Implementation of the Greenship Rating Tools in The Centre of Excellent (CoE) building at Universitas Pendidikan Indonesia

T Busono¹, H O Rahmana¹, U Surahman¹, Y Mulyadi¹ and W Setiawan¹

Universitas Pendidikan Indonesia
tjahyanibusono@upi.edu

Abstract. Environmental problems, especially global warming, have become the main topics discussed recently, and one of the causes is coming from the construction sectors. Therefore, to reduce environmental damage and global warming caused by the construction sectors, design and planning of buildings refer to the concept of green buildings. Universitas Pendidikan Indonesia (UPI), especially the Faculty of Technology and Vocational Education (FPTK), intended to implement the Green Buildings concept in the design and planning of the Center of Excellent (CoE) Technical And Vocational Education And Training (TVET) Building. For this reason, an evaluation of the implementation of the green building concept was carried out by using the criteria assessment based on the Greenship Assessment tool for New Buildings version 1.2 belongs to the Green Building Council Indonesia (GBCI). This research aims to obtain an assessment index and evaluate the green building concept in that building design. It was conducted at the Design Recognition (DR) stage, which is the assessment stage carried out when the project is in design and planning finalization. The data used is in the form of secondary data from the planner, including a plan drawing, BoQ (Bill of Quantity), and DED (Detail Engineering Design). The results generate ratings of greenship level at a percentage of 62.34%, with the predicated Gold. The category which generates the most points is the energy efficiency and Appropriate category with the improvement in building material used. Recommendations are divided into design recommendations (architectural) and management recommendations (non-architectural).

Keywords: Environment, Green Building, GBI, CoE TVET

1. Introduction
Environmental problems, especially global warming, have become the main topics discussed recently, and one of the causes is coming from the construction sectors because buildings have the potential to produce carbon gas emissions of more than thirty percent. In addition, the increasing demands for the quality of human life encourage the use of consumptive technology towards using non-renewable energy sources such as petroleum. Currently, the use of petroleum as a source of electrical and mechanical energy is difficult to separate from human life. For this reason, the concept of Green Building is present and becomes a necessity in the midst of the global warming phenomenon, as an
effort in the architectural planning approach to reduce environmental damage and minimize carbon gas emissions from the construction sector.

In Indonesia, the reference standard for assessing green building criteria is Greenship, developed by Green Building Council Indonesia (GBCI). According to GBCI, Green Building is a building in which since the start of the process of planning, construction, operation, and maintenance, attention to operational aspects of protecting, conserving, reducing the use of natural resources, maintaining the quality of both buildings and air quality in the room, and also paying attention to the health of its occupants. All of them are based on the principles of sustainable development.

There are 6 (six) aspects in implementing Green Building based on the Greenship assessment tool for new buildings version 1.2 include Appropriate Site Development (ASD), Energy Efficiency and Conservation (EEC), Water Conservation (WAC), Material Resources and Cycle (MRC), Indoor Health and Comfort (IHC), and Building Environment Management (BEM). Each aspect consists of a score (point) that contains standards and recommendations for achieving these standards (Kandita, 2017). If a building can apply the recommended criteria, then the building will get a high score on the predicate and rating, so that building can be categorized as an Eco-friendly building.

Increasing the score can be done by providing recommendations from design recommendations (architectural) and management recommendations (non-architectural) so that it can increase the score to the highest predicate, that is, platinum. This research aims to obtain an index and evaluate the green building concept in the design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET) Building Universitas Pendidikan Indonesia at the Design Recognition (DR) stage, according to the GBCI assessment tool.

2. Methodology
This research was conducted on the building design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET) at Universitas Pendidikan Indonesia, which is located on Jl. Dr. Setiabudhi No. 229, Isola, Sukasari District, Bandung City, West Java, 40154.

![Figure 1. Research Location of CoE building](image)

This research was conducted using a descriptive, evaluative method on the Green Building criteria based on the Greenship assessment tool for new buildings version 1.2, which aims to assess the concept of implementing green building and determine the predicate and rating on the building design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET) Building at Universitas Pendidikan Indonesia. The data used is in the form of secondary data from the planner, including a plan drawing, BoQ (Bill of Quantity), and DED (Detail Engineering Design). The assessment process is carried out on the prerequisite criteria, credit criteria, and bonus criteria. This research was conducted at the design recognition (DR) stage with a maximum of 77 points. There are 4 (four) levels of determination in the assessment the Greenship predicates there are Platinum, Gold, Silver, and Bronze.
The first step in this research is to determine the criteria to be evaluated based on the Greenship assessment tool version 1.2. After that, it is followed by calculating the rating obtained by the object based on the point scoring system. And the last stage is to evaluate and provide recommendations. The Recommendations are divided into design recommendations (architectural) and management recommendations (non-architectural). This recommendation is given to help improve quality and predicate Green Building at the next assessment stage.

The data collection technique used in this study is the documentation technique. This documentation is a technique using a source in the form of a plan drawing document, BoQ (Bill of Quantity) document, and DED (Detail Engineering Design) document.

3. Findings and Discussion
The results and discussion at this point include the results of the analysis of the prerequisite criteria, credit criteria, and bonus criteria using descriptive methods.

3.1. Appropriate Site Development (ASD)
Based on the categories and criteria for Appropriate Site Development, this building has a green base area as a green building requirement. For the assessment of the credit criteria obtained by 1 point from the Site Selection criteria, there is the selection of a site that is supported because of the need for space and is a revitalization of the previous building. From this building, it also has an affordable distance to several public facilities, including banks, public parking lots, mosques, restaurants or canteens, copy shop, health facilities, and libraries, so it gets 2 points from Community Accessibility criteria. There is a shuttle bus that connects from the parking area to every building on this campus. One of them goes to the CoE building. And there is also access for pedestrians so that it is safe to walk without being disturbed by motorized vehicle access, and it gets 2 points as Public Transportation criteria.

Unfortunately, there is no dedicated parking space for bicycles which is intended to make it easier for building users to use bicycles, so there are no points on Bicycle facility criteria. For Landscape, areas are around the building and in the center of this CoE building. The landscaping around the building can help maintain and expand greenery to improve the quality of the microclimate, increase O₂, and reduce CO₂. To cover the roof of the CoE building, it uses a tile roof, but there is no green roof, so in this Micro Climate criteria, it gets 2 points. And while for the Stormwater Management category, it gets 2 points, which is obtained from the stormwater management in this building which is enough to help reduce the load volume with the rainwater drains around the building, which is also supported by the existence of land for plants that can absorb rainfall so it can minimize the possibility of inundation on the road due to high rainfall.

3.2. Energy Efficiency and Conservation (EEC)
Based on the Energy Efficiency and Conservation categories, this building lighting system uses LED lamps with more efficient lighting power. The location of the light switch is also within reach when opening the door. This building is also facilitated by vertical transportation, that is, an elevator that uses a traffic management system that has passed the analysis, so from this criteria, it gets 10 points. Meanwhile, air conditioning in the CoE building does not require AC because the building design supports smooth air circulation, with windows around the building that can be opened whenever needed. With the glass around the building, it also supports natural lighting from sunlight entering through the building windows. For air ventilation, the CoE building has efficient air ventilation with windows around the building that can be opened whenever needed, so it doesn't require AC, especially on toilets, stairs, corridors, and lobby lifts. So, from the Natural Lighting criteria, it gets 4 points, and from Ventilation criteria, it gets 1 point.

For the drawback of this building, there is no calculation of CO₂ emission reduction that is obtained from the difference in energy requirements between the designed building and the baseline building.
And not using new and renewable energy sources that come from within the building site, either from biofuels, biomass, geothermal, water, wind, sun as a source of electricity generation. Because it still depends entirely on PLN. So, from climate change impact criteria and on-site renewable energy criteria is not get any point.

3.3. Water Conservation (WAC)
Based on water conservation categories, this building is equipped with the use of water features that are in accordance with the discharge capacity below the maximum standard of water output capability, which is 75 percent of the total procurement of products such as flush toilets, flush urinal, sink faucets, and wall taps. With this feature, it can save more money, compared to the manual method using a scoop, where more water is wasted than used. The drawback is that it is not equipped with water from recycled sources, alternative water resources, and rainwater harvesting; all of them still use clean water from wells or PDAM. Therefore, this category gets 6 points from the Water Use Reduction criteria and 3 points from the Water Fixtures criteria.

3.4. Material Resources and Cycle (MRC)
Based on the Material Resources and Cycle Categories, the CoE building uses new building materials because the used materials from the old buildings are no longer suitable for use. The materials also use environmentally friendly materials, such as glass, which, if they are not used, can be recycled in the future. This building is designed with lots of open glass so as not to use AC (Air Conditioning) in the room. Even though the glass causes a heating effect on the inside, the use of plants outside the glass one of its functions is also to reduce hot sunlight entering the building, so that comfortable conditions in the room remain can be felt without having to use AC. The materials used in this building are entirely derived from the fabrication process originating from the territory of the Republic of Indonesia, thereby minimizing the possibility of construction waste in the construction process. The wood used in this building is certified and obtained from legal and certified producers. So in this category, it gets 2 points.

3.5. Indoor Health and Comfort (IHC)
Based on the Indoor Health and Comfort categories, this building is not equipped with a carbon dioxide gas sensor installation. However, this building is equipped with a no-smoking sign so that the internal materials and health of the building users are maintained. This building also uses safe materials such as the use of paints with low levels of volatile organic compounds and with mercury content at maximum tolerance so that air pollution from material emissions can be reduced and the health of workers is maintained.

The view out of the building is fulfilled by providing a visual connection to the outside using glass. Every room in this building is supported by adequate lighting, both natural lighting and lighting using LED lights that are safe for the user's visual. Thermal comfort in this building is also maintained, one of which is the presence of adjustable window openings so that air humidity remains stable. The noise level in the building is also maintained with a barrier so that it blocks the possibility of noise from inside to outside the building or from outside to inside the building. From this category, it gets 5 points.

3.6. Building Environment Management (BEM)
Based on the Building Environment Management in the Green Building assessment, the CoE building has not been specifically involved with Greenship Professional certified experts in the design of this building. In the construction of this building, solid waste is separated based on the type of waste, both solid waste that is disposed of directly to the TPA, solid waste that can still be reused, and waste that can be recycled by third parties, thereby minimizing solid waste stored in the TPA. Meanwhile, liquid waste that comes from the construction process is maintained so as not to pollute the city drainage. So,
this category gets 2 points from the Pollution of Construction Activity criteria and 2 points from the Advanced Waste Management criteria.

The commissioning system in the construction process is well-planned and executed, with the presence of building supervisors from the owner and construction and architects so that they always pay attention to the suitability of the design with the technical specifications being implemented. This building will later be accompanied by a statement and data on the implementation of the green building from the building. So, in Proper Commissioning criteria, it gets 2 points.

This building must have an agreement that this building uses certified wood, conduct training by building management, carry out indoor air quality management in the form of POS. And the building owner must provide a statement that he will conduct a temperature and humidity survey.

### Table 1. Recapitulation of Assessment Results on Design Recognition (DR) stage

| Category | Maximum Points | Points Earned | Percentage |
|----------|----------------|---------------|------------|
|          | Prasyarat | Kredit | Bonus | Prasyarat | Kredit | Bonus |   |
| ASD      | V           | 17    | -     | V           | 11    | -     | - |
| EEC      | V           | 26    | 5     | V           | 15    | 0     | - |
| WAC      | V           | 21    | -     | V           | 9     | -     | - |
| MRC      | V           | 2     | -     | V           | 2     | -     | - |
| IHC      | V           | 5     | -     | V           | 5     | -     | - |
| BEM      | V           | 6     | -     | V           | 6     | -     | - |

| Total number of Criteria and Benchmarks | 77 | 5 | 48 | 0 | 62.34 % |

### 3.7. Recommendation

The Recommendations are divided into design recommendations (architectural) and management recommendations (non-architectural). This recommendation is given to help improve quality and predicate Green Building at the next assessment stage. The recommendation is given according to building capabilities. Recommendations buildings can be seen in Table 2 and Table 3.

From the recommendations, the building design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET) at Universitas Pendidikan Indonesia reached Platinum predicate with a total of 58 points or 75.32%.
### Table 2. Design Recommendations (Architectural)

| Category | Criteria                  | Recommendation                                                                                                                                 |
|----------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| ASD      | Bicycle Facility          | Recommendations that can be made in this category are to provide parking for bicycles as much as 1 parking unit per 20 building users up to a maximum of 100 bicycle parking units. So it can add 2 points. |
| EEC      | On-Site Renewable Energy  | Recommendations that can be made in this category are the need for the use of renewable energy on-site such as the use of photovoltaics (PV) technology, which directly converts sunlight into solar electricity. So it can add 3 points. |
| WAC      | Water Recycling           | Utilizing recycled water from STP is there to meet irrigation needs, flushing, and provide a tank for recycled water reservoir. So it can add 3 points. |
|          | Alternative Water Resources| Making a system for water purification alternatives such as air conditioning condensation water, used ablution water, or rainwater so that it can be used as clean water. So it can add 2 points. |

### Table 3. Management Recommendations (Non-Architectural)

| Category | Criteria                  | Recommendations                                                                                     |
|----------|---------------------------|-----------------------------------------------------------------------------------------------------|
| IHC      | CO₂ Monitoring            | It is suggested to be equipped with sensor installation to maintain CO₂ levels and to keep the room healthy and comfortable. |
| BEM      | GP as a Member of Project Team | Involving specifically Greenship Professional certified in the design of this building. |

Based on the recommended criteria, the building will get increased points and predicate, total results Evaluation values and recommendations can be seen in Table 4.

### Table 4. Recapitulation of Assessment Results after Recommendation

| Category | Maximum Point | Point Earned | Recommendations Point | Percentage |
|----------|---------------|--------------|-----------------------|------------|
| ASD      | 17            | 11           | 2                     |            |
| EEC      | 26            | 15           | 3                     |            |
| WAC      | 21            | 9            | 5                     |            |
| MRC      | 2             | 2            |                       |            |
| IHC      | 5             | 5            |                       |            |
| BEM      | 6             | 6            |                       |            |
|          | 48            | 10           |                       | 75.32%     |

Number of Criteria and Benchmarks: 77

Total: 58
4. Conclusion

The results of the assessment index in each Greenship category in the building design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET) at Universitas Pendidikan Indonesia obtained an index value of 48 (forty-eight) with a percentage of 62.34%, then the building design of the Centre of Excellent (CoE) Technical and Vocational Education and Training (TVET), at Universitas Pendidikan Indonesia can be categorized as a Green Building with Gold Predicate. The Gold predicate can be upgraded to platinum with an index of 58 (fifty-eight), a percentage of 75.32% with a predicate of platinum, if the recommendations are made according to what has been recommended.

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