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The Concept and Practice of Green Building in Denpasar, Bali`s Commercial Buildings

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Abstract

Green concepts and practices develop, along with awareness of the sustainability of the surrounding environment. Even though the concept of green has been understood correctly, all of them sometimes experience obstacles in green practice. Denpasar Municipality as one of the cities in Indonesia that has green building regulations is required to implement these regulations properly. This study aims to investigate the concepts and practice of green buildings in Denpasar Bali, Indonesia. Descriptive qualitative research methodology with semi-structured interviews with ten participants and observation of five selected buildings. Then the data were analyzed using the content analysis method. The analysis found that all participants well understood the benefits of the green concept. This study's conclusion is needed to apply a deeper understanding of the benefits of green practice so that there is integration from concept to practice. Therefore, it is advisable for related parties, such as consultants, contractors, project managers, green building boards, suppliers, owners, and governments to increase knowledge, apply technology, control, and monitor green building policies.

Keywords: *Green practice, Green concept, Green building, Sustainable building, Commercial building*

INTRODUCTION

The environmental awareness movement has undergone an evolutionary process that began in the early 1900s. An environmentally caring activity is attributed to human life's economic welfare and quality. The world is moving towards green concepts that focus on increasing resources' efficiency while reducing human health, productivity, and the environment (Allen, C., Metternicht, G. & Wiedmann, T.,2018).

The world's attention, especially researchers and practitioners, is currently focused on the concept of green or sustainable (Li, Yang, & Lam, 2013). The green concept is the central theme of the current construction sector (Darko A. & Chan PC, 2016). The concept prioritizes environmental friendliness, health, and building comfort.

Practitioners and researchers have called for many criticisms of the number of green buildings that can provide comfortable, healthy spaces and a friendly environment. However, the community's benefits are still limited (Z Ding, Z Fan, VWY Tam, Y Bian, S Li, Illankoon. IMCS, Moon S, 2018).

Additionally, the Indonesia government setting regulations on the green building through the Minister of Public Works Regulation no.02/2015. This regulation is set to complement the existing laws and regulations (law No. 28 of 2002, Government Regulation No. 36 of 2005, and Minister of Public Works Regulation No. 29 of 2006). Since the adoption of green building to government regulations in 2015 and 2020, there has been no specific data on Bali's green buildings' growth rate. Green building concepts and regulations do not yet have positive implications on the number of government and private building developments in Indonesia, including Bali. Therefore, it is a challenge to understand how the Green building concept is implemented or practiced.

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This research objective is to investigate the implementation of green building in commercial buildings in Bali. This study's findings provide greater insight into green buildings' actual implementation, apart from the written concept, policy, or regulation.

LITERATURE REVIEW

The green concept is a commitment to the environment. That concerns a broader principle of the relationship between humans and nature. Green practices as a mechanism for construction and facilities to conserve land, reduce the adverse effects on the environment, and develop a higher quality atmosphere for citizens (Samer, 2013). Green building practices focus primarily on designing sustainable sites, increasing water and energy usage, reducing waste and pollution, using environmentally safe building materials, and enhancing indoor environmental quality more effectively than traditional designs.

Efficient energy

Energy efficiency means saving energy for other services such as in the following example, with a lighting system that has the technical capability to save and reduce energy consumption achieved by LED lighting (Ann & Abualrejal, 2015). The building and environment together capture these sources, including sunlight and natural fresh air, to reduce energy demand. This concept is commonly referred to as passive design, and building energy-saving methods with passive design concepts in green buildings has become a trend (Chen, Yang, & Lu, 2015).

Water use management

The depletion of water sources results from an uncontrolled exploration of water and shortages in water management. Furthermore, efforts are needed to reduce water use or water efficiency (Das, Bera, & Moulick, 2015). Water efficiency also means water conservation. That minimizes the unnecessary and inefficient use of clean water on site. In this case, it also maximizes the recycling and reuse of wastewater. That includes harvested rainwater/rainwater (GBCI, 2012).

Protecting health of occupation and improvement employee productivity

In a green room climate, there are many factors regarding comfort, health, and productivity. Such factors include indoor air quality, thermal comfort, outdoor views, and limiting natural light with mission illumination and clean water (Means, 2011). All of these are significant problems for commercial and non-commercial buildings. One that affects employee productivity is the quality of the indoor environment. Employees who have a low indoor environmental quality will have a lot of time and performance loss (Burton et al., 2001; Wargockiet al., 2000).

Reduce waste, pollution and environmental degradation

It is understood that organic waste is one of the causes of disease. Residents must be aware of how to process waste to reduce environmental degradation (Madaleno. M, 2018). Thus, the general public must also promote more recycling, and policies must be formulated to encourage waste recycling (Madaleno, M., & Moutinho, V., 2018).

The rating system in Indonesia

There are three regulations of the ministry of housing and public works (PUPR) that pay attention to the green building and environment's specifics, namely the first, PUPR 08/2008 about green open space. Secondly, PUPR 02/2015 about the green building, and the third, PUPR 05/2015, about sustainable construction implementation's general guidelines. The first regulation is discussing the principle of implementing rules in green building. The second regulation is discussing the background of emerged rules. The third approach is to understand the details of green Building regulations.

Since its establishment in 2009, GBC Indonesia has continued to be committed to transforming and educating all society levels by carrying out various transformation activities (Adiwoso, 2018). Green Building Council Indonesia is a non-governance organization.

RESEARCH METHOD

Nowadays, research in specific qualitative contexts, such as cultural, political, or social, places attention on investigations' interpretive nature (Creswell, 2008). According to Creswell in the above paragraph, this qualitative research method was chosen because the problems in this study need to be explored more. By using a qualitative method, the data were collected using a semi-structured interview technique. Further elaboration of the research process is carried out in several phases. The initial phase is found as a research idea. Then with a condition and gaps that occur in society and policy in a background of research.

In this study, data collection was done by interviewing some who have knowledge and experience in green building. Furthermore, it is explained in more detail regarding the process and data collection methods used. In the interview data collection method, verbal or verbal stimulation is required. This response is expected to fulfill the elements in its presentation. The interview method is used face-to-face and via the telephone network. That is done to dig more in-depth information from the sources. Interview participants were selected based on the criteria of experience in green building projects of at least five years and a minimum of 10 years' experience in the construction industry.

ANALYSIS AND RESULT

Green concept and green practice analysis – Efficient energy use.

Referring to the data of the interview results, especially those relating to the energy usage efficiency are found different statements on each participant. The concept statements of efficient use of energy from the 10 participants are presented in Table 1.

Table 1
Concepts of efficient energy use

No	Description	Code	Number of participant statements
1	Energy consumption savings. Reducing resource usage.	CE-1	10
2	Utilizing renewable energy	CE-2	2
3	Energy conservation efforts with photovoltaics	CE-3	1
4	Environmentally friendly energy	CE-4	2
5	The right material and standard green	CE-5	1

With the data shown above, it can be said that all participants (100%) are in unison that the concept of efficiency of use is related to energy savings and reduces resource utilization. The practice of energy efficiency is presented in Table 2, shown ten codes that is indicated many practices in green implementation.

Table 2
Practices of efficient energy use

No	Description	Code	Number of participant statements
1	Using the control tool of energy consumption such as motion sensors, light sensors, etc.	SE-1	10
2	application with the selection of energy-saving electrical appliance such as LED light, automatic switch, etc.	SE-2	10
3	Windows glass on the north-south side	SE-3	6
4	Heating-reducing glass. Anti UV radiation	SE-4	7
5	The Louvre windows for air circulation	SE-5	5
6	Ventilation holes. Using a solar panel	SE-6	2
7	Temperature control at 25°-27°C	SE-7	2
8	Application of renewable energy at the client`s order	SE-8	1
9	Double surface protection	SE-9	2
10	Roof garden	SE-10	1

In the above table also shown, most participants practiced energy efficiency selection of energy-saving electrical appliance (SE-2).

Table 3
Observation Practices of efficient use of energy

Building	Efficient use of energy	
	Photo	Brief description
1		The glass windows are placed in a north-south position (SE-3) and use anti-UV glass (SE-4).
2		use of windows for natural air circulation (SE-5)
3		Using the control tool of energy consumption such as motion sensors, light sensors, etc (SE-1).
4		placement of windows on the north-south side and the use of anti-UV glass (ES-3) (SE-4).
5		The glass windows are placed in a north-south position (SE-3) and use anti-UV glass (SE-4).

Green concept and green practice analysis – Efficient water use and others source.
The concept is found that some of the statements are grouped in 5 (five) codes. The fifth code is displayed in the Table 4.

Table 4
Concepts of efficient water use and others Source

No	Description	Code	Number of participant statements
1	Water management and utilization efforts	CW-1	10
2	Efficient use of water; Saving water use	CW-2	6
3	Daily water usage volume settings	CW-3	2
4	Minimizing water use and recycling	CW-4	1
5	Water regulating system	CW-5	2

Observing the table above seems evident that the water management and utilization effort (CW-1) is the most widely delivered statement. That means about 68% participant states the perception that a water usage effort is a form of water efficiency. Next, in Table 5, the results for the practice of efficient water use and other resources are presented.

Table 5
Practices of water use and others Source

No	Description	Code	Number of participant statements
1	Water meter installation	SW-1	4
2	Using a shower, faucet, flush toilet, etc. saves water	SW-2	10
3	swimming pools use filters to clean impurities in the water and reuse treated water	SW-3	8
4	Separating the working water tank and the sanitary water tank	SW-4	1
5	Clean water is bought or taken from other parties and collected	SW-5	1
6	Pond water, toilet water is treated and discharged into fish ponds or splashed onto plants	SW-6	8
7	Rainwater is collected into clean water or watering plants	SW-7	9
8	Using water sourced from deep wells or PDAM	SW-8	3
9	Using a spring water source	SW-9	1

The most common management practice of water and other resources was using the shower, faucet, flush toilet, and saving water.

Table 6
Observation practices of efficiently water use and other sources

Building	Efficiently water use and other source	
	Photo	Brief description
1		Selection and use of water-saving sanitary (SW-2).
2		Natural pond water treatment and reuse (SW-6)
3		Selection and use of water-saving sanitary (SW-2).
4		Water treatment with fish ponds and reuse (SW-6).
5		Treatment of pond water for reuse (SW-3)

Green concept and green practice analysis – Protecting health of occupation and improvement employee productivity.
With regards to protecting the health of occupation and improvement employee productivity, there are 3 (three) codes for the concept.

Table 7
Concepts of protecting health of occupation and improvement employee productivity

No	Description	Code	Number of Participant statements
1	Maintain and improve air quality as well as lighting in the room	CH-1	4
2	Entering outside air as needed for health	CH-2	4
3	Maintain occupant comfort	CH-3	7

The results revealed that 'maintain the comfort of the occupants and workers in a thermal and visual' (CH-3) is the most widely mentioned participants. With regards to tenant health protection and improvement of employee productivity practices, Table 8 below presents the results.

Table 8
Practices of protecting health of occupation and improvement employee productivity

No	Description	Code	Number of Participant statements
1	Provide a smoking area outside the building. Open area	SH-1	8
2	Using environmentally friendly paints. Low VOC`s	SH-2	3
3	using asbestos-free products, etc.	SH-3	6
4	using non-mercury lamps	SH-4	6
5	Set up no-smoking signs and no-smoking rules	SH-5	9
6	Set room air conditions at a temperature of 25-27C	SH-6	1
7	Using air conditioning with bacteria-free filters and specifications	SH-7	3
8	Prevent dust pollution by installing a dustproof safety net	SH-8	1
9	using certified environmentally friendly materials	SH-9	7
10	Using CO smoke detectors and fire alarms	SH-10	1

Table 9
Observational Practices of protecting occupant health and improving employee productivity

Building	Protecting occupant health and improving employee productivity	
	Photo	**Brief description**
1		All areas using smoke detectors, carbon gas control and fire alarms (SH-10). Put up a no-smoking sign and a no-smoking rule (SH-5). Using environmentally certified materials (SH-9).
2		Use of air conditioners with bacteria-free filters and specifications (SH-7). Using environmentally certified materials (SH-9).
3		Provide an outdoor smoking area for employees (SH-1). Put up a no-smoking sign in certain areas (SH-5).
4		Using environmentally friendly paint (SH-1). Using asbestos-free products (SH-2). Designing every room to have a view out (SH-

		1). Set the room temperature at a comfortable temperature of 25-27 C (SH-6).
5		All areas using smoke detectors, carbon gas control and fire alarms (SH-10). Put up a no-smoking sign and a no-smoking rule (SH-5).

Green concept and green practice analysis – Reduce waste, pollution and environmental degradation.

The coding process on the data interview waste reduction, pollution, and environmental degradation obtained 3 (three) concept codes (CM). The following table (Table 10) presents the concept of reduction of waste, pollution, and environmental degradation.

Table 10
Concepts of reduce waste, pollution and environmental degradation

No	Description	Code	Number of Participant statements
1	Manage waste to reduce the negative impact of waste on the surrounding environment	CM-1	5
2	Efforts to protect the surrounding natural environment from pollution and destruction and others	CM-2	9
3	Balancing the environment by restricting, prohibiting development in congested areas	CM-3	1

The results revealed that 'Efforts to protect the surrounding natural environment from pollution and destruction and others' (CM-2) are the most widely mentioned participants. Regarding reducing waste, pollution, and environmental degradation, Table 11 below presents the most common practices are sorting organic and non-organic waste (SM-1).

Table 11
Practices of reduce waste, pollution and environmental degradation

No	Description	Code	Number of Participant statements
1	Sorting organic and non-organic waste	SM-1	8
2	Plant trees to reduce air and noise pollution	SM-2	4
3	Using recycled wood materials	MS-3	2
4	Garbage waste is transported and disposed of outside the area by officers	SM-4	4
5	The local community takes garbage (food waste or plastic waste) to eat livestock or become art item	SM-5	4
6	Waste treatment with green-certified technology	SM-6	1
7	Make canals for waterways so as not to damage the contour of the land	SM-7	1

Table 12
Observational practices of reducing waste, pollution and environmental degradation

Building	Reducing waste, pollution and environmental degradation	
	Photo	Brief description
1		waste collection and sorting is carried out between organic and inorganic waste. Garbage is collected and dumped into final disposal by city cleaners daily.
2		waste collection and sorting is carried out between organic and inorganic waste
3		Waste separation is carried out between organic and inorganic. Garbage is collected and dumped into final disposal by city cleaners daily.
4		Organic waste is turned into compost and inorganic waste is collected and collected by municipal waste processing cleaners
5		Garbage is collected and dumped into final disposal by city cleaners daily.

FINDINGS AND DISCUSSION

Based on the results of the analysis, it was found three finding as follow,

1. Energy efficiency, water use management, and others resources.
   The first rank answers refer to green practice efforts through the use of tools that support energy savings such as sensors, controls, energy saving lamps and others. While the second rank focuses more on statements related to passive strategies. Concerning other renewable energy sources, it was found that efforts to use and develop other sources such as solar energy sources were not widely applied to buildings.
2. Protection of occupant health and improve employee productivity.
   The concept of implementing green buildings in protecting the health of occupants and increasing employee productivity in the analysis results found that 5 (five) essential components. These components are natural air ventilation, direct external scenery design, noise suppression with plants and finishing materials, lighting with SNI standards, safety with K3 standards.
3. Reduction of waste, pollution and environment degradation.
   Referring to the ranking of analysis results in the above discussion that found the majority of waste reduction is applied by sorting waste and reusing existing waste such as for animal food and art goods. Meanwhile, efforts to reduce pollution and environmental degradation are mostly stated by not cutting down trees at the construction site and reusing materials such as wood, plastic.

CONCLUSION

That is essential to measure energy efficiency performance (calculation and consistency of controlling energy use) starting from the initial stage, design, and construction to the end of the building's life cycle. By referring to the green building method, an average energy use performance of 25-30% is

achieved. Buildings that adopt the series of continuous processes achieve maximum and measurable performance energy efficiency targets. that is recommended to related parties, such as consultants, contractors, project managers, green building councils, suppliers, owners, and governments. To increase knowledge, apply technology, control, and monitor green building policies to overcome the four impeding factors to green building effectively.

The purpose of this research has been achieved, but there are still some limitations. That should be considered when replicating the study elsewhere. The scope of the research focused only on commercial buildings. Future studies are recommended to focus on other types of buildings to provide a deeper understanding of the implementation of green building in Bali.

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