamic University of Indonesia (UII) has a vision that is Rahmatan lil 'alamin University, wherein the Rahmatan lil' alamin education model, Islamic-based education should be able to answer the challenges posed by humans and turn them into opportunities and not lose their identity as education based on faith, worship and morality karimah (Nata, 2016). The aspect of education that is sustainable is not only applied to people but it should also be reflected in the facilities and its application in the field.

The Indonesian Islamic University Library Building was inaugurated by the Minister of Culture and Tourism Dr. Djero Watjik who was accompanied by Mrs. Dr. Meutia Hatta, Bung Hatta's daughter as the founder of UII and the Republic of Indonesia Proclaimer on October 17, 2011 (Jogjalibrary, 2014). The

Mohammad Hatta Building is a central library building located at the Islamic University of Indonesia. This building is not only intended as a library but also as a historical museum of the establishment of the Islamic University of Indonesia. Another uniqueness of this building is the historical heritage in the form of a Hindu temple that was previously buried right on the site of this building. This discovery is a history, where a Hindu temple was found in a university complex with Islamic breath (Puskompub, 2011). The choice of the Greenship Tools assessment tool model by using the Greenship Existing Building (EB) category was used for the Mohammad Hatta Building, the Islamic University of Indonesia because this building is located in the territory of Indonesia, where the measurement tool has been adapted to the conditions and sustainability issues that exist in the country of Indonesia and adapted with existing regulations. The use of the building as a library and museum and also there is a temple in it makes this Mohammad Hatta building a building that can later provide more value from the aspect of sustainability not only from cultural aspects but also from social aspects and most importantly in the field of architecture.

This study tries to assess the level of success of a building in implementing sustainability, where the case study taken is the Mohammad Hatta Building, Islamic University of Indonesia, using a modification from the Greenship Existing Building benchmark. Modification of the assessment is seen from the aspects of eligibility, categories, criteria, and benchmarks of the Greenship Existing Building by adjusting existing categories to the conditions of the research object.

This study aims to determine how much the value of sustainability (sustainability) of the scope of architecture contained in the Mohammad Hata building of the Islamic University of Indonesia by looking at various aspects contained in the modified Greenship Tools model in terms of points, categories, and criteria contained in the assessment model this. This research is expected to be able to provide readers with an understanding of the level of sustainability in architecture and which points are felt to be easily identified in the assessments contained in the Mohammad Hata Building, Islamic University of Indonesia.

LITERATURE REVIEW

Sustainable Development

Sustainable development is an unlimited development system, where development is focused on achieving greater benefits for humans and more efficient use of resources in balance with the environment needed for all humans and other living things (Chansomsak & Vale, 2016). Sustainable development is also a scientific and technological effort for sustainable development that contributes to increasing knowledge for humans in the development of environmentally friendly science throughout the world (Kates et.al, 2005).

Environmental Issues Sustainability

Global environmental issues that have arisen in recent years provoke human awareness of the environment that has been damaged. Global environmental issues that are sticking to the surface of a global nature and the most important in the environment is global warming. This incident occurred by many events that originated from humans, causing more severe damage. Global warming occurs not only because of one event, but many things that make this natural phenomenon occur, such as; air pollution, which originates from fossil combustion originating from factories and motor vehicles where this event contributes a lot of NOX substances, CO, and volatile organic compounds (Mou et.al, 2018), from air pollution, led to the impact of Urban Heat Island, where air temperatures in urban areas that were built were higher than the surrounding rural countries (Tzavali et.al, 2015), then impacted on ozone depletion, where agriculture, burning of fossil fuels, and industrial processes produce emissions of chlorofluorocarbons, halons, and other destructive gases causing holes in the ozone layer of the stratosphere to emerge (Safiuddin & Sarbatly, 2016), and finally, the impact of some of these events causes the melting of polar ice caps to make sea levels rise. It also makes summer temperatures higher in countries with four seasons (Tandong et al., 2009). Like the domino effect, where a natural event arises not only due to one thing but also several things even have an impact or can cause a thing because of that in life on earth.

Sustainability Concept

Sustainability is comprehensive because it is a complex subject. This concept is very important for everyone because it is related to the survival of humans and almost every living creature on earth. One concept of sustainability in architecture is green architecture. Green architecture is an approach to development that minimizes harmful effects on human health and the environment and protects air, water and earth by choosing environmentally friendly building materials.

Green architecture has several characteristics such as; ventilation systems are designed for efficient heating and cooling, lighting and energy-saving equipment, water-saving plumbing fixtures, landscapes planned to maximize passive solar energy, minimal damage to natural habitats, alternative energy sources such as solar or wind energy, non-synthetic materials, non-toxic, locally obtained wood and stone, wood harvested responsibly, adaptive reuse of old buildings, use of rescue recycled architecture, efficient use of space. Apart from the characteristics of green architecture it also has principles such as; Water Systems (can be accommodated, stored, filtered and reused), Natural Building (produces a healthy living environment and maintains indoor air quality), Passive Solar Design (the use of solar energy to heat and cool spaces), Green Building Materials (source power used environmentally responsible), Living Architecture (integrating ecological functions into buildings to capture, store and filter water, purify the air, and process other nutrients) (Ragheb et al., 2016).

Model Assessment Tools

The model assessment tool was first spearheaded by the SAM (Sustainable Architecture Matrix) in March 1971, then developed by GBC 98 (Green Building Council 98) which was developed with the GBTools rating system which assesses about 120 sub-criteria. This assessment system has been developed by many countries with various names and types of rating tools by the concentration following the issues of each country. Types of model tools used in several countries, among others;

a. LEED (Leadership in Energy and Environmental Design) was created by the United States Green Building Council in 1998 and this tool became a tool known in the United States wherein 2009 there were more than 3400 registered buildings and the potential to succeed in finding.
b. The UK's BREEAM (Building Research Establishment's Environmental Assessment Method) was first launched in 1990, the rating has certified up to 200,000 buildings and more than one million have registered for the certification process.
c. The CASBEE (Comprehensive Assessment System for Building Environment Efficiency) is the development of the first assessment tool in Asia that was developed in Japan in 2001. The method applied at CASBEE is very different from other tools. The score will be generated from the BEE value depending on the environmental burden and the quality of the building's performance.
d. The BCA Green Mark (Building Construction Authority) from Singapore provides certification standards for the development of environmentally friendly practices in building planning, design and construction.
e. GBI (Green Building Index) was developed in Malaysia which allows developers to design and build sustainable green buildings and can provide guarantees for energy savings, water savings, healthy indoor environment, good connectivity to public transportation.
f. GBCI (Green Building Council Indonesia) originates from Indonesia which was launched on June 17, 2010 using the Greenship Tools rating system.

GBCI Greenship Tools

Green Building Council Indonesia (GBCI) is an independent (non-government) and non-profit (non-profit) organization that is fully committed to the application of sustainability principles and to the application of environmentally friendly building practices through planning, construction and maintenance of buildings in Indonesia (Manggiasih et.al, 2019). GBCI issued a green building rating system for Indonesia, namely Greenship, where the rating system is a tool containing items from the aspect of valuation called rating, and each rating item has a point value. If a building successfully carries out a rating item, then the building will get value points from that item. If the sum of all points collected has reached a certain amount, then the building can be certified to a certain level of certification. But before reaching the rating stage, a building assessment is first carried out to fulfill the initial assessment requirements (Teknika, 2017).

The assessment used in Greenship Tools is seen from five types of assessments namely; Greenship New Building (in new buildings or in the final design phase), Greenship Existing Building (in buildings that have been in operation for at least one year after the building is completed), Greenship Interior Space (scope of assessment of fit-out activities, management policies, and management by the management after the activities in it start operating), Greenship Neighborhood (area), and Greenship Homes (houses that are wise in using land, are efficient and effective in the use of energy, water, and resources, and are healthy and safe for residents of the house) (GBCI , 2019).

The measurement and assessment techniques used as a reference in this study are based on the Greenship Existing Building Version 1.1 standard modified from several criteria contained in the assessment category. This modification is carried out to find out what criteria and values can be changed in each category to achieve a greener and sustainable building. In the Greenship Existing Building Version 1.1 there are several categories and criteria along with their evaluation points. In the type of building Mohammad Hatta UII is part of the type of Greenship Existing Building, by modifying the existing meaning in the assessment parameters and focusing on several criteria and assessments that are adjusted to the existing conditions in the Mohammad Hatta UII building as follows:

Tabel 1. Summary of Greenship Existing Building Standard Criteria Version 1.1
Source: Green Building Council Indonesia, 2016

Category and Criteria		Score (max)	Description of Each Category
Appropriate Site Development (ASD)			
ASD P1	Site Management Policy	P	2 prerequisite criteria; 7 credit criteria
ASD P2	Motor Vehicle Reduction Policy	P	
ASD 1	Community Accessibility	3	
ASD 2	Motor Vehicle Reduction	2	
ASD 3	Site Landscaping	3	
ASD 4	Heat Island Effect	2	
ASD 5	Storm Water Management	2	
ASD 6	Site Management	2	
ASD 7	Building Neighbourhood	2	
Total Category Values ASD		**16**	**13,68%**
Energy Efficiency and Conservation (EEC)			
EEC P1	Policy and Energy Management Plan	P	2 prerequisite criteria; 5 credit criteria; 2 bonus criteria
EEC P2	Minimum Building Energy Performance	P	
EEC 1	Optimized Efficiency Building Energy Performance	16	
EEC 2	Testing, Re-commissioning or Retro-commissioning	2	
EEC 3	System Energy Performance	12	
EEC 4	Energy Monitoring and Control	3	
EEC 5	Operation and Maintenance	3	
EEC 6	On Site Renewable Energy	5B	
EEC 7	Less Energy Emission	3B	
Total Category Values EEC		**36**	**30,77%**
Water Conservation (WAC)			
WAC P	Water Management Policy	P	1 prerequisite criteria; 7 credit criteria; 1 bonus criteria
WAC 1	Water Sub-Metering	1	
WAC 2	Water Monitoring Control	2	
WAC 3	Fresh Water Efficiency	8	
WAC 4	Water Quality	1	
WAC 5	Recycled Water	5	
WAC 6	Potable Water	1	
WAC 7	Deep Well Reduction	2	
WAC 8	Water Tap Efficiency	2B	
Total Category Values WAC		**20**	**17,09%**
Material Resources and Cycle (MRC)			
MRC P1	Fundamental Refrigerant	P	3 prerequisite criteria; 5 credit criteria
MRC P2	Material Purchasing Policy	P	
MRC P3	Waste Management Policy	P	
MRC 1	Non-ODS Usage	2	
MRC 2	Material Purchasing Practice	3	
MRC 3	Waste Management Practice	4	
MRC 4	Hazardous Waste Management	2	
MRC 5	Management of Used Good	1	
Total Category Values MRC		**12**	**10,26%**

Indoor Health and Comfort (IHC)			
IHC P	No Smoking Campaign	P	1 prerequisite criteria; 8 credit criteria
IHC 1	Outdoor Air Introduction	2	
IHC 2	Environmental Tobacco Smoke Control	2	
IHC 3	CO2 and CO Monitoring	2	
IHC 4	Physical, Chemical and Biological Pollutants	8	
IHC 5	Thermal Comfort	1	
IHC 6	Visual Comfort	1	
IHC 7	Acoustic Level	1	
IHC 8	Building User Survey	3	
	Total Category Values IHC	**20**	**17,09%**
Building Environment Management (BEM)			
BEM P	Operation and Maintenance Policy	P	1 prerequisite criteria; 5 credit criteria
BEM 1	Innovations	5	
BEM 2	Design Intent and Owner's Project Requirement	2	
BEM 3	Green Operational and Maintenance Team	2	
BEM 4	Green Occupancy/Lease	2	
BEM 5	Operation and Maintenance Training	2	
	Total Category Values BEM	**13**	**11,11%**
	Total All Values	**117**	**100%**

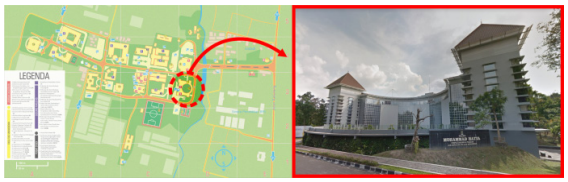
There are differences in the selection of categories by determining the criteria that are deemed appropriate and allow information to be sought by the building that is the object of study, then the results of this study will be different from the assessment using standardization of the Greenship Existing Building.

RESEARCH METHOD

Case Study

The building case used in this study is the Mohammad Hatta University of the Islamic University of Indonesia which is seen in the criteria according to the conditions of the study object as well as in the prerequisite points, credits and bonuses modified in the Greenship Existing Building Assessment. The location of the building is in the integrated campus environment of the Islamic University of Indonesia.

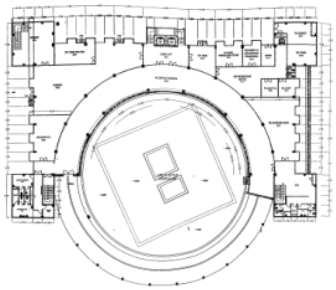
Figure 1. Location of Mohammad Hatta UII Building



The Mohammad Hatta Building consists of five levels with several different functions at each of the following levels.

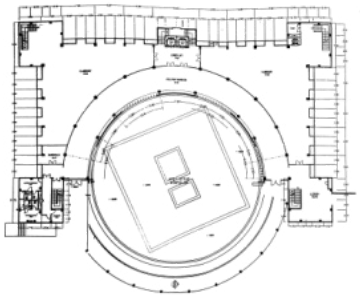
At the basement level, the Mohammad Hatta building is designated as a historical museum area of the founding of the Islamic University of Indonesia as well as the temple artifact area.

Figure 2. Basement of the UII Mohammad Hatta Building



At the Lower ground level in the Mohammad Hatta building is the elevation which is the main access to enter the area in the building. This area is intended as a content exhibit hall, a multi-media space and an Islamic and FIAI collection room.

Figure 3. Lower Ground of the UII Mohammad Hatta Building



At the upper ground level, the Mohammad Hatta building is designated as a collection room for industrial engineering and civil engineering planning and collection of the library directorate. The elevation in the upper ground is typical in terms of spatial planning and laying with elevation on the 1st floor, where at this elevation is intended as a collection room for social, cultural, medical, economic,

MIPA psychology books as well as reference and reserve collections.

Figure 4. Upper Ground of the UII Mohammad Hatta Building

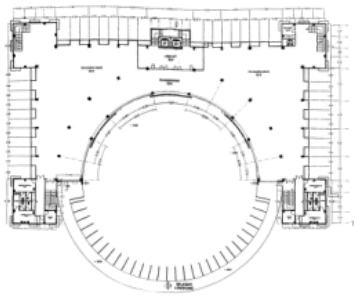
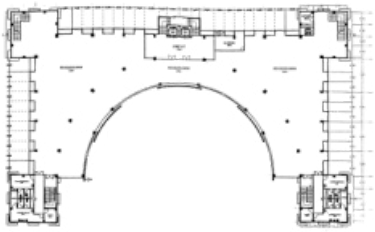
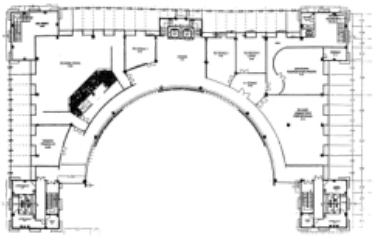


Figure 5. 1st floor of the UII Mohammad Hatta Building



At the 2nd floor level, the Mohammad Hatta building is the top elevation of the inner space where this elevation is used as a courtroom, audiovisual, and language laboratory as well as a special director, administration and collection room.

Figure 6. 2nd floor of the UII Mohammad Hatta Building



Evaluation Methods and Techniques

The method applied in this study is to look for primary data (direct observation in the field through observation and interviews) and search for secondary data needed. Furthermore, the data obtained are adjusted to the benchmarks and values contained in the rating tools of defining the criteria set out in the Greenship Existing Building Version 1.1 standard, so that the total results of the final study are obtained. Modifying existing criteria by focusing on several benchmarks and assessment criteria that are adapted to the existing conditions in the Mohammad Hatta building of the Islamic University of Indonesia.

Meaning Method

Based on the six categories with 50 criteria and the number of points by Greenship Existing Building Version 1.1 is 117 subpoints, with a total percentage of 100%. However, in this study not all criteria in the Greenship Existing Building Version 1.1 were used, there were only 5 categories that were part of the assessment because they were adjusted to the research case study with a total of 52 points being calculated points, so that there were criteria that were omitted in the research assessment process.

Determination of points on availability through three conditions namely; Yes, Nothing and Not Available. Existing provisions make it clear that points in the criteria are declared to exist or are applied to buildings. No provisions on availability explain that points in the criteria are stated to be absent or not applied to buildings. Provisions Unavailable on availability explain that the points in the criteria are unknown or cannot be assessed because the criteria in question are a private scope for the building management, so the points contained in this criterion are omitted and not included in subpoints.

RESULTS AND DISCUSSION

Result

This research was conducted to find out what criteria are found in the Mohammad Hatta Building of the Islamic University of Indonesia that applies green points according to the categories and criteria in Greenship Existing Building Version 1.1. The categories and criteria applied to the Mohammad Hatta University building include the following aspects:

1. Appropriate Site Development

In this category nine criteria are consisting of 2 prerequisite criteria and 7 credit criteria where each criterion has assessment points. Availability under "Yes" in this category is in the following criteria;

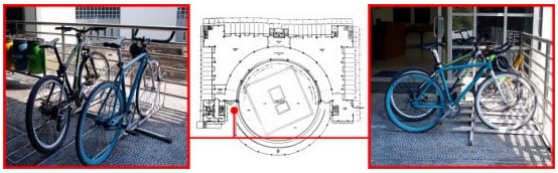
a. Community Accessibility, with points regarding there are at least 5 types of public facilities within the reach of the main road as far as 500 m from the site filled with 1 point, where there is a Mosque, Book Store,

Cafeteria, Clinic, ATM Center and shops right in front of Boulevard UII.

Figure 7. Public facilities within reach of 500m

b. Motor Vehicle Reduction, with 1 unit of secure bicycle parking, 1 point filled with parking, where there are 5 units of bicycle parking right in front of the southern building entrance area.

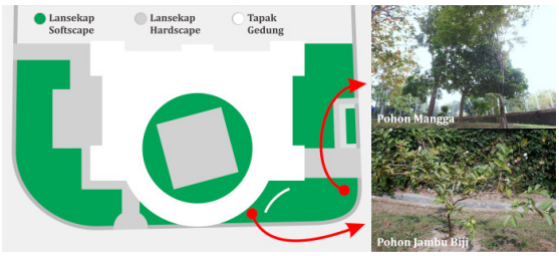
Figure 8. Location of the bicycle parking building of Moh. Hatta UII



c. Site Landscaping, with points regarding, (1) The existence of a landscaping area in the form of vegetation (soft scape) that is free from garden buildings (hard scape) located on the surface of the land area of at least 30% of the total land area and an additional value of 1 point for each additional 10% area site for the use of landscape area filled with 1 point where the site area of the building is around 5986 m², while the area of the landscape area that is free of buildings and hardscape is around 1944 m² (on the outside of the building) and 547 m² (on the inside of the building/temple area). If calculated using a percentage, the available soft scape landscape area is 41.61% of the total site area, with 11.61% of the excess landscape area exceeding the minimum limit, 1 more point is filled. (2) The use of 60% of local plants originating from local nurseries with a maximum distance of 1000 km is filled with 1 point where 100% of plants used in the landscape area are all developed and cultivated in the Sleman area and its surroundings. (3) Use of productive plants, at least 10% of the landscape area is filled with 1 point where there are several mango and guava trees in the building landscape area, so that the points in this criterion are met.

d. Heat Island Effect, with points regarding the use of materials with an average value of albedo of at least 0.3 according to calculations on the roof area of a pavement-covered building filled with 1 point where the value of albedo contained on the roof is 0.32. Where Greenship sets a good albedo value is> 0.3, with that the value of the albedo roof area in this building meets the standards (note that the metal roof area is 656m², the roof area is 140m², the roof area is 1874m², and the total roof area is 2730m²).

Figure 9. Zoning of landscape and position of productive tree species



e. Storm Water Management, with the point of reducing the burden of rainwater runoff from land area to the city drainage network, is fulfilled because of empirical logic it appears that there is no standing water in the building area after rainfalls.

f. Site Management, with points on controlling disease pests and plant weeds by using non-toxic materials, and providing non-pet animal habitat in the building site area where the results of interviews with park officials obtained information that in the care of plants employees use non-hazardous pesticides and vegetation available in the form of trees can be a habitat for animals that live on the tree.

Figure 10. Points in the Building Neighborhood category

g. Building Neighborhood, with points on, (1) Improving the quality of life of people around the building filled with 1 point where there

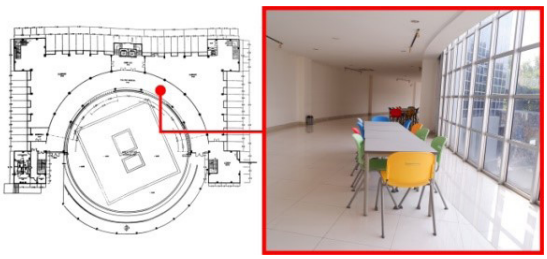
are many places to eat around the building area that can be a source of income and improve the quality of life of people from the economic sector, (2) Open pedestrian access to neighboring buildings filled with 1 point where there is pedestrian access to neighboring buildings such as the Ulil Albab Mosque, (3) Dedicated to the public interest of open land for private green open spaces filled with 1 point where there is a green open space in the form of landscaping in the building area, and (4) Revitalization of cultural heritage buildings filled with 1 point where there is a Temple Conclusion in the central area of the building that is guarded and preserved by the building manager so that the points on this criterion are met.

2. Energy Efficiency and Conservation

In this category nine criteria are consisting of 2 prerequisite criteria, 5 credit criteria, and 2 bonus criteria where each criterion has assessment points. Availability under "Yes" in this category is in the following criteria;

a. System Energy Performance, with points on saving energy consumption in-room lighting power and using high-frequency ballasts (electronics) and/or LEDs in public workspaces filled with 3 points wherefrom the observations seen that not all lights are turned on during the day because some rooms still get natural lighting from the sunlight, and the lamp component used is a type of LED and TL in the space contained in the building.

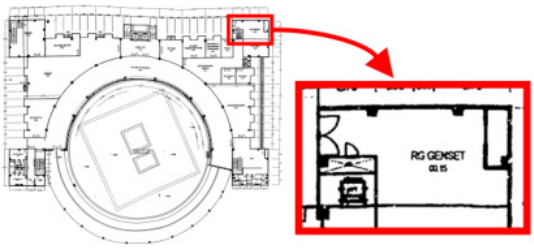
Figure 11. Location of the reading room on the lower ground



b. Energy Monitoring & Control, with points regarding the provision of kWh meters which include; Air conditioning systems, lighting systems, and contact boxes, other load systems, as well as monthly routine records on kWh meters filled with 1 point.

c. Operation and Maintenance, with the points regarding the operation and maintenance of the entire AC system and backup power plant filled with 3 points where the building routinely carries out maintenance such as AC cleaning and operation of the backup power plant also available on the building.

Figure 12. Location of the generator room in the building



3. Water Conservation

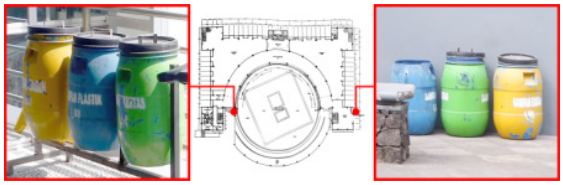
In this category nine criteria are consisting of 1 prerequisite criteria, 7 credit criteria, and 1 bonus criteria where each criterion has assessment points. Availability with the provisions of "Yes" in this category is not found in all the criteria. System Energy Performance, with points on saving energy consumption in-room lighting power and using high-frequency ballasts (electronics) and/or.

4. Material Resource and Cycle

In this category eight criteria are consisting of 3 prerequisite criteria and 5 credit criteria where each criterion has assessment points. Availability under "Yes" in this category is in the following criteria;

a. Fundamental Refrigerant, with points regarding using non−CFC Refrigerants and Fire Extinguishers that have an Ozone Depleting Potential (ODP) value <1 filled with 1 prerequisite where the fire extinguishing material provided is Dry Chemical Powder which has an Ozone Depleting Potential (ODP) value <1, but the refrigerant used is still a type of CFC.
b. Material Purchasing Policy, with points regarding the existence of top management policies that prioritize spending on all environmentally friendly materials filled with 5 prerequisite points out of 12 prerequisite points.
c. Waste Management Policy, with points regarding top management commitment governing waste management by type and campaign to encourage separate waste sorting behavior filled with 1 prerequisite where building management provides separate waste bins according to the type of waste, this includes a campaign to encourage separate waste sorting behavior.

Figure 13. Location and model of the garbage can provided by building management



d. Waste Management Practice, with points regarding organic and inorganic sorting by processing organic waste independently or in collaboration with official organic waste treatment bodies filled with 1 point where from the information obtained it is known that UII collaborates with official waste treatment bodies.

5. Indoor Health and Comfort

In this category nine criteria are consisting of 1 prerequisite criteria and 8 credit criteria where each criterion has assessment points. Availability under "Yes" in this category is in the following criteria;

a. No Smoking Campaign, with the points regarding the existence of a no-smoking campaign that includes the negative impact of smoking on yourself and the environment with a minimum installation of a permanent written campaign on each floor, including in the form of stickers, posters, emails filled with 1 prerequisite where in the area within the building there is a no-smoking campaign.

Figure 14. No-smoking sticker

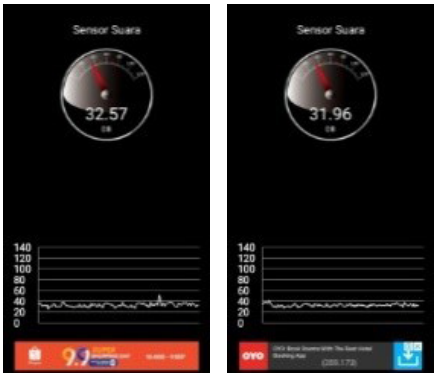
b. Environmental Tobacco Smoke Control, with points regarding no smoking in all areas of the building and not providing a building / special area in the building for smoking filled in 2 points which when viewed from the floor plan, this building does not provide a smoking area for building users, and also seen several smok banned campaigns on each floor of the building.

c. Thermal Comfort, with the points regarding the general thermal conditions of the room at a temperature of 24°C - 27°C and 60% + 5% relative humidity filled with 1 point where from field studies with empirical logic/ supervision seen thermal conditions in the library room is still within reasonable limits, where AC used in settings at temperatures 17 and 18°C (lowest temperature), but researchers did not get room humidity data.

Figure 15. Remote AC settings in the building

d. Acoustic Level, the points regarding the measurement results indicate the sound level in the workspace under SNI 03− 6386−2000 concerning Sound Level Specifications and Buzzing Time in Buildings and Residential Buildings filled with 1 point were based on the SNI intended the sound level for a Library building has a value of 40-50dB (BSN, 2000), from the measurement results obtained average results at different times, where during the daytime obtained a value of 32.57dB while at night time of 31.96dB.

Figure 16. Building acoustic test of a building



6. Building Environmental Management

In this category six criteria are consisting of 1 prerequisite criteria and 5 credit criteria where each criterion has assessment points. Availability with the provisions "Yes" in this category is not available in all criteria.

Discussion

Of the six categories discussed in the results above there are still many criteria that have

not been met and some criteria are not available. In the criteria section that has not been met ("None") the researchers include recommendations as an effort to provide a solution in solving the problem of green values in buildings that are case studies in research. Recommendations are given in the form of solutions in the form of design concepts and management patterns in management, as in:

1. Appropriate Site Development
In the criteria of the Motor Vehicle Reduction Policy, the researchers recommend that UII management call for a reduction in the use of private motor vehicles and switch to bicycles. In the Community Accessibility criteria, researchers recommend that UII be able to provide facilities for public vehicles such as Bus Stop and the provision of special lanes for pedestrians connecting several public facilities such as the skywalk. In the Motor Vehicle Reduction criteria, researchers recommend what type of vehicle should be used and one of the toilet cubicles in the south is converted into a shower for bicycle users.

2. Energy Efficiency and Conservation
In the Policy and Energy Management Plan criteria, the researcher recommends that the building provide stickers or posters that encourage building users to participate in energy-saving efforts. In the Energy Performance System criteria, the researchers recommend that the building can strive in the efficiency of equipment that uses an AC system that is operated with electricity and efforts to save with efficiency improvements, such as using air conditioning with a sensor system that works when there are users in it. In the Energy Monitoring & Control criteria, researchers recommend that energy displays are provided that can provide information about the energy use each year by the building, such as information running on the monitor information on the library building or the official site owned by the building management and the building can use a technology system to monitor and controlling building equipment, such as the use of central operation or sensor-based equipment. In the On-Site Renewable Energy criteria, researchers recommend that renewable energy systems be added to buildings such as the use of solar panels, because Indonesia is on the equator that geographically receives maximum light and solar heat.

3. Water Conservation
In the Recycled Water criteria, researchers recommend the use of water for building purposes can be obtained from collected rainwater and re-use of water from the drain to water existing plants and drainage of water from washtafel can be connected to the flushing toilet WC so that it can be reused. In the Potable Water criteria, the researcher recommends that the building management apply the use of water filtration tools such as "pure it" in the pantry or kitchen building area. In the Deep Well Reduction criteria, researchers recommend that the use of water in buildings is not only sourced from the ground, but can be sourced from rainwater that is collected and reused in the building. In the Water Tap Efficiency criteria, the researcher recommends that the building can use the auto stop feature on the taps found in the available washtafel.

4. Material Resource and Cycle
In the Material Purchasing Policy criteria, researchers recommend the development of using used materials in the backfill and using renewable materials such as solar glass that can absorb solar heat so that the space in the building does not get solar heat radiation. In the Non-ODS Usage criteria, researchers recommend the use of FREON as a refrigerant material can be replaced with hydrocarbons, but their use must be following established procedures.

5. Indoor Health and Comfort
In the Outdoor Air Introduction criteria, researchers recommend the application of smart windows that can open/close by detecting the quality of the air outside the building. In the CO_2 and CO Monitoring criteria, the researchers recommend an auditorium room in the building using this carbon dioxide gas sensor installation, because with the large number of users in the room the air quality and residual carbon dioxide increase. In the Visual Comfort criteria, researchers recommend using glass material that is clearer or does not use vertical blinds in the window.

In the Building Environmental Management category the researcher determines "Not Available" on all the criteria in which in this category the researcher cannot assess because in this category is part of maintenance and management in the construction which is the private scope of the building, so the

points in this category do not become part of the researcher's judgment. Availability with the provisions "None" and "Not Available" on each criterion will be presented in the appendix. Modifications in the assessment with Greenship tools are still in the testing phase where the results of this study may not be appropriate in determining the criteria available and the points obtained.

CONCLUSIONS AND SUGGESTIONS

Conclusion

From the results of the modification of the assessment with the Greenship tools trial test at the Mohammad Hatta Building, the Islamic University of Indonesia, the following results were obtained:

a. In the ASD category, there were 16 points out of 16 sub-totals, with a percentage of 28.85%
b. In the EEC category, there were 6 points out of 17 sub-totals, with a percentage of 7.69%
c. In the WAC category, points are 0 out of 8 sub-totals, with a percentage of 0.00%
d. In the MRC category, a point of 1 in 3 subtotals was obtained, with a percentage of 1.92%
e. In the IHC category, points were obtained for 4 out of 7 sub-totals, with a percentage of 5.88%

Based on the above calculation, it can be seen the value collected based on the modified Greenship Existing Building criteria by 27 points from 51 sub-totals with a percentage value of 52.94%.

Suggestion

The evaluator criteria with the provisions "None" make points in the available categories low. It is expected that with the recommendation of researchers on the point of the provision "None" can be used as a reference in improving the green value of the building, so that later the Mohammad Hatta building can be a building that has a high green value. If the recommendations presented can be realized, the Mohammad Hatta building can be used as one of the buildings that reflect the green and sustainable values in the UII environment, especially for universities throughout Indonesia.

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