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Improving the Public Building Green Concept with Greenship New Building Version 1.2

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ABSTRACT

Green building criteria analysis research based on Greenship New Building version 1.2 in the Malang Creative Center (MCC) building aims to analyze criterion benchmarks and green rating building on MCC buildings based on greenship rating criteria tools. Because many buildings stand in Indonesia, especially Malang City, it causes environmental problems that have fatal consequences for human life. The research method used in solving the problem mentioned above, namely using a quantitative approach to examine the application of green building principles at MCC, is based on Greenship New Building version 1.2. Data was collected using observation techniques, interviewing experts and building managers. Results of the study based on the benchmark of green building criteria show a percentage of 37,62%. Therefore, it demonstrates that MCC gets a "bronze" rank. However, this ranking can still be upgraded to "gold" by paying attention and doing what experts suggest.

Keywords Greenship New Building version 1.2, Green Building, Mixed Method, Malang Creative Center

INTRODUCTION

In this increasingly modern and sophisticated era, development is inevitably required to meet the times (Laksmana & Wijayaningtyas, 2019). So, the massive growth required to support the facilities and infrastructure of human activities (Hidayat et al., 2021). However, with many buildings in Indonesia, especially Malang City, it is hoped that it will not cause fatal environmental damage to human life (Wijayaningtyas & Lukiyanto, 2021).

Preventive acts for these problems need rules and building owners' awareness to apply the green building concept. According to Gou (2017), "Green building is a building concept that in the design stage, construction work or operation can reduce or eliminate negative impacts and result in positive impacts on our climate and natural environment."

Malang Creative Center is one of the building projects in Malang City managed by the Office of Cooperatives, Industry, and Trade (Disperindag). The Malang Creative Center building will be used to develop the Malang City creative industry in the former building. TAPS. Located on A. Yani Street No.16, Blimbing District, Malang City. Therefore, checking a building with the concept of green building is necessary to follow the provisions that must be kept by the requirements of the Green Building Council Indonesia institution (Wijayaningtyas et al., 2021).

According to Green Building Council Indonesia (2016), "In Indonesia, the reference standards for the assessment of new building green building criteria version 1.2 include land use, energy efficiency, conservation, water conservation, material sources and cycles, health and comfort in space and building environment management". Each aspect consists of values/points that contain standard standards and recommendations for achieving the standards (Teddy et al., 2018). From the criteria set by the Green Building Council Indonesia institution,

researchers will conduct research on the Malang Creative Center building using an analysis of green building criteria with a research instrument in the form of a greenship rating tools system for new buildings version 1.2.

LITERATURE REVIEW

Green Building Concept

The concept of green building is present. It becomes necessary in the phenomenon of global warming and the issue of environmental damage sweeping humanity. Based on data from the World Green Building Council, worldwide, buildings contribute 33% of CO2 emissions, consume 17% of clean water, 25% of wood products, 30-40% of energy use, and 40-50% use of raw materials for their construction and operation (Reztrie et al., 2018; Wijayaningtyas et al., 2018). Therefore, the concept of green building is considered one of the solutions to reduce environmental damage and minimize carbon emissions, the leading cause of global warming, from the construction sector".

Greenship New Building Version 1.2

Greenship new building version 1.2 is a written assessment guide on the object of construction of a new building. Based on benchmarks that minimize the effects caused by development, including appropriate land use, energy efficiency and conservation, water conservation, material sources and cycles, health and comfort in space, and building environment management (GBCI, 2013).

Greenship Benchmarks

The benchmarks in the assessment of greenship new building version 1.2 are as follows:

a. Appropriate site development (ASD)
1. Green base area;
2. Site selection;
3. Community accessibility;
4. Public transportation;
5. Bicycle user facilities;
6. Climate micro; and
7. Rain runoff water management.

b. Energy Efficiency and Conservation (ECC)
1. Sub-meter installation;
2. OTTV calculation;
3. Natural lighting;
4. Ventilation;
5. Effects of climate change; and
6. Renewable energy in the footprint.

c. Water Conservation (WAC)
1. Water meter;
2. Water use calculation;
3. Reduction of water use;
4. Water features;
5. Water recycling;
6. Alternative water sources;
7. Rainwater storage; and
8. Efficiency of landscape water use.

d. Material Resources and Cycle (MRC)

1. Refrigerant fundamental;
2. Use of buildings and materials;
3. Environmentally friendly materials;
4. Use of refrigerants without ODP;
5. Certified wood;
6. Prefabricated materials; and
7. Regional materials.

e. Indoor Health and Comfort (IHC)

1. Introduction to the outside air;
2. Monitoring CO_2 levels;
3. Control of cigarette smoke in the environment;
4. Chemical pollutants;
5. The out view of the building;
6. Visual comfort;
7. Thermal comfort; and
8. Noise level.

f. Building Environment Management (BEM)

1. Basic waste management;
2. Greenship professional as a member of the project team;
3. Pollution from construction activities;
4. Advanced waste management;
5. Good and correct commissioning system;
6. Green building data submission;
7. Agreement on doing fit-out activities; and
8. Building use survey.

Rating System

The green building ranking is divided into four levels, namely Platinum rank, Gold rank, Silver rank, and Bronze rank. Each order has its rating. Platinum rank is obtained if the assessment of the application of green building gets a percentage of 73% and a minimum value of 74. Gold rank is obtained if the evaluation of the application of green building receives a rate of 57% and a minimum value of 58. Silver rank is obtained if the assessment of the application of green building gets a percentage of 46% and a minimum value of 46. Bronze rank is obtained if the evaluation of the application of green building receives a ratio of 35% and a minimum value of 35.

MATERIALS AND METHODS

The sampling approach estimates the number of samples based on the sample size used as the actual data source, considering the population's characteristics and distribution to generate a representative sample (Duan et al., 2015). Malang Creative Center (MMC) conducts research in the former Regional Drinking Water Company (PDAM) building. The research location is A. Yani Street, No.16, Blimbing District, Malang City, with coordinates 7°56'26" south and 112°38'31" east. This research analyzed the Greenship New Building version 1.2-based green building application system. The research was conducted through direct observation (observation) and interviews to confirm that professionals or officials were involved in the Malang Creative Center (MMC) project.

Data Collection

In this research, data collection came from direct visits to related parties related to the development of the Malang Creative Center, including:

a. Non-participation observations

Observation activities are carried out by going directly to the research location. Researchers can observe and document important events on the research object that are useful for obtaining the data needed.

b. Interview

Denzin, Norman and Lincoln (2017) show that an interview is a conversation with a specific intent carried out by both parties, the interviewer who asks the question and the interviewer who answers the question. From interviews, researchers can seek information verbally through the submission of questions that refer to the benchmarks for assessing the criteria of greenship rating tools to respondents who understand related to the existing condition of the building.

c. Questionnaire

At this data collection step, the researcher gave a written data leaflet containing measurable questions referring to the greenship rating tools criteria to respondents who understood the existing conditions of the building.

Research Variables

This study has six factors: proper site planning, energy efficiency and water conservation, material resources and cycle, indoor health and comfort, and building environment management (GBCI, 2013). Figure 1 shows each criterion for the variables studied.

Data Analysis

This research's data analysis comprises evaluating the findings of green building measures and ranking the greenship of the new building version 1.2 at the Malang Creative Center. First, calculating the score using the results of assessing the green building criteria in the Malang Creative Center (MCC) building in line with version 1.2 of the greenship rating tools criterion for new buildings. Then, the value and percentage table of the greenship of the new building version 1.2 is derived using research factors. Table 1 displays the greenship of the new building version 1.2 value and percentage.

After ranking the greenship of the new building version 1.2 in the Malang Creative Center building, technical recommendations are input from the research results reviewed by green building experts, as evidenced by a valid certificate of recognition from the institution. The input results can be used as an addition to complement the research on the achievement of good researchers.

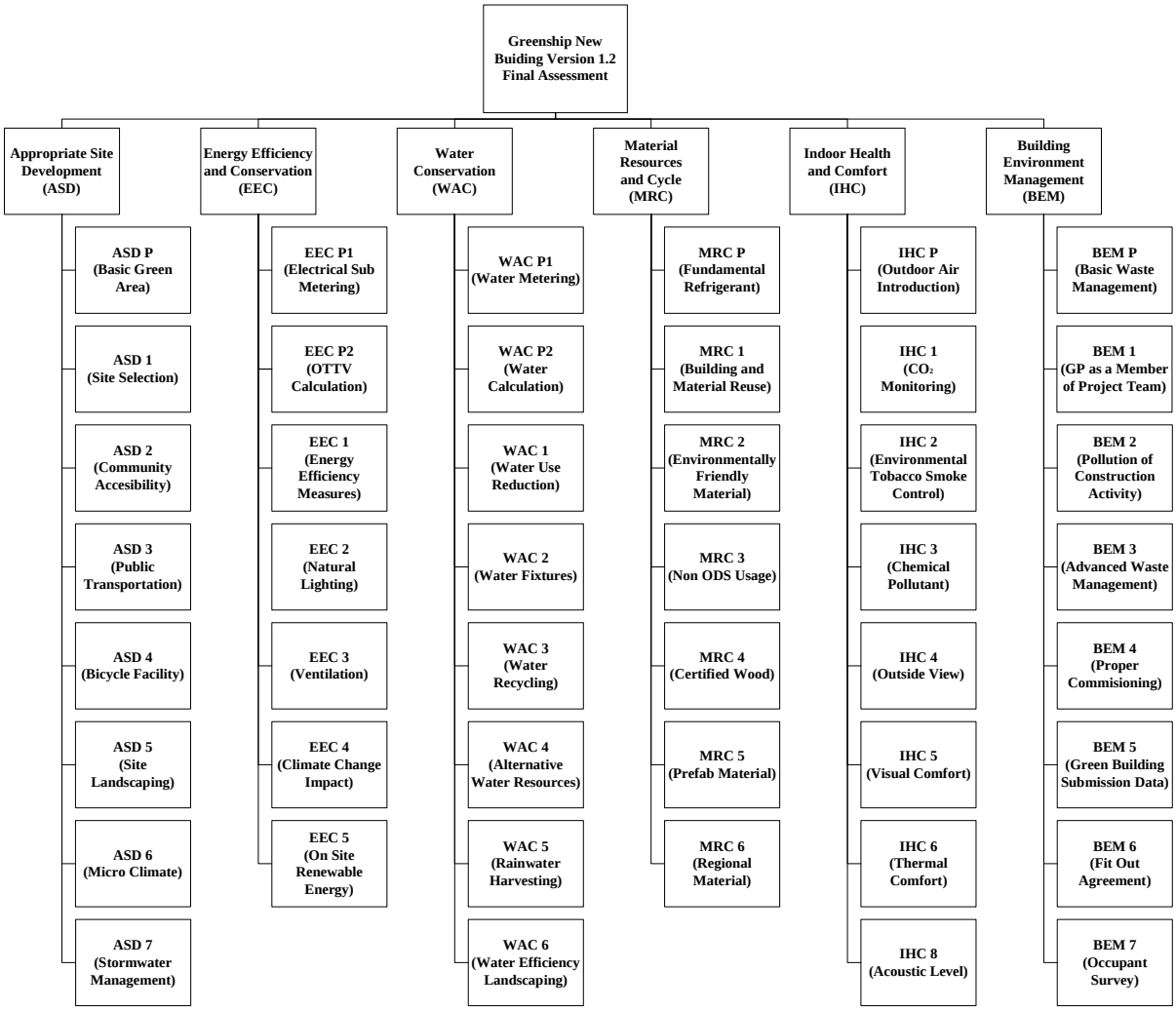

Figure 1. Final Assessment Variables of Greenship New Building Version 1.2

Table 1. Values and Percentages of Six Categories

Categories	Criteria		Maximum Criterion Value
Appropriate Site Development	P	Basic green area	P
	1	Site selection	2
	2	Community Accessibility	2
	3	Public transportation	2
	4	Bicycle facility	2
	5	Site landscaping	3
	6	Microclimate	3
	7	Stormwater management	3
Energy Efficiency and Conservation	P1	Electrical sub-metering	P
	P2	OTTV calculation	P
	1	Energy efficiency measures	1-20
	2	Natural lighting	4
	3	Ventilation	1
	4	Climate change impact	1
	5	Onsite renewable energy	5
Water Conservation	P1	Water metering	P
	P2	Water calculation	P
	1	Water use reduction	8

Categories	Criteria		Maximum Criterion Value
	2	Water fixtures	3
	3	Water recycling	3
	4	Alternative water resources	2
	5	Rainwater harvesting	3
	6	Water efficiency landscaping	2
Material Resources and Cycle	P	Fundamental refrigerant	P
	1	Building and material reuse	2
	2	Environmentally friendly material	3
	3	Non-ODP usage	2
	4	Certified wood	2
	5	Prefabricated material	3
	6	Regional material	
Indoor Health and Comfort	P	Outdoor air introduction	P
	1	CO2 monitoring	1
	2	Environmental tobacco smoke control	2
	3	Chemical polutant	3
	4	Outside view	1
	5	Visual Comfort	1
	6	Thermal comfort	1
	7	Acoustic level	1
Building Environment Management	P	Basic waste management	P
	1	Greenship professional as a member of the project team	1
	2	Pollution of construction activity	2
	3	Advanced waste management	2
	4	Proper commissioning	3
	5	Green building data submission	2
	6	Fit out agreement	1
	7	Occupant survey	2
Total Value of All Categories	**101**	**100%**	

Source: GBCI, 2013

RESULTS AND DISCUSSION

Analysis Greenship New Building of Version 1.2

The evaluation in the Greenship Rating Tools Criteria for New Buildings Version 1.2 is about the Green Building Council Indonesia's recognized benchmark and technology. This study examined the variables of appropriate site development, energy efficiency and conservation, water conservation, material sources and cycles, interior health and comfort, and building environmental management.

Appropriate Site Development

The following scores were obtained from these benchmarks as a research reference in Table 2.

Table 2. Assessment of Appropriate Site Development Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Basic green area	P	P1	
2.	Site selection	2	2	

3.	Community Accessibility	2	2	12.87%
4.	Public transportation	2	2	
5.	Bicycle facility	2	2	
6.	Site landscaping	3	0	
7.	Microclimate	3	2	
8.	Stormwater management	3	3	
Total		**17**	**13**	**12.87%**

The assessment results for the Appropriate Site Development category of the greenship rating tools criteria for new buildings version 1.2 indicate that the score value for site landscaping and microclimate is less than optimal. It shows that less than 40% of the total land area is provided for landscaping in the form of vegetation free from garden buildings positioned above ground level. Moreover, developing landscaping in the form of flora in the pedestrian circulation core does not signal protection from solar radiation heat or safety from strong winds (Qureshi et al., 2017).

According to Figure 2, the rate of land use assessment outcomes is typically 100%. Additionally, a few factors are investigated, such as site selection, community accessibility, public transportation, bicycle user amenities, and water management from rain runoff. The microclimate makes up 67% of these factors, whereas site landscaping makes up 0%.

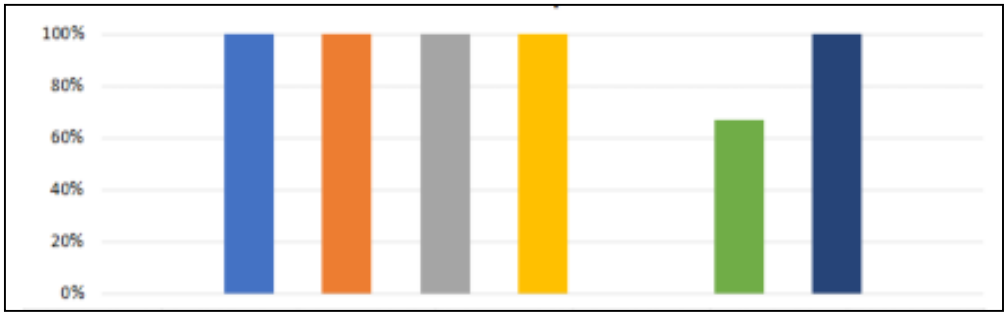

Figure 2. Percentage of Appropriate Site Development Assessment

The explanation of the figure is as follows:

: Site selection = 100%
: Community accessibility = 100%
: Public transportation = 100%
: Bicycle facility = 100%
: Micro climate = 67%
: Stormwater management = 100%

Energy Efficiency and Conservation

From these benchmarks as a research reference, the following score values were obtained in Table 3.

Table 3. Assessment of Energy Efficiency and Conservation Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Electrical sub-metering	P	P1	
2.	OTTV calculation	P	P2	
3.	Energy efficiency measures	1-20	2	
4.	Natural lighting	4	2	

5.	Ventilation	1	1	4.95%
6.	Climate change impact	1	0	
7.	Onsite renewable energy	5	0	
Total		**26**	**5**	**4.95%**

The energy efficiency and conservation assessment results include only one variable with a ratio of 100%, namely the ventilation, followed by natural lighting at 50% and energy-saving measures at 13%. In addition to these three variables, two variables, namely the influence of climate change and renewable energy on the site, do not receive an evaluation point, or 0% of the assessment percentage, in the construction of the Malang Creative Center (Figure 3).

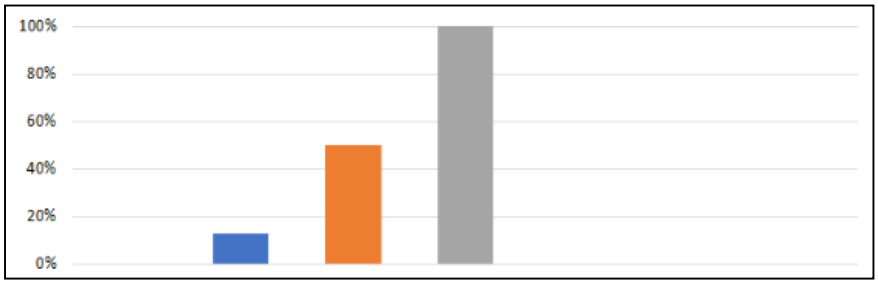

Figure 3. Percentage of Energy Efficiency and Conservation Assessment

The explanation of the figure is as follows:

: Energy efficiency measures = 13%
: Natural lighting = 50%
: Ventilation = 100%

Water Conservation

From the benchmark research reference, the following score scores were obtained in Table 4.

Table 4. Assessment of Water Conservation Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Water metering	P	P1	4.95%
2.	Water calculation	P	P2	
3.	Water use reduction	8	0	
4.	Water fixtures	3	2	
5.	Water recycling	3	2	
6.	Alternative water resources	2	0	
7.	Rainwater harvesting	3	0	
8.	Water efficiency landscaping	2	1	
Total		**21**	**5**	**4.95%**

The results of the percentage of water conservation assessment do not have variables that have a percentage of 100%. In comparison, the evaluation rate obtained includes 67% in water feature variables and water recycling and 50% on the variable efficiency of landscape water use. In addition to these three variables, three did not get an assessment point in the construction of the Malang Creative Center which means 0% percentage of the assessment, namely reducing water use, alternative water sources, and rainwater storage (Figure 4).

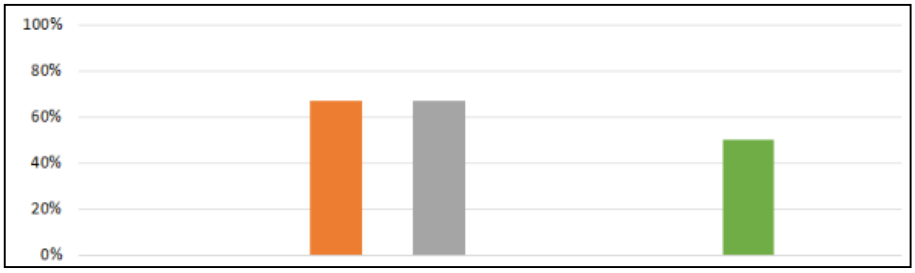

Figure 4. Percentage of Water Conservation Assessment

The explanation of the figure is as follows:

: Water fitures = 67%
: Water recycling = 67%
: Water efficiency landscaping = 50%

Material Resources and Cycle

From these benchmarks as a research reference, the following score values were obtained in Table 5.

Table 5. Assessment of Material Resources and Cycle Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Fundamental refrigerant	P	P1	6.93%
2.	Building and material reuse	2	0	
3.	Environmentally friendly material	3	0	
4.	Non-ODP usage	2	2	
5.	Certified wood	2	0	
6.	Prefabricated material	3	3	
7.	Regional material	2	2	
Total		**14**	**7**	**6.93%**

The evaluation of material source and cycle evaluation yields just two percentages. First, it obtained 100% for using refrigerants without ODP, prefabricated materials, and regional materials. Meanwhile, 0% for using used structures and materials, ecologically friendly materials, and certified wood (Figure 5).

Figure 5. Percentage of Material Resources and Cycle Assessment

The explanation of the figure is as follows:

: Non ODP usage = 100%
: Prefabricated material = 100%
: Regional material = 100%

Indoor Health and Comfort

From these benchmarks as a research reference, the following score scores were obtained in Table 6.

Table 6. Assessment of Indoor Health and Comfort Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Outdoor air introduction	P	P1	2.97%
2.	CO2 monitoring	1	0	
3.	Environmental tobacco smoke control	2	0	
4.	Chemical polutant	3	1	
5.	Outside view	1	1	
6.	Visual Comfort	1	0	
7.	Thermal comfort	1	1	
8.	Acoustic level	1	0	
Total		**10**	**3**	**2.97%**

The percentage of indoor health and comfort assessment results are only two variables with a rate of 100%, namely the view outside the building and thermal comfort, 33%, which is chemical pollutants. In addition to these three variables, four did not get an assessment point in the construction of the Malang Creative Center, meaning 0% of the assessment percentage, namely monitoring CO_2 levels, controlling cigarette smoke in the environment, visual comfort, and noise levels (Figure 6).

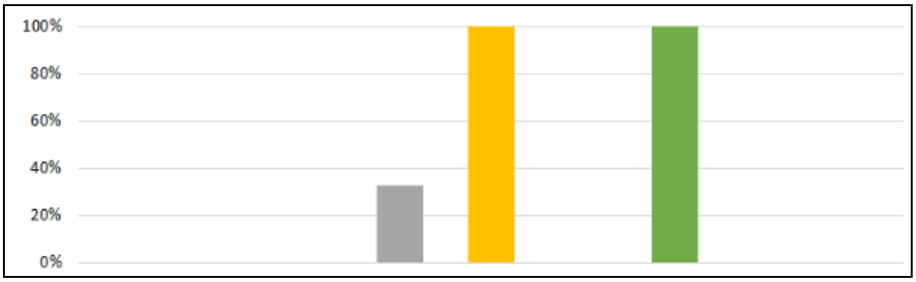

Figure 6. Percentage of Indoor Health and Comfort Assessment

The explanation of the figure is as follows:

: Chemical polutant = 33%
: Outside view = 100%
: Thermal comfort = 100%

Building Environment Management

From these benchmarks as a research reference, the following score scores were obtained in Table 7.

Table 7. Assessment of Building Environment Management Benchmarks

No.	Indicator	Maximum Criterion Value	Score	Percentage
1.	Basic waste management	P	P1	
2.	Greenship Professional as a member of the project team	1	0	

3.	Pollution of construction activity	2	1	
4.	Advanced waste management	2	1	
5.	Proper commissioning	3	3	
6.	Green building data submission	2	0	
7.	Fit out agreement	1	0	4.95%
8.	Occupant survey	2	0	
Total		**13**	**5**	**4.95%**

The building environmental management assessment results include only one variable with a score of 100%, namely a good and accurate commissioning system, and two variables with a score of 50% each, namely pollution from construction activities and advanced waste management. In addition to the three variables listed, four variables do not receive an assessment point in the construction of the Malang Creative Center, representing 0% of the assessment percentage. These variables are Greenship Professional as a project team member, submission of green building data, agreement in carrying out fit-out building activities, and building use surveys (Figure 7).

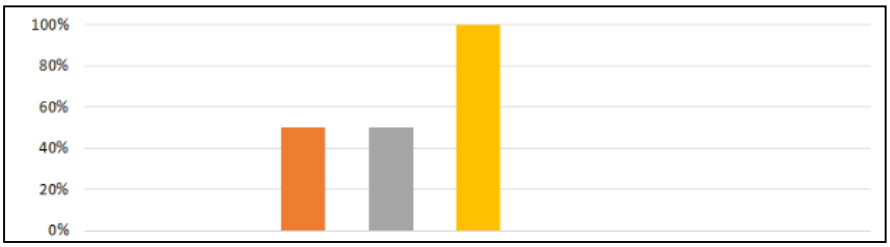

Figure 7. Percentage of Building Environment Management Assessment

The explanation of the figure is as follows:

: Pollution of construction activity = 50%
: Advanced waste management = 50%
: Proper commissioning = 100%

Determining Rating of Greenship New Building Version 1.2

Based on the benchmarks in each indicator, the final result is obtained, as shown in Table 8.

Table 8. Conclusion of Criterion Values

No.	Categories	Maximum Criterion Value	Score	Percentage
1.	Appropriate Site Development	17	13	
2.	Energy Efficiency and Conservation	26	5	
3.	Water Conservation	21	5	
4.	Material Resources and Cycle	14	7	
5.	Indoor Health and Comfort	10	3	
6.	Building Environment Management	13	5	37.62%
Total		**101**	**38**	**37.62%**

The greenship rating tools for new buildings version 1.2 assessment yielded a score of 38 with a weight percentage of 37.62%. As a result, the Malang Creative Center (MCC) building may be classified as a bronze-level green building.

Discussion for Greenship Analysis at MCC

On the result of the benchmark study and green building rating analysis results for the Malang Creative Center (MCC) building, the following opinions and suggestions were solicited from green building experts:

a. The building construction project for the Malang Creative Center (MCC) should be able to rank higher than bronze. It still includes a new building with continuing construction, so promotion can occur before the structure is operational. According to the results of the analysis, in descending order of the lowest scores and percentages:

1. Energy Efficiency and Conservation percentage is 19%.
2. Water Conservation percentage is 23%.
3. Indoor Health and Comfort percentage of 30%.
4. Building Environment Management percentage is 38%.
5. Material Resources and Cycle percentage of 50%.
6. Appropriate Site Development percentage is 76%.

b. The ranking in the analysis's findings order, which is less than 38%, could be made better by the following:

1. Energy-saving technologies, such as motion sensors, must be used to turn on the lights.
2. New applications for renewable energy, such as the use of solar-generated electricity. Example: Solar-powered roof coating.
3. Using an integrated building operational system, the building's energy production is optimized to respond to the climate (Lu et al., 2019; Moghayedi et al., 2021).
4. Water conservation solutions like automatic sensors for water outflow should be available.
5. It may make the most of rainwater by using rainwater storage tendons to support buildings.
6. For building support water, for instance, air conditioning wastewater optimization (Teddy et al., 2018).

Table 9 and Figure 8 compare the assessments of green buildings made by professionals.

Table 9. Recapitulation of Final Scoring Result and Suggestions from Experts

No.	Categories	Maximum Criterion Value	Research Study		First Alternative		Second Alternative	
			Score	Percentage	Score	Percentage	Score	Percentage
1.	Appropriate Site Development	17	13	12.87%	13	12.87%	13	12.87%
2.	Energy Efficiency and Conservation	26	5	4.95%	8	7.92%	23	22.77%
3.	Water Conservation	21	5	4.95%	11	10.89%	11	10.89%
4.	Material Resources and Cycle	14	7	6.93%	7	6.93%	7	6.93%
5.	Indoor Health and Comfort	10	3	2.97%	3	2.97%	3	2.97%

6.	Building Environment Management	13	5	4.95%	5	4.95%	5	4.95%
Total		**101**	**38**	**37.62%**	**47**	**46.53%**	**62**	**61.39%**

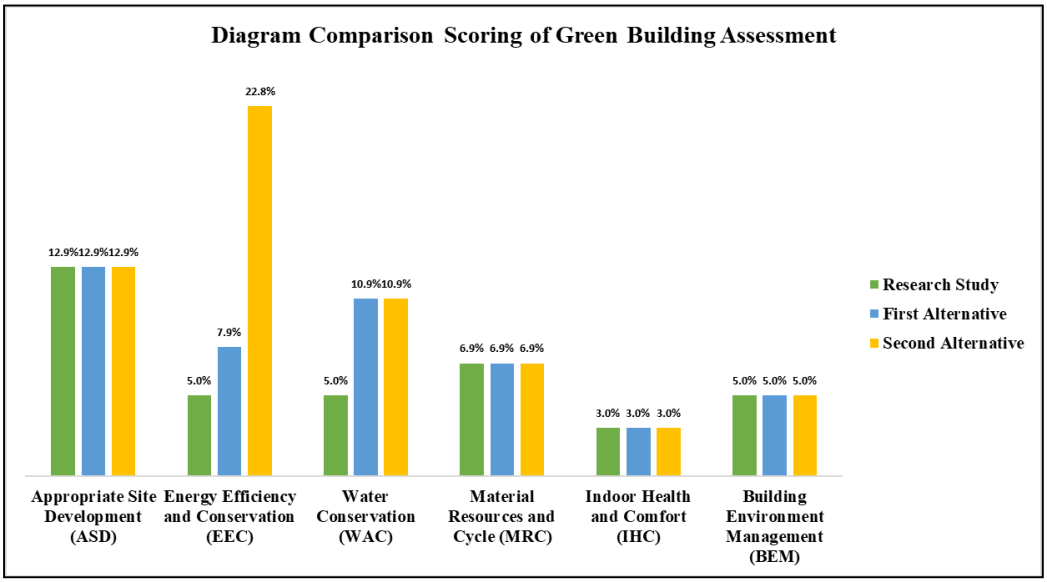

Figure 8. Comparison of Final Scoring Result and Suggestions

CONCLUSIONS

Based on the results and conversations stated previously, the following conclusions can be drawn:

The benchmark of green building criteria in the Malang Creative Center (MMC) building, based on the greenship rating tools criterion for new building version 1.2, received several benchmark criteria points, including the following:

Appropriate Site Development received a score of 13 (12.87%).

Energy Efficiency and Conservation receives a score of 5 and a notional percentage of 4.95%.

Water Conservation receives a 5 with a notional percentage of 4.95%.

Material Resources and Cycle received a score of 7 and 6.93%.

Indoor Health and Comfort receives a score of 3 with a nominal percentage of 2.97%.

The score for Building Environment Management is 5, with a notional percentage of 4.95%.

The benchmark assessment for green construction criteria yielded a score of 38. Therefore, the total score obtained was 38, for a percentage of 37.62%. Therefore, it is reflected in the minimum bronze ranking score of 35.35, which corresponds to a percentage of 35%. Based on the results of the benchmark evaluation score for green building criteria, the building construction project for the Malang Creative Center (MCC) should be able to rank even higher than the acquired grade because it is still in the construction phase.

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