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Implementing the Greenship Existing Building 1.1 to Improve Catholic Church Performance (Case Study: St. Antonius Padua Pasuruan, East Java)

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Abstract Caring for, utilizing and preserving cultural heritage buildings located in polluted areas is not a simple matter. There are many things that become the focus of attention, such as commitment and consistency of human resources, various policies/ regulations as conservation guidelines, supporting equipment, maintenance/ renovation methods, recycling/ reuse materials, utilization management, and cost optimization. Evaluating the performance of cultural heritage buildings based on the Greenship Existing Building Version 1.1. becomes valuable input for managers. The next step is to evaluate the green perception and behavior of the Catholics to overcome the problem of disturbing the comfort of worship. Environmental improvement and improving the quality of green perception and behavior are two inseparable things, interrelated and reinforcing each other. Utilizing Greenship parameters and Importance Performance Analysis can produce a form of evaluation that is right on target. The results of the evaluation become recommendations for the implementation of improving building performance and optimizing the cost of preserving the Catholic Church of St. Antonius Padua Pasuruan as a cultural heritage. Research shows that the Church is ranked Silver, with a Church score of 52.99% (62 points) smaller than the total score of 117 points. Efforts to improve church performance based on the potential of Catholics are focused on reforestation, saving electricity consumption and increasing the capacity of church building maintenance personnel.

Keywords Evaluation, Greenship, Improvement, Church Performance, Recommendations

1. Introduction

The Church of St. Anthony of Padua was built and inaugurated on July 28, 1895, and was designated as a cultural heritage in May 2020 by the Decree of the Mayor of Pasuruan No.188/166/423.011/2020. As a place of worship, this church is designed with a comfortable and environmentally friendly character in the Pasuruan city area [2].

However, due to climate change and environmental degradation, the church is experiencing discomfort in the form of pollution and seawater intrusion. Thus, the evaluation and implementation based on Greenship Existing Building Version 1.1 is a continuous effort for the preservation of the cultural heritage church.

Based on the Greenship, the assessment of the comfort and friendliness of the church was carried out in the period October 2020-January 2021 by the church administrator, the Pastoral Council of the Parish of St. Antonius Padua Pasuruan. This joint assessment data is processed by Importance Performance Analysis. This assessment is carried out together with the management so that all people actively participate in preserving the cultural heritage church and its environment [3].

The results of the assessment become useful recommendations for improvement in Catholic church service performance. Recommendations are based on the potential of the people in terms of knowledge, finance, availability of tools and materials [4] in the Pasuruan area.

2. Literature Study

Regulation of the State Minister for the Environment Number 8 of 2010 states that green buildings are buildings that apply elements of environmental function preservation in their design, construction, operation, and management and are important aspects in handling the impacts of climate change [5,6,7].

Roshaunda (Roshaunda et al., 2019) citing Brenda and Robert Vale (1991) in the book Green Architecture Design For Sustainable Future states that green building has the following principles [11]:

1. Save Energy

This principle presupposes the maximum utilization of solar energy sources in the operation of a building.

2. Working with Climate

This principle presupposes maximum utilization of natural, climatic and environmental conditions in the operation of a building.

3. Respect the Site

This principle presupposes the maximum utilization of the function of the building with the land on which the building is built, so that the existence and operation of the building do not damage the surrounding environment.

4. Respect Users

This principle presupposes the achievement of maximum comfort and health for the occupants.

Green Building Council Indonesia (2010) classifies Greenship into six categories, namely: 1) Greenship Net Zero Healthy (NZH); 2) Greenship New Building (NB); 3) Greenship Existing Building; 4) Greenship Interiors; 5) Greenship Homes, and 6) Greenship Neighborhood [8].

Greenship Existing Building (GEB) is a guideline for performance appraisal operational management and building maintenance that has been built into six categories. Each category contains various prerequisites, credit points, and bonus points with a total value of 117 points [9], as follows:

1. Appropriate Site Development (ASD);
2. Energy Efficiency and Conservation (EEC);
3. Water Conservation (WAC);
4. Resources and Material Cycle (MRC);
5. Indoor Health and Comfort (IHC) and
6. Building and Environmental Management (BEM).

This Greenship system aims to cultivate healthy buildings, affordable costs, durable and environmentally friendly.

Table 1 shows the Parameters Greenship for Existing Building, for example, parameter of Energy Efficiency and Conservation has a credit score is 36 and its bonus is 8 (or the percentage is 30.77%).

Table 2 shows the rank of parameters that provide platinum, gold, silver, and bronze ratings for buildings constructed [10]. For example, Platinum's ranking number is 1 with a score of 86 or a percentage of 73%.

Table 1. Parameters Greenship for Existing Building [8]

Code	Parameter	Score		Percentage
		Credit	Bonus	
ASD	Appropriate Site Development	16		13,68%
EEC	Energy Efficiency and Conservation	36	8	30,77%
WAC	Water Conservation	20	2	17,09%
MRC	Material Resource and Cycle	12		10,26%
IHC	Indoor Health and Comfort	20		17,09%
BEM	Building Environment Management	13		11,11%
		117		100%

Table 2. Ranking Greenship for Existing Building [8]

Rank	Score	Percentage
Platinum	86	73%
Gold	67	57%
Silver	54	46%
Bronze	41	35%

3. Research Method

The research method is a mixed method [12,13] based on Greenship for Existing Building with interviews with administrators, observations with air quality test equipment, clean water, ground water, noise and lighting and a green perception and behavior questionnaire with Importance Performance Analysis. This research was conducted to calculate church performance scores and rankings and to prepare recommendations for implementing church performance improvements based on people's potential [4].

The research method used is a mixed method [12,13] based on a sequential Greenship for Existing Building using a qualitative method with observation and interviews, and a quantitative method with a field survey [12,13,14].

This research with a deductive quantitative approach aims to evaluate the performance of church buildings based on the criteria in Greenship [12,14]. Various instruments

were used to collect air quality data (CO_2, TVOC, HCHO, PM 2.5, PM 10, O_2, CO, H_2S, LEL, air temperature, humidity, and wind speed); water quality data (salinity, O_2, pH, TDS, H_2S, Iron, Copper, Lead, Nitrate, Nitrite, Bromine, Total Chlorine, Chromium, Fluoride, Cyanuric acid, Hardness and E coli/E coliform bacteria); data on soil quality, noise and lighting. This research was conducted to calculate church performance scores and ratings and to develop recommendations for improving church performance based on community potential [4] with a higher Greenship rating target.

Apart from that, this research also uses an inductive qualitative approach with the Importance Performance Analysis method. This qualitative research aims to evaluate green perceptions and behaviors as well as seek to increase the knowledge and green behavior of stakeholders based on Greenship [12] in preserving cultural heritage churches.

Considering the large congregational population of 1625 people, this research uses purposive sampling based on the following:

1. the subject's ability to perceive the environment and the feasibility of GKCB;
2. maturity in thinking and acting;
3. the ability to communicate through social media;
4. active in GKCB ecclesiastical office;
5. the intensity of the subjects carrying out their daily tasks in the preservation of GKCB;
6. Subjects are GKCB ecclesiastical administrators and officials for the 2016-2021 period, both active and retired, visitors, local government officials/related services, and church representatives from youth to elderly clusters, who meet the qualifications.
7. Subjects are faithful people who are active in activities during the 2020-2021 pandemic
8. People who live or have daily activities around the church.

4. Research Results and Discussion

The result of the first research is an assessment of church performance based on Greenship for Existing Building 1.1.

Table 3 shows the Greenship-based assessment, for example parameter Appropriate Site Development (ASD) has GBCI score is 16 and Church score is 13 and the quality is 11.11%, and the total quality is 52.99%. It means the rank of parameter is silver (see Table 2).

Table 3. Accumulation of Greenship-based Church Performance Assessment Results [14]

Parameters	Score GBCI	Score Church	Quality
ASD	16	13	11,11%
EEC	36	23	19,66%
WAC	20	6	5,13%
MRC	12	8	6,84%
IHC	20	7	5,98%
BEM	13	5	4,27%
	117	62	**Silver** 52,99%

Based on Greenship, all parameters are below the minimum score. Based on the scores obtained from the smallest to the largest BEM, WAC, IHC, MRC, ASD, EEC, the implementation of performance improvement can be planned properly. However, the manager determines the form of implementation based on financial capacity, the availability of materials and equipment as well as the knowledge and ability of the manager to preserve the cultural heritage church [10,14].

The results of the second research are five forms of disturbances in the comfort of worship experienced by members of the Pasuruan Catholic Church and solutions in the form of recommendations.

Figure 1 shows (Quantitative research) that church members experience disturbances in the comfort of worship due to five things, namely: *one*, noise (100% of respondents said they were disturbed); *two*, RTH environmental cooling performance (81,72% of respondents said they were disturbed); *three*, high electricity consumption for the management of air circulation, light and sound (71,27% of respondents said they were disturbed); *four*, hot and dusty environment (70,91% of respondents said they were disturbed); *five*, poor air circulation in room (53,33% of respondents said they were disturbed).

Table 4 shows (based on the perception) that managers respond to various disturbances using the Importance Performance Analysis method. Jacquelyn (Monday, 2005) stated that this response process should involve the participation of many people in formulating recommendations. The results of the analysis become a reference for recommending solutions [15]. The basis for the manager's actions to determine the solution is Quadrant A (improvement) in Figure 2.

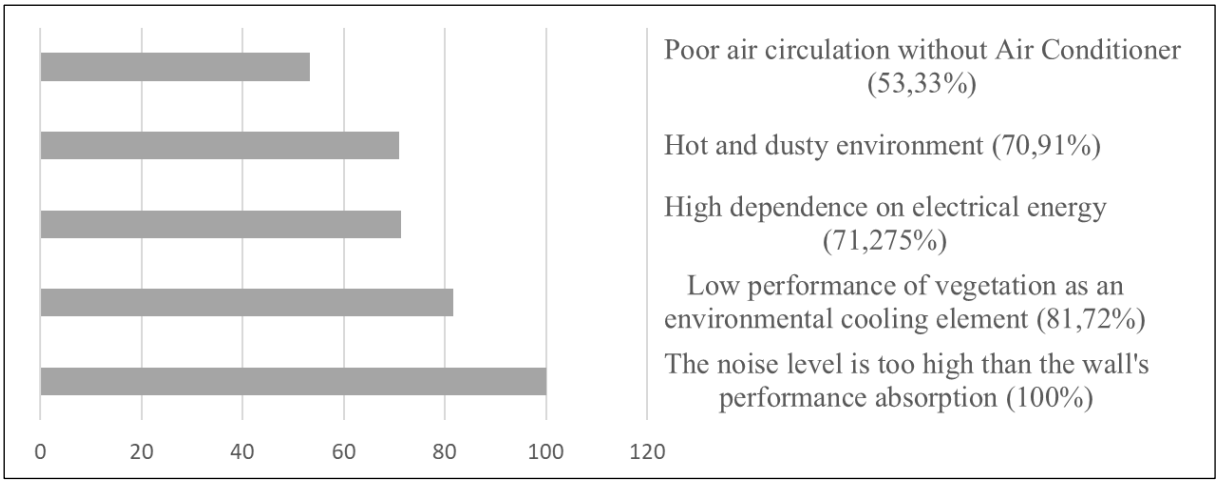

Figure 1. Inhibiting Factors for Convenience of Worship User Version (Analysis results)

Table 4. Conformity Level of Church Performance in User Perception

Item Code		Information	Performance Appraisal Weight	Importance Level Weight	Suitability Level	Average Service Performance Weight	Average Weighted Level of Interest
a	ASD P1	Site Management Policy	28	28	100	3,5	3,5
b	ASD P2	Motor Vehicle Reduction Policy	20	24	83,33	2,5	3
c	ASD P1		21	23	91,304	2,63	2,875
d	ASD P1		24	26	92,308	3	3,25
e	EEC P1	Policy and Energy Management Plan	21	28	75	2,63	3,5
f	EEC 5	Operation and Maintenance	21	28	75	2,63	3,5
g	EEC 6	On Site Renewable Energy	17	26	65,385	2,13	3,25
h	WAC 2	Water Monitoring Control	23	27	85,385	2,88	3,375
i	WAC 6	Portable Water	21	24	87,5	2,63	3
j	MRC 1	Non ODP Usage	21	28	75	2,63	3,5
k	MRC 2	Material Purchasing Practice	24	26	92,308	3	3,25
l	MRC 3	Waste Management Practice	16	27	59,259	2	3,375
m	MRC 5	Management of Used Good	18	23	78,261	2,25	2,875
n	IHC P	No Smoking Campaign	25	27	92,593	3,13	3.375
o	IHC 1	Outdoor Air Introduction	15	27	55,556	1,88	3,375
p	IHC 5	Thermal Comfort	17	27	62,963	2,13	3,375
q	IHC 6	Visual Comfort	24	27	88,889	3	3,375
r	IHC 7	Acoustic Level	16	29	55,172	2	3,625
s	BEM 1	Innovations	23	26	88,462	2,88	3,25
t	BEM 5	Operation and Maintenance Training	21	27	77,778	2,63	3,375

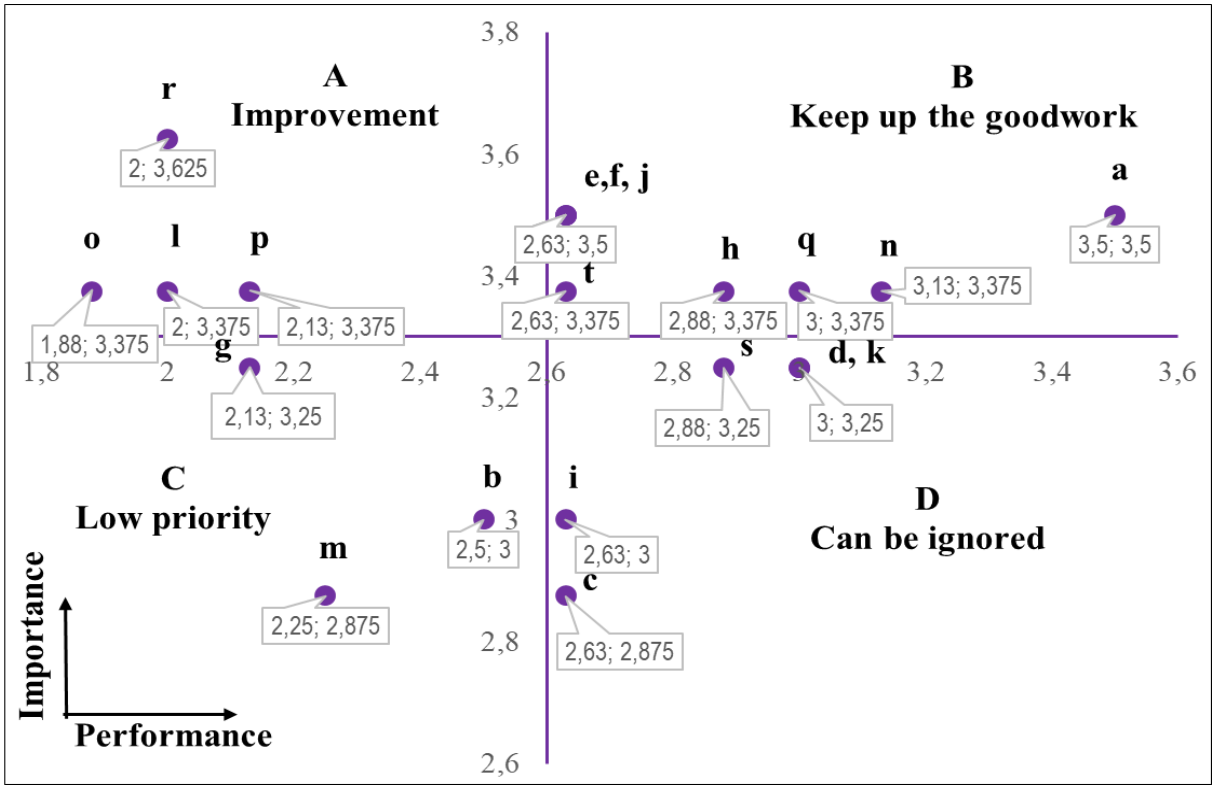

Figure 2. Plotting of Greenship-Based Perception and Behavior Analysis Results

The green perception and behavior of church administrators are very important and very decisive in making existing policies [16].

Figure 2 (based on the Cartesian IPA diagram) shows the manager views the need to improve church performance in terms of:

1. Management of waste, waste or rainwater runoff (MRC 3, point l)
2. Air circulation system (IHC 1, point o)
3. Indoor thermal arrangement (IHC 5, point p)
4. Room acoustic management (IHC 7, point r)

The following information is a recommendation to improve church performance from the perspective of Greenship Existing Building Version 1.1 and Management Perceptions:

1. Re-operating the composter which had been stopped since the pandemic Covid 19, April 2020.
2. Expanding green open space as a weather cooler to have an area of more than 30% of the Church area as a nature-based solution that contains social, economic, cultural and ecological benefits [17].

Recommendations for vegetation characters in Table 5:

a) Long-lived shady trees, broadly titled and the leaves do not fall off easily;
b) Arrangement of tree branches at least 2.0 meters from the ground;
c) Easy maintenance, can withstand the conditions of the Pasuruan area and is non-toxic;
d) Roots do not interfere with the structure of the building.

Table 5 and Figure 3 shows the recommendation of vegetation, function and location, for example, number 1 (see Table 5) – location c and d (see Figure 3) is suitable for planting Tanjung (Indonesian name) tree, and the function for shade tree and reduce noise.

Table 5. Recommendation of Vegetation, Function and Location in Figure 3 [14]

No	Name (functions)	Location
1	Tanjung, *Mimusops elengi* (shade tree and noise reduction) [1]	c, d
2	Glodog, *Polyalthia longifolia* (shade tree and noise reduction) [1]	e, d
3	Mangga, Mangifera Indica (shade tree and productive tree) [1]	a, d
4	Kiara, *Fellicium Decipiens* (shade tree and noise reduction) [1]	b, c, d

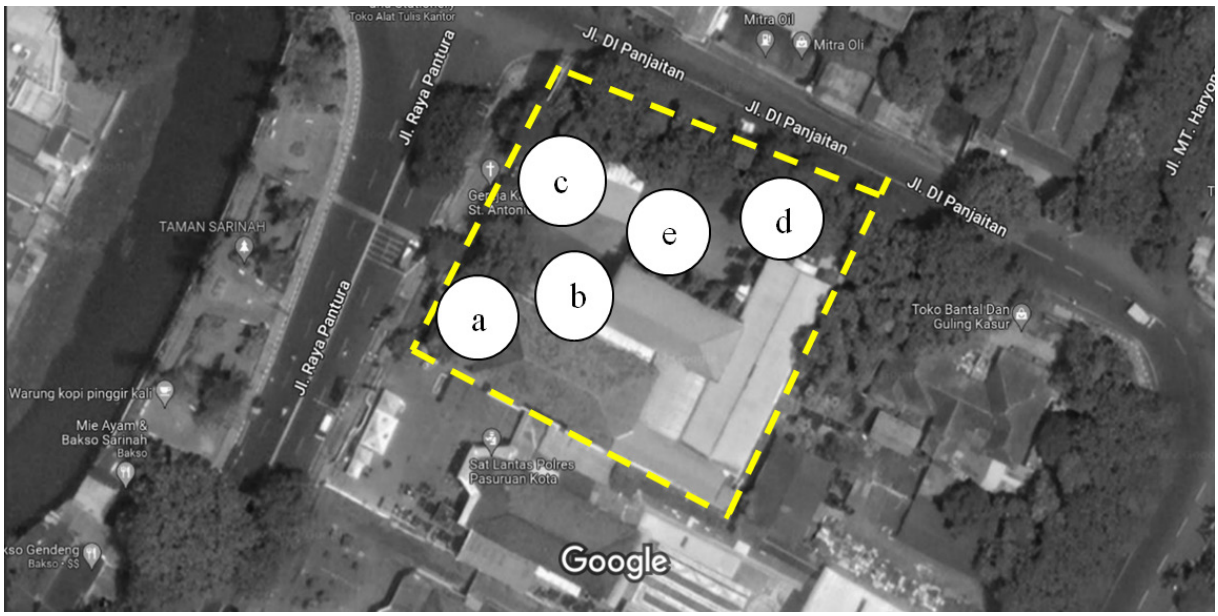

Figure 3. Recommended Vegetation Locations [20]

3. Replacement of paving blocks in Figure 4 with grass blocks in Figure 5 [14].

Figure 4 is a field or park using a solid paving block and Figure 5 is a field or park using a hollow paving block and planting the grass in the middle of the hollow paving block.

Figure 4. (Solid) Paving block

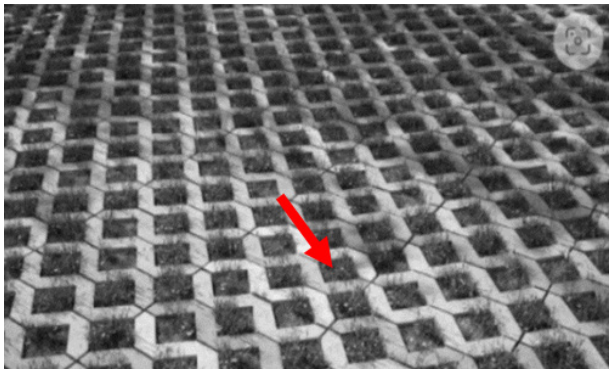

Figure 5. Grass (Hollow) paving block [19]

This activity aims to include increasing permeability, directing water to a more permeable area, retaining water to allow for infiltration, and intercepting and retaining rainwater for later use on-site [18].

4. Improved air circulation by increasing the window opening with an exhaust fan with a diameter of 40 cm at the location of Figure 6 and Figure 7.

Figure 6. Northwest Balcony Conditioning Location

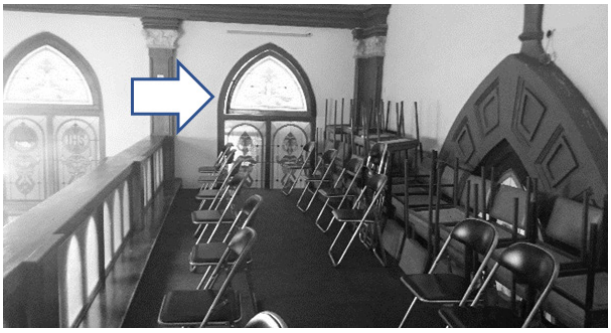

Figure 7. Southwest Balcony Conditioning Location

Table 6. Indoor Air Circulation Comfort Conditioning

P	Unit Condition		O_2	CO_2	PM		dB	%H	t	lux	Information	
	AC	Fan			2,5	10					PLN	Target
1	Off	Off	20,6	1002	0,36	0,42	66,7	78	30	379	0	0
2	Off	Off	20,6	706	0,36	0,40	63,0	77	29	81	0	0
3	On	Off	20,7	531	0,36	0,42	63,8	67	26	233	+	-
4	Off	On	20,3	840	0,44	0,62	71,1	79	29	233	-	-
5	*On*	*On*	*20,8*	*540*	*0,37*	*0,52*	*72*	*63*	*27*	*233*	+	+

Figure 6 shows the results of the conditioning (condition P5 in Table 6 – AC and fan went on) showed an increase in O_2 levels, a decrease in CO_2 levels and the achievement of the target room temperature of 27°C. This effort is able to increase air circulation in the room, even though there is an increase in electricity consumption [14].

Figure 7 shows the conditioning results (condition P5 in Table 6 – AC and fan went on) show that there is an increase in O_2 levels, a decrease in CO_2 levels and there is an achievement of the target indoor temperature of 27°C. This effort is able to improve air circulation in the room, although there is an increase in electricity consumption [14].

Description

a. The experiment was carried out for a period of 3 hours according to the time of worship activities (preparation to closing), pk. 12.00 WIB - 15.00 WIB, the condition of the rainy season March-April 2022, the location of the balcony and the people's territory.
b. Krisbow fan performance produces 58.6-70.1 dB noise; v = 0.7-1.1 m/s; 0.9-1.7 m/s and 1.2-2.1 m/s, the position of the fan above the North (1) or South (2) Balcony window.
c. AC Stand performance produces noise from 40.1 dB-56.4 dB; v = 1.2-1.9 m/s. The average duration of decreasing indoor temperature (rainy season) from t1 = 29^{o}C to t2 = 26^{o}C is 30 minutes.

5. Cooperating with Greenship experts to improve the performance and ability of management personnel through scheduled training/workshops based on Greenship Existing Building.

5. Conclusions

The conclusions of this research are as follows:

1. The performance of the St. Antonius Padua Catholic Church, Pasuruan, received a Silver rating with a score of 62 points (52,99%) out of a total of 117 points according to the evaluation results of the Greenship Existing Building 1.1.
2. Recommendations and implementations prepared according to the financial capability, knowledge and skills of Greenship-based managers categorized as successful in increasing the rating to Gold rating with a score of 69 points (58,97%) out of a total of 117 points are a) re-operating organic fertilizer-producing composters (up 1 point); b) increasing the area of green open space with vegetation variants (up 2 points); c) increasing the absorption of rainwater on the ground using grass block paving (up 2 points); and d) rejecting the proposed addition of an exhaust fan due to increased operational and maintenance costs (up 1 point); e) improving the performance of the Greenship-based church cultural heritage manager (up 1 point).

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Biography

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