Tri Hita Karana-based green environment building management model

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Abstract. The development of tourism in Bali has a positive impact on improving people's welfare and national economic development. This is followed by a negative impact on the environment in development activities, namely land use change and declining green land area, which in turn did not reflect sustainable development. Therefore, tourism development efforts must also be balanced with efforts to prevent negative impacts to maintain sustainability is and based on local cultural values. Green building environmental management is one aspect in the application of international standard, namely the Greenship issued by the Green Building Council Indonesia. The purpose of this study is to create green building environmental management model based on Tri Hita Karana, one of the local wisdoms of Balinese culture, consisting of Parahyangan, Pawongan and Palemahan. The study is conducted on several hotel buildings in Bali and using multiple linear regression tests. It shows that the application of environmental management aspects of green buildings had a significant effect of 75.3 percent on Palemahan, 20.2 percent on Pawongan and 5.1 percent on Parahyangan. The aspect of advanced waste management which is one of the aspects of environmental management of green buildings has the highest influence of 35.3 percent on Palemahan.

1. Introduction

At present various development activities are carried out in big cities in Indonesia and Bali in particular to support economic development. The development of tourism in Bali has had a positive impact on improving the welfare of the community and on the development of the national economy. However, the important thing that must be observed is that the development of tourism areas which is accompanied by development is always accompanied by negative impacts on the environment such as land conversion that is less controlled and the decreasing area of green land which in the end does not reflect sustainable development. Construction activities provide more than 40% of all carbon emissions, which have a negative impact on the environment [1]. Results resulting from construction activities on average emit 30% of CO2 emissions that cause climate change, use of 17% clean water, 25% wood, 40-50% other raw materials and 20-40% of energy use [2]. Green buildings can overcome the problems that occur related to energy, resource consumption and energy in the development sector by 44% of the total use of community needs [3]. Public and commercial buildings such as offices, retail, hotels, restaurants, etc., consume almost 20% of total energy consumption [4]. Green buildings can contribute to a reduction of 30-50% of total energy use, 35% reduction in carbon dioxide (CO 2) emissions, 40% reduction in water use, and 70% savings on waste expenditure [5]. The concept of sustainable building is a building that is

friendly to the environment and provides efficiency to resources, where this efficiency can be done at every life cycle project starting from design, construction, operational, maintenance, repair and demolition [6]. The application of green buildings minimize negative impacts on the environment because they reduce resource consumption and contamination over the life of the building, green buildings can also show high performance on environmental, economic and energy performance, compared to standard buildings [7]. The construction of green buildings is also getting full support from the government with green building requirements as stipulated in ministerial regulations [8].

Preliminary studies that have been carried out based on the results of questionnaires from several respondents of construction actors and top level hotel management in Badung Regency, the results show that 70% of respondents apply the values contained in the Tri Hita Karana concept starting from planning, implementation, construction maintenance and operational periods , but does not apply green building environmental management which is one aspect of applying green building based on international standards, namely the Greenship issued by the GBCI (Green Building Council Indonesia). Therefore the urgency of implementing green building environmental management is very necessary to realize green buildings based on international standard, consisting of basic waste management, GP as a project team member, pollution from construction activities, advanced waste management, a good and correct commissioning system, submission of green building data, fit out agreement, and occupant survey [9,10].

In a previous study related to green building that in China there were differences in risk interests between stakeholders namely owners and contractors, owners and engineers, designers and contractors, implementing an appropriate risk management strategy in accordance with their perception of the importance of risk in green buildings [11] , the need for green procurement / tender practices by construction practitioners for construction projects in Malaysia [12], the method of building environmental assessment of land planning and appropriate design is one of the green building applications [13]. We propose a green building environmental management model which is one of the important aspects in implementing green buildings while still based on local cultural wisdom, one of which is the Tri Hita Karana concept, which consists of Parahyangan, Pawongan and Palemahan, is a concept of harmony between humans and God , harmony between humans and humans and harmony between humans and the environment [14-17]. Development based on the concept of Tri Hita Karana can ground sustainable development because the principles of environmentally friendly have been contained in the concept of Tri Hita Karana [18,19].

The purpose of this study is to obtain a model of environmental management of green buildings based on Tri Hita Karana (Parahyangan, Pawongan, Palemahan) and its application in hotel buildings in Badung Regency.

2. Methodology

The overall research design in this study is descriptive correlation, which is the relationship of two or more variables, aims to find whether there is a relationship and how much influence the relationship [20]. Correlation descriptive research design is a study to determine the relationship and the level of relationship between two or more variables without any effort to influence these variables so that there is no manipulation of variables [21]. Correlation descriptive research is a study that involves data collection measures to determine the relationship and the level of relationship between two or more variables so that researchers can develop them in accordance with research objectives [22]. This study aims to obtain a green building environmental management model based on the Tri Hita Karana concept, namely determining the relationship between green building environmental management variables with variables on the Tri Hita Karana concept (Parahyangan, Pawongan, Palemahan). The study is conducted at 5 (five) hotels in Badung Regency, by distributing questionnaires to 50 (fifty) respondents consisting of hotel management, planners, construction implementers, Tri Hita Karana practitioners and green building practitioners. The independent variables used in this study are basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement and occupant survey. The dependent

variables in this study are the values contained in Tri Hita Karana are Parahyangan, Pawongan and Palemahan.

The analysis used in this study is multiple linear regression analysis is a regression equation that describes the relationship between more than one independent variable (X) and one independent variable (Y), the relationship of these variables can be written in the form of an equation [20,23]:

$$Y = a + b_1 X_1 + b_2 X_2 + ... + b_n X_n. \quad (1)$$

Where Y is the dependent variable, and X is the independent variables, a is a constant and b is the regression coefficient for each independent variable.

Multiple linear regression requires simultaneous testing using F arithmetic. Significance is determined by comparing the F count with the F table or looking at the significance of the SPSS output [24,25,26], in this study creating a green building environmental management model by looking at the significance of the Parahyangan, Pawongan and Palemahan elements on Tri Hita Karana.

3. Results and discussion

The correlation and results of significance between the green building environmental management model with Parahyangan, Pawongan and Palemahan as Tri Hita Karana elements can be stated as follows:

3.1. Green building environment management on Parahyangan

Variables of basic waste management (X1), GP as a member of the project team (X2), pollution of construction activity (X3), advanced waste management (X4), proper commissioning (X5), submission green building data (X6), fit out agreement (X7), occupant survey (X8) on Parahyangan (Y1):

Table 1. Results of green building environmental management regression tests on Parahyangan.

Model summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.226[a]	.051	.134	1.353

a. Predictors: (constant), basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey.

b. Dependent variable: Parahyangan.

From Table 1, the R-Square value is 0.051. It shows that the proportion of the influence of the variable basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey use on Parahyangan variable of 5.1%.

3.2. Green building environment management on Pawongan.

Variables of basic waste management (X1), GP as a member of the project team (X2), pollution of construction activity (X3), advanced waste management (X4), proper commissioning (X5), submission green building data (X6), fit out agreement (X7), occupant survey (X8) on Pawongan (Y2):

Table 2. Results of green building environmental management regression tests on Pawongan.

Model summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.450[a]	.202	.047	2.007

a. Predictors: (constant), basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey.

b. Dependent Variable: Pawongan.

From the R-Square value of 0.202, as shown in Table 2, the proportion of influence of the variable basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey use on Pawongan variable is 20.2%.

3.3. Green building environment management on Palemahan

Variables of basic waste management (X1), GP as a member of the project team (X2), pollution of construction activity (X3), advanced waste management (X4), proper commissioning (X5), submission green building data (X6), fit out agreement (X7), occupant survey (X8) on Palemahan (Y3):

Table 3. Results of green building environmental management regression tests on Palemahan.

Model summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.450[a]	.202	.047	2.007

a. Predictors: (constant), basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey.

b. Dependent variable: Pawongan.

From the R-Square value of 0.753, as shown in Table 3, it shows that the proportion of the influence of the variable basic waste management, GP as a member of the project team, pollution of construction activity, advanced waste management, proper commissioning, submission green building data, fit out agreement, occupant survey use on Palemahan variable is 75.3%.

The green building environmental management that gives the most significant value on the Palemahan aspect of Tri Hita Karana can be stated as follows.

3.3.1. Basic waste management on Palemahan. The R Square value is 0.159 as shown in Table 4. So, it can be interpreted that the variable of basic waste management has an effect of 15.9% on Palemahan variable.

Table 4. Basic waste management on Palemahan.

Model Summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.399[a]	.159	.148	9.116

a. Predictors: (constant), basic waste management.
b. Dependent variable: Palemahan.

3.3.2. Pollution of construction activity on Palemahan. Judging from the table of the simple regression test results above, the R Square value obtained is 0.207 as shown in Table 5. So, it can be interpreted that the pollution of construction activity variable has an effect of 20.7% on Palemahan variable.

Table 5. Pollution of construction activity on Palemahan.

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.144[a]	.207	.189	8.654

a. Predictors: (constant), pollution of construction activity.
b. Dependent variable: Palemahan.

3.3.3. Advanced waste management on Palemahan. From Table 6, it shows that the R Square value obtained is 0.353. So, it can be interpreted that the advanced waste management variable has an effect of 35.3% on the Palemahan variable. The advanced waste management methods as follows:

Table 6. Advanced waste management on Palemahan.

Model Summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.188[a]	.353	.344	7.264

a. Predictors: (constant), advanced waste management.
b. Dependent variable: Palemahan.

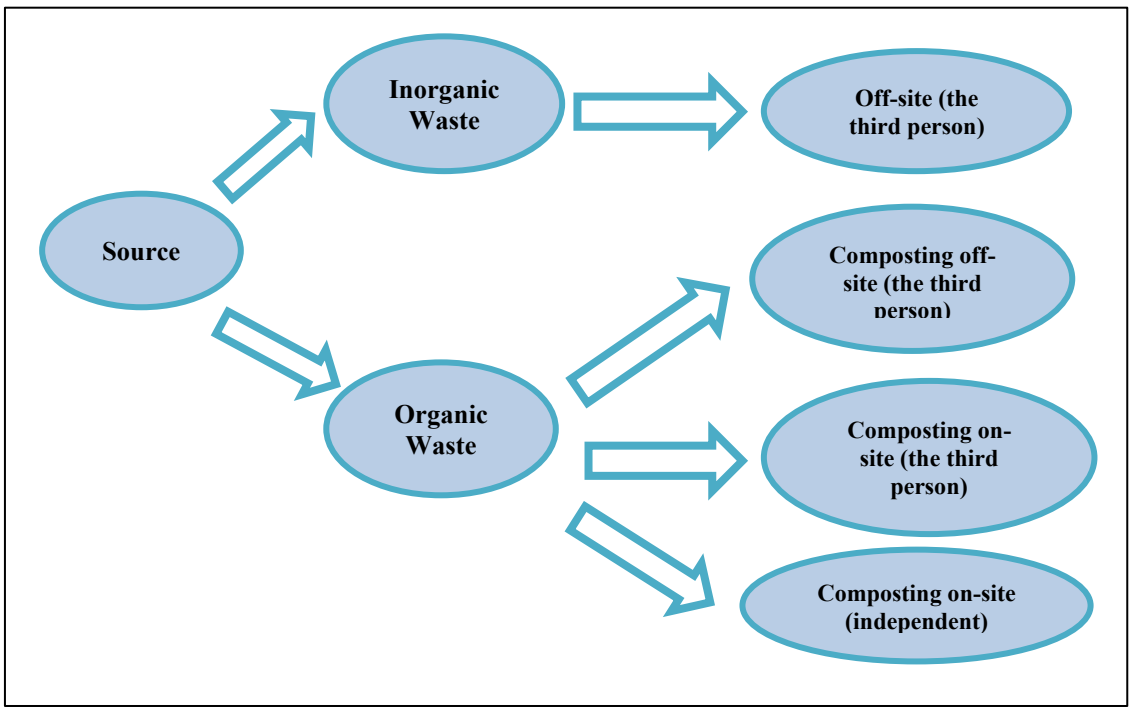

Figure 1. The advanced waste management methods**.**

In advanced waste management, all forms of organic and inorganic waste management carried out by third parties must be outside the municipal solid waste network system. Waste management can be in the form of changing the characteristics, composition and amount of waste, and the final processing of waste in the form of returning waste and residues from the previous processing to the environment media safely as shown on Figure 1.

4. Conclusions

Based on the discussion explained in the previous section, it can be concluded that the influence of green building environmental management variables on the Parahyangan variable is 5.1%, the effect of green building environmental management variables on the Pawongan variable is 20.2%. The influence of green building environmental management variables on the Palemahan variable by 75.3%. Green building environmental management has a great influence on the concept of Tri Hita Karana, namely Palemahan, which is the harmony relationship between humans and the environment. The aspect of advanced waste management on green building environmental management has an effect of 35.3% on the Palemahan variable, followed by other aspects namely pollution of construction activity has an effect of 20.7% on the Palemahan variable, and the basic waste management has an effect of 15.9% on the Palemahan variable. This means that the advanced waste management variable has the most significant effect on the Palemahan aspect of Tri Hita Karana. The implementation of advanced waste management is to process organic and inorganic waste in buildings that are carried out independently or in collaboration with third parties so that it adds value to benefits and can reduce environmental impacts.

5. References

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