Study On Implementation Of Green Construction Concepts In Construction ProjectsIn Banjar Regency

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ABSTRACT : There is environmental consequences from rapid development in various sectors aside to increase well being of the community. The purpose of this research is to describe the condition of construction industry in Banjar Regency in the context of green construction, to analyze the application of green construction in Banjar Regency based on sustainability aspect, and to develop the model of green construction implementation strategy for the contractor. This research use Simple Random Sampling method. Data analysis with percentage analysis to know the respondent's characteristic and analysis Chi-square test is used to approach from several factors or evaluate the frequency of the investigated or frequency of observation result with expected frequency from the sample whether there is significant or not significant relationship at the concept implementation level -the concept of green construction undertaken by the contractor against construction projects. The result of this research is implementation of 9 respondents (30%), sometimes implemented by 4 respondents (13.33%) and not implemented by 17 respondents (56.67%), The research based on the sustainability aspect approach shows unfavorable conditions, indicating that the contractor is not thoroughly or even seldom implementing green construction concepts on construction projects. Strategies is needed in order to increase awareness about importance of Green construction implementation for contractors and local governments, including appropriate commitments, policies and regulations, awareness raising and environmental awareness, and training on green construction.
KEYWORDS:green construction, contractors, implementation.

I.   INTRODUCTION

Rapid development in various sectors today is not only improves well being of the community, there is environmental cost that must be counted and anticipated to avoid indirect problem in the future. Project is an activity that has a certain period of time with limited allocation of resources, to carry out a task that has been outlined. In [3] the author mentions that construction projects are a series of activities that are only used once and are generally short-term. In the series of activities there is a process that processes project resources into a result of activities in the form of buildings.

In [6] the author states that globally, the construction sector consumes 50% of natural resources, 40% of energy, and 16% of water. Construction activities such as material retrieval, material transportation to construction project sites, construction processes, building operations, building maintenance, to building demolition contribute 50% of total waste and consume 50% of natural materials [1].

Several steps must be taken by the actors of construction services, so that the development does not permanently ruin environment. One of the ways is, the construction industry players in the business is to constantly applying construction concepts that are environmentally sound, or commonly called green construction. This concept must be indoctrinate deeply and developed thoroughly to achieve optimal and sustainable results.

The green infrastructure concept must be developed more, especially green buildings, it is necessary to take concrete steps so that the contractors can understand this concept in its implementation. The things that need to be understand by the contractor in the application of the concept of green construction is to include the construction process that seeks to reduce materials that damage buildings, construction processes that do not

disturb the surrounding community, the construction process that uses materials that do not damage the environment [2].

From the background of these problems, a research is required to provide standard on the implementation of green construction for contractors involved in the development in Banjar Regency.

This study intends to find out the conditions of implementation of green construction and find out the strategy in the implementation of green construction in Banjar Regency. The research objective is to conduct a study of the condition of the construction industry in Banjar Regency in the context of green construction and the development of a green construction implementation strategy for contractors.

This research is intend as a reference material to give contractors and construction actors both private and government in the Banjar Regency understanding about green construction concept and its implementation, in order to make a development process sustainable environmentally.

II. METHODS

This research is based on the background of green construction as an improvement in the quality of urban life. The existence of urban development and an increase in the number of population causes complex environmental problems. For this reason, the importance of the sustainability aspect approach in implementing green construction in urban development.

In this study using Simple Random Sampling method. It is said Simple Random Sampling because the taking of members of the sample from the population is done randomly without regard to the strata that exist in the population. This method is done because members of the population are considered homogeneous. The number of samples taken is as many as 40 contractors who each represent companies that have or are carrying out development projects in the Banjar Regency area.

Research instruments are tools to obtain data or collect data. The instrument in this study uses a questionnaire in the form of questions about the respondent's identity and about the implementation of green construction, which consists of:
1. Questionnaire A: respondent's characteristic sheet which includes the name of the respondent, place of birth date, age, gender, company name, position, tenure, building that has been done and signature.
2. Questionnaire B: questionnaire sheet used to determine the level of implementation of green construction, in the form of green construction processes, green behavior practices and green supply chains carried out by contractors in each work project consisting of 16 questions and answers to scores Yes = 3, Sometimes = 2 and No = 1.

The results of primary data collection in the form of a questionnaire will then first test the level of validity and reliability to determine whether the questionnaire can be used or not. The accuracy of the results of a study is largely determined by the validity and reliability of the instruments used to collect data. The results of this test will be used to analyze the level of validity and reliability of the research questionnaire. After testing the questionnaire by testing the validity and reliability and stated that the questionnaire is valid and reliable as a measurement tool then data analysis is carried out, namely:
1. Percentage Analysis

This percentage analysis is used to determine the characteristics of respondents. This analysis tool is done by comparing the number of respondents to be analyzed with the total respondents as a whole.

$$P = \frac{n}{N}$$

Where P is the number of percentages, n is the number to be analyzed, and N is the total number of respondents.
2. Chi-square analysis

To find out the implementation of greenconstruction concepts that have been carried out by the contractor, the researcher uses quantitative analysis. Data analysis on the level of implementation of the green construction concepts carried out by the contractor on construction projects consisting of three scales, namely score 3 for the answer "implemented", score 2 for answers "sometimes implemented" and score 1 for answers "no implemented ", carried out using tabulation analysis by comparing the average number of scores obtained with scores calculated in percentage, as follows:

$$P = \frac{\sum \text{Implementation of Respondents}}{\sum \text{Total Respondents}} \; x \; 100\%$$

The classification of the level of implementation of green construction concepts carried out by contractors towards construction projects is based on three categories, namely:
1. Not implemented, if the score obtained is <60%.
2. Sometimes implemented, if the score obtained is $\geq 60\%$ - $\leq 70\%$.
3. Implemented, if the score obtained is> 70%

Furthermore, statistical tests will be used to find the influence or relationship between independent and non-free variables. The statistical test used in this study is the analysis The chi-square (x 2) test is used to approach several factors or evaluate the frequency of the investigation or the frequency of observations with the expected frequency of the sample whether there is a significant relationship or not.

Chi-square (x 2) test with the formula as follows:

$$X^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

where is the chi square value tested / compared to X2 table, Oi is the frequency / amount of data observed in the ke-category, Ei is the expected frequency / number in the ke-category and k is the number of categories (i = 1,2, 3).

The hypothesis tested is:

H_o : The contractor implements green construction concepts in construction projects in Banjar Regency.

H_1 : The contractor did not implement green construction concepts in construction projects in Banjar Regency.

With criteria:

If: $<$(0.05; db = k -1, then H0 is accepted (p$>$ 0.05)

$\geq$ (0.05; db = k -1, then H0 is rejected (p $<$0.05)

$<$(0.05; db = k -1, then H0 is accepted (p $<$0.01)

3.   Mode

Data analysis is then used mode. According to [4] states that mode is one of the concentration measures in the mean and median sampling. Mode is an observation value that most often appears.

In [5] the author defines that mode as the value of the data that most often appears or most appears or the frequency with the most. To determine the mode of a single data, we can simply sort the data, then look for the highest frequency data value.

III. RESULTS AND DISCUSSION

Before analyzing the research data, based on the results of questionnaire data input from 30 respondents were tested for validity and reliability testing using the SPSS application. Validity testing technique in this study uses Spearman Rank correlation coefficient test with SPSS to determine the closeness of the relationship between variables in the study if the data is ordinal. This analysis is done by correlating each variable item score in the form of a ranking and calculating the Spearman Rank correlation coefficient. Items - question items that are significantly correlated with the total score indicate that the items are able to provide support in revealing what is called valid. If the value is sig. $<$0.05, it can be concluded that there is a significant correlation (declared valid) and vice versa, if the value of sig. $>$ 0.05, it can be concluded that there is no significant correlation (declared invalid).

Before the questionnaire is distributed to respondents, it is necessary to give an idea of who will give answers to the questionnaire. Accurate data is needed in order to get results that are in accordance with the actual situation, therefore not all respondents can fill out thequestionnaire. Respondents who were selected to answer the questions in this questionnaire were parties who were directly involved in theconstruction of buildings in Banjar Regency. The distribution of questionnaires and respondents is obtained in Table 1.

Table 1 Distribution of Questionnaires and Respondents

Category	Amount distributed	The amount used	Amount that cannot be used	amount
Contractor	40	30	10	40
Percentage	**100%**	**75%**	**25%**	**100%**

The respondents involved were contractors who had and had carried out building construction projects in Banjar Regency. The number of questionnaires distributed was 40 copies for 40 respondents. From the number of questionnaires that have been distributed, only 30 questionnaires meet the requirements. The remaining 10 questionnaires did not qualify because they did not return the questionnairethat had been distributed, administrative errors and errors in filling out the questionnaire.

Based on the results obtained in the field through filling out the questionnaire, then using the statistical software, Microsoft Excel 2007, the data obtained about the level of implementation of green construction concepts carried out by contractors towards construction projects can be seen in Table 2.

Table 2. Level of Implementation of Green Construction Concepts

No.	Implementation Level	Respondents	Percentage (%)
1.	Not implemented (<60%)	17	56,67
2.	Sometimes implemented (60-70%)	4	13,33
3.	Implemented (> 70%)	9	30
	Amount	30	100

Based on Table 2 above, sequentially the level of implementation includes implementation of 9 respondents (30%), sometimes implemented as many as 4 respondents (13.33%) and not implemented as many as 17 respondents (56.67%) . This shows that the majority of contractors in Banjar Regency are still lacking in implementing green construction concepts in the construction projects they are working on. In relation to the green construction requirements and conditions contained in the contract documents for projects in Banjar District, it shows that many contractdocuments in Banjar Regency do not include the requirements and conditions for green construction so it is only natural that the contractors do not implement these conditions in the field. and considered not mandatory to be implemented.

To test the difference in the level of implementation of green construction concepts, nominal data is used from the data frequency of the percentage of respondents using the Chi-square test. The full results are presented in Table 3.

Table 3 chi-square test results

Implementation Level	Yes	No	Amount	X^2H	$X^2_{\alpha(0,05)}$
Not implemented	17	13	30		
Sometimes implemented	4	26	30	12,9	5,991
Implemented	9	21	30		
Amount	30	60	90		

Description: x^2 tabel table is x^2 0,05,
X^2H is X^2 count, db (3-1) = 5,991

Based on the results of Chi-square analysis ($X2$) shows that the calculated $X2$ value is 12.9 greater than the 5% table $X2$ (5.991), because $X2$ counts 2 $X2$ table ($p < 0.05$), this indicates that H0 is rejected and H1 is accepted. That is, the majority of contractors significantly do not implement green construction concepts in the implementation of construction projects in Banjar Regency.

After performing a Chi-square analysis, thenproceed with data analysis to determine the values that appear most frequently (mode). Each question variable from each category will then be collected (tabulated) in table form using Microsoft Excel. In this study descriptive analysis used only saw the mode of understanding level in the implementation of green construction concepts in construction projects in Banjar Regency. The following tabulation results are summarized in Table 4.

Table 4. Results of Analysis Based on Implementation of Green Construction Concepts on Construction Projects in Banjar Regency.

No.	Levels of Understanding Factors in the Implementation of Green Construction Concepts in Construction Projects in Banjar Regency	Answer (Percentage)			Mode
		Yes	Sometimes	No	
1.	**Green construction process**				
	(P₁) Does the implementation of a project always schedule every stage of construction activities?	90%	10%	0%	3
	(P₂) Is there always a regular monitoring and evaluation of performance in the implementation of a construction project?	40%	60%	0%	2
	(P₃) Is a warehouse that is good for material storage?	37%	63%	0%	2
	(P₄) In the implementation of projects that require heavy equipment, do the heavy equipment used have permission to function?	90%	10%	0%	3
	(P₅) Is the material for the remaining construction before being reused or recycled, the sorting and collection area prepared?	27%	30%	43%	1
	(P₆) Is rainwater used as a source of water during construction?	23%	20%	57%	1
2.	**Green behavior practices**				
	(P₇) In the implementation of projects that require heavy equipment, are these heavy equipment operated by certified operators?	33%	67%	0%	2
	(P₈) To minimize waste generated during construction, such as material and waste residues, is it done by a 3R prinsive approach that is reducing, reusing and recycling?	33%	60%	7%	2

No.	Levels of Understanding Factors in the Implementation of Green Construction Concepts in Construction Projects in Banjar Regency	Answer (Percentage)			Mode
		Yes	Sometimes	No	
	(P9) Does the company provide work protection such as helmets, boots, gloves, masks (personal protective equipment)?	37%	63%	0%	2
	(P10) During construction, the company provides medicines for first aid in the event of a work accident?	37%	63%	0%	2
	(P11) Does the construction company provide health insurance for every employee during the construction?	40%	60%	0%	2
	(P12) Does the company implement environmentally friendly behavior (saving and conserving water, energy, other resources) to every worker involved in construction implementation?	40%	43%	17%	2
3.	**Green supply chain**				
	(P13) During construction do you use energy-saving equipment and equipment?	33%	20%	47%	1
	(P14) Does the company always use environmentally friendly materials during construction?	40%	53%	7%	2
	(P15) Does the company prioritize the use of local equipment / material suppliers to the maximum extent possible as a construction material?	37%	20%	43%	1
	(P16) Does the company always take into account / consider the location of the acquisition of heavy equipment / materials used in construction?	37%	63%	0%	2

Seeing the current condition of the construction industry in Banjar Regency, it is very necessary that green construction concepts be implemented as a whole in subsequent construction projects because in addition to providing cost savings, it can also have a goodimpact on the environment. For this reason, a good strategy is needed so that the concepts of green construction can always be implemented as shown in Figure 1.
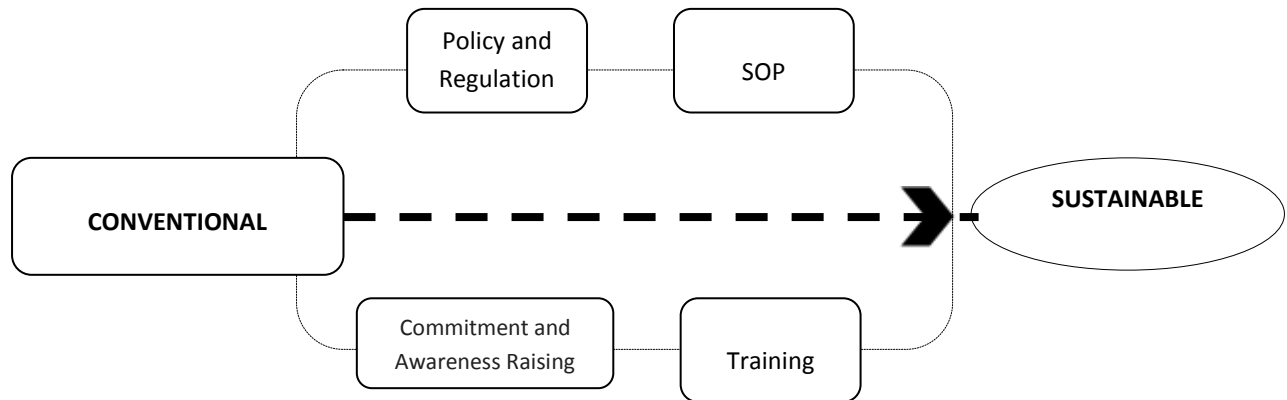

Figure 1 Strategies Towards Environmentally Friendly Construction

In an effort to implement green construction concepts in the implementation of construction, the government and contractors have a very large role and responsibility.

IV. CONCLUSION

From the discussion about the implementation of green construction concepts in construction projects in Banjar Regency, it can be concluded as follows:

1. The condition of the construction industry in Banjar Regency in the context of implementing green construction shows unfavorable conditions. This is indicated based on the results of data analysis in the field, it can be seen that as many as 30% (9 people) only implemented green construction concepts while 56.67% (17 people) did not even implement it, the remaining 13.33% (4 people) respondents who sometimes implement green construction concepts in the implementation of projects in Banjar district. According to the results of the analysis, the application of green construction in Banjar District based on the sustainability aspect approach shows that the most frequent frequency value is value 2 with a total of

10 times out of 16 questions. This proves that the contractor is lacking in implementing the green construction concepts in the construction projects that he is carrying out.

2. Green construction implementation strategies for contractors and local governments include strengthening commitments, increasing awareness and concern for the environment, appropriate policies and regulations, training in green construction and SOPs that include environmental aspects.

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