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Recognizing of Building Components to Achieve Green Performance for Renovation and Retrofitting Works

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Abstract. Renovation and retrofitting have differing meanings. The term renovation refers to the process of returning something to a good state of repair. In the construction industry, improvement relates to the method of improving or modernizing an old, damaged, or defective building. The opposed to a term of retrofitting which is providing something with a component or feature not fitted initially. Retrofitting means giving something with a part or not installed during manufacture or adding something that it did not have when first constructed. Otherwise, it used as improving the health of occupants or increasing the building adaptability, durability, and resiliency. The strategy of green achievement is the purpose of the research. This state of the art is providing how researchers to understand the achievement strategy from building components. To provide a clear overview for the reader, which are building components in Green Building. Then Green building is one of the measures forward to mitigate significant impacts of the building stock on the environment, society, and economy. Professional for respondents taken from three which has differed on AMSL and climate, exploring for knowledge and practices profiles. However, this paper consists of a critical review of the existing body of knowledge of researches related to the strategies of green building achievement. The research themes and findings identified. These universal themes are the definition and scope of renovation and retrofitting on green building, and discussions approach to achieve green buildings by researchers how recognizing the building components. It found that the emphasis played predominately focus on knowledge of professional role as the aspects which are affecting green building achievement. Future research opportunities were identified, such as climatic of all countries to consider green building assessment tools and future-proofing on preconstruction. We suggest developing an awareness of managing and controlling preconstruction work for achieving green achievement. Moreover, it could develop to the next research on developing a strategy on green construction for construction management and project management.

1. Introduction

Indonesia has a Building Regulation [1],[2]. In article [3], mentioned that regulating aims to the sustainable building. Due to this regulation, green development discourses have begun since 2002.



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Moreover, Public Works & Public Housing Ministry issued [2] for Implementation of Sustainable Construction, and Green Building assessment [3].

Related to the buildings, green evaluation in Indonesia use the Public Works & Public Housing Ministry of Indonesia Republic [2] for Green Building, and Circular Letter [3]. That focused on efficiency and effectivity for building operation/ performance of the sustainable building. In southeast Asia has been issued green development that based on World Green Building Council such as in Indonesia, Malaysia, Singapore, Philippines, and lastly Vietnam in 2013.

Moreover, it has four assessments system for green development. They are Greenship (from GBCI), SE No. 86/PRT/M/2016, UI Greenmetric, and EDGE. Greenship, SE No. 86/PRT/M/2016 and EDGE focus on the building sectors, UI Greenmetric focuses on related to green campus and sustainability in the universities.

For green evaluation, Kats [4], [5] found that the benefits of green buildings are most significant for public entities that have a specific responsibility to be concerned about broader societal benefits such as health. Programming, design & planning, construction, operation, and demolish (part, retrofit or energy evaluation) used for new and existing building evaluation of green assessment in Indonesia, with categories on mandatory, recommended and voluntary. Towards broader societal benefits of health, based on thermal comfort.

Furthermore, Francesca [6] found the five primary policy targets, for reducing greenhouse gas emissions from buildings. There are increasing the energy efficiency of new & current buildings, energy efficiency of devices, emission reducing in building, changing attitudes & behaviour, lastly renewable energies.

It means to increase the energy efficiency on a new and existing building, that focused on building skin, appliances, effort on attitudes & behavior, and lastly on renewable energies. Moreover, this based on this research related to an existing building, particularly post-occupancy.

Later, Zhihua [7] extended their analysis and revealed that conventional technologies used in the case study office building, such as improving the insulation of the building envelope, retrofitting of the HVAC system. Similarly, operation strategies play an essential rule to capitalize on the benefits of building energy-efficient retrofitting. After the building energy-efficient retrofitting, the staff can adjust the fresh air rate according to their demands and regulate the temperature of their workplace to a comfortable level via the ceiling fans.

According to Miimu [8], current office buildings are becoming more and more energy-efficient. Notably, while the importance of heating is decreasing, the share of electricity use is still increasing. Also, Zhenjun [9] found that a systematic methodology for appropriate retrofits of existing buildings for energy efficiency and sustainability. Then, an overview of previous studies related to the investigation and evaluation of energy performance and economic feasibility vided.

Then it is shown that makes it possible to rank or to rate buildings or retrofit scenarios according to more than one criteria [10]. So [11] stated that sustainable building rating systems used to examine the performance or expected the performance of a 'whole building' and translate performance assessment into a tool that can be used to compare the building performance of other buildings or a performance standard.

It is related to green evaluation studies to obtain a strategy on achieving thermal comfort through assessing of green rating tools approach. Hence, selected professionals who practice for green development, based on climate and geographic characteristic in Indonesia to evaluate.

Table 1: Professional Practices & Characteristic

Professionals	Location	Registered Member	Certified	Green Certified		Age (years old)			Green Working Years Average (2008-2018)		Green Rating Tools		Position on Projects			Project Location (AMSL)			
				GBCI	Others	30-40	40-50	>50	>2 projects	Never	KemenPU PR RI	Greenship 1.2	Principal	Assistant	Project Engineer	Bandung (700m)	Yogyakarta (110m)	Surabaya (2m)	Others
- Architect - Structural Engineer - MEP Engineer - Construction Management	West Java	86%	75%	47%	8%	36%	42%	19%	44%	50%	33%	64%	42%	25%	25%	56%	11%	6%	22%
	Yogyakarta	100%	60%	40%	0	20%	0%	80%	0	80%	40%	20%	40%	0	20%	20%	60%	0	20%
	East Java	100%	56%	11%	0	67%	22%	11%	0	100%	0	33%	22%	22%	0	11%	0	33%	11%

Source: Survey 2019 [12]

Professional characteristics have an impact on what they do in the area. According to table 1, it shows that professional practice in the regions still has minimal potential. The average competence possessed is already registered in the area (86% West Java, 100% Yogyakarta, and 100% East Java), While that is certified not only more than 75% and not less than 56%. Furthermore, it shows in green certificates that are not owned by professionals (11% - 47%). In this study, pre-construction work will be the goal of how professionals work according to their competencies, and how professionals recognize the pre-construction work scope as well as the readiness to start work. At table 1, only a few professionals who have certificates of work for green buildings, but those who practices found that none in Yogyakarta and Surabaya had green buildings.

2. Renovation and Retrofitting

2.1. Renovation

James [13] found that the consequences of current and future obsolescence and redundancy need to bear in mind in any adaptation proposal to responses the obsolescence and redundancy. These divided into three main groups: economic, technical, and functional. Economic obsolescence occurs because maintenance has become unreasonably costly or disruptive, and when acceptable (cheaper) alternatives to maintenance are available. Depreciation of a built asset's capital/rental value is the primary economic consequence.

Technical obsolescence implies that the performance of the building is deficient or otherwise lacking, leading to dilapidation and, if left unattended, dereliction. Functionally, a building usually becomes underused because of obsolescence. Complete vacancy, however, is the most noticeable effect of building redundancy.

2.2. Retrofitting

The current building retrofits predominantly focused on energy and cost efficiency at an individual building or building component scale. While the aspirations of these retrofits are crucial to the sustainable development of our built environment, we can and need to do better. Many argue that we need a shift in worldview from mechanistic to regenerative, and to do so, we must engage with the living world by (re)aligning human and natural systems. The purpose of a 'proactive' retrofit approach which seeks to integrate net-positive, restorative, and regenerative design concepts into building retrofits. A regenerative design model that explores the critical interactions between physical, human, and natural systems is developed to achieve these proactive outcomes. A set of regenerative design principles for building retrofits are proposed to emphasize the positive interactions an existing building can have with its surrounding environment. More specifically, this paper will explore how an energy-efficient building retrofit can improve occupant health and wellbeing, and restore and enhance local ecosystems. A detailed example will then be used to demonstrate the principles as a means of shifting the way designers and decision-makers view the building retrofit design process [14] [15].

Moreover, Nandish [16] found that retrofitting of an existing building into a green building taking into account the aspects of energy, water, and materials along with cost considerations such that the occupant wellbeing, environmental performance, and economic returns are improved. In the present project, we have proposed to give credits to rate the chosen building for its various green features according to the rating system of LEED and suggest measures to improve the green performance of the building.

3. Building Components

Renovation is a change effort of a current performance towards the new one, even a part or full of renewable step. In Indonesia for Green Building gave definitions of renovation is stated by demolished, with building types such as: residential in any categories, office building, commercial, warehouse, campus, laboratory, and others. Demolish means to a part or full of renovation. Moreover, this addresses to focus on office building category [2].

Nevertheless, CASBEE for renovation (CASBEE-RN) stated that functional upgrading after the commencement of building operation describes by various terms such as repair, upgrading, renewal, renovation, and retrofitting [17]–[19]. This assessment addressed to building category.

The resume of assessment targets for building an improvement on renovation and retrofitting, as follows:

- a. Functional improvement of building energy & system
- b. Interior function improvement
- c. Building envelope improvement
- d. Whole building improvement
- b. Change of building usage

According to the research, topics focus on building category with office function currently. Thus, renovation and retrofitting will focus as topics in this part. Based on Casbee-RN and Indonesia Building Regulation, this table below resuming that shows the targets for green assessment on renovation and retrofitting of the buildings, the results of researchers from other countries from 2002 to 2018.

4. Result and Discussion

Queena [20], [21] found that the government's role in enhancing BEE promotion by breaking that role into four categories: the roles of law and policymaker, economic motivator, fiscal hub, and advocator, then found that governments of different countries play different roles in BEE promotion based on their national circumstances. It is shown by Roulet [10] that make it possible to rank or to rate buildings or retrofit scenarios according to more than one criteria. Also, sustainable building rating systems are used to examine the performance or expected the performance of a 'whole building' and translate performance assessment into a tool that can be used to compare the building performance of other buildings or a performance standard [11].

Related that, the government has an essential role in issuing the green rules for buildings implementation towards a green achievement. Indonesia has a Ministry Regulation [2] and a Circular Letter [3] to guide the building stakeholder such as architect, engineer, and building management. Green Building defined that a building has criteria and real performance significantly on water and energy saving, and other sources through green rules to function and classified its building management. It has stages as programming, planning & designing, construction, operation, and demolition. Moreover, it divided into three categories: mandatory, recommended, and voluntary for greening achievement.

According to the research, that focus on renovation and retrofitting, in Building Regulation above stated that improvement is the activity of the demolition stage. Demolition meant by demolishing a part or full of the buildings, component, material, and or facility that has similarity meaning with a renovation. Nevertheless, all retrofitting based on repairing a green achievement.

In the table are listed marking arrows in red, orange & green. As a result, the assessment analysis from professional responses. They must recognize the existing building components for renovation and retrofit. It shows that there were many objections to the statements given, which shown in the dominance of red and orange for all provinces, West Java, Yogyakarta & East Java.

Table 2: Responses of Component Statements

NO.	TARGET IMPROVEMENT CATEGORIES	TOOLS	EMPHASIS	WEST JAVA	YOGYA-KARTA	EAST JAVA
1	Functional Improvement of Building Energy & System	inequilibrium of temperature indoor & outdoor	- human comfort - building performance			
2		climates & geographical conditions				
3		materials of wall & floor				
4		human comfort				
5		energy performance				
6		technology tools				
7	Interior Function Improvement	personal control over operable windows	- human attitude in building operation			
8		multi or single space				
9		cleanliness & maintenance				
10		lighting, acoustic & ventilation				
11		attitude & education				
12	Building Envelope Improvement	routine & respons maintenance	indoor temperature control			
13		building management				
14	Whole Building Improvement	reduce negative of environment impact	self-control of the building by stakeholders' role			
15		satisfatiocn				
16		software app usage				
17		role of stakeholders				
18	Change Of Building Usage	function & physical attributes	upgrading			
19		upgradable				

AGREE
DISAGREE

Source: Survey 2019 [12]

5. Conclusion

Therefore, we need to study the assessment of green building since the issue of achievement for public buildings had brought lots of problems to the current or existing building in Indonesia. Particularly on renovating and retrofitting works. It is necessary to identify the issues and to develop how to solve the problems to achieve the green assessment. A whole process in design to operate the building actually should be reviewed on green assessment. Nevertheless, Indonesia still has lots of existing buildings to be assessed the green achievement.

In conclusion, the research answered all questions regarding on recognizing the components of the buildings through five improvement statement (functional improvement of building energy & system, interior function improvement, building envelope improvement, whole building improvement, & change of building usage) for pre-construction on renovation and retrofitting for green achievement. It could develop to the next research on developing a strategy on green achievement for construction.

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