The obstacles of green building implementation in Semarang city

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Abstract. The Semarang City Government has issued a Mayor Regulation on Green Buildings since 2019. Since then the construction of buildings with a certain floor area in Semarang City must follow this regulation. Evaluating implementation constraints related to green building construction based on the experience of the development actors, is an important thing to do. This study aims to identify obstacles in realizing green buildings in the city of Semarang. Data collection was carried out through a questionnaire survey of respondents from development actors involved in green buildings such as contractors, consultants and project owners and bureaucratic officials related to green building licensing. Data analysis was performed using descriptive analysis to reach agreement between respondents. Next, a hierarchy of these constraints will be sought. Constraints found in realizing green buildings are: lack of socialization from the city government, alternative materials, lack of best practices, experts, and financing. For this reason, a strategy is needed to overcome these obstacles from every aspect or based on a combined consideration of all aspects.

1. Introduction
The concept of green building has begun to be widely applied in Indonesia. The Green Building Council Indonesia (GBCI) has started since 2009 by providing education and facilitating the application of the concept of sustainable green buildings. Since then, there have been several buildings in Indonesia that can be categorized as green buildings. Apart from the role of non-governmental organizations (GBCI or other institutions), the number of green buildings in Indonesia is also inseparable from the role of the government, both central and local governments. The role of the central government through one of the regulations of the Minister of Public Works and Public Housing Number 02 / PRT / M / 2015 concerning Green Buildings [1], has also contributed to the emergence of green buildings, especially for government buildings. For local governments, the most prominent is from the Provincial Government of the Special Region of Jakarta. Through the Regulation of the Governor of the Special Capital Region of Jakarta Province Number 38 of 2012 concerning Green Buildings [2], the construction of strategic buildings in the City of Jakarta has been designated as green buildings.

The emergence of several regional regulations governing Green Building in several areas, such as DKI Jakarta, Bandung City, and Semarang City, is certainly a positive thing related to the application of green building principles on the issue of sustainable development. In principle, these regulations regulate, direct certain buildings to follow the green building principle, which is usually associated
with the issuance of building permits (IMB). In fact, the implementation of green building construction in several regions certainly faces obstacles and challenges on its own, considering that until now there have only been three regions that have passed regional regulations relating to green building buildings from hundreds of cities or regions in Indonesia. Likewise in neighboring countries, barriers to the application of green buildings are also encountered, especially in relation to the awareness of the public, including actors in the construction industry who do not have a high commitment to realizing green buildings [3, 4].

As a city that already has regulations regarding green buildings in Semarang City, it is necessary to evaluate the implementation of these regulations, especially those related to implementation constraints.

2. Literature Review

2.1. Green Building

As a result of climate change, green building is expected to be a solution to overcome the increasingly limited resources for human life. Green building is a concept for saving and optimizing resources, controlling pollution, which also takes into account the health and comfort needs of building users.

The Green Building Council Indonesia (GBCI) as a pioneer of the green building movement in Indonesia formulates several measurable criteria to assess and facilitate the realization of green buildings by grouping the criteria into several categories, namely [5,6]:

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

Each category has several criteria, both as prerequisite criteria and criteria that receive an assessment. The ASD category has criteria as prerequisites that must be met, namely the basic green area, while the criteria for assessment include: site selection, community accessibility, public transportation, bicycle user facilities, landscaping on land, micro climate and rainwater runoff management. The EEC category has prerequisite criteria, namely: sub-meter installation and calculation of OTTV (overall thermal transfer value). Based on the OTTV calculation criteria, it is required that the building has a maximum OTTV value of 35 watts / m². The criteria for the EEC category which are criteria for assessment include: energy saving measures, natural lighting, ventilation, impacts of climate change, and renewable energy in the site. The WAC category has prerequisite criteria, namely: water meter and water use calculation. The assessment criteria are: reduction in water use, water features, water recycling, alternative water sources, rainwater storage and efficient use of landscape water. The MRC category has prerequisite criteria, namely: fundamental refrigerants. The criteria that are assessed for this category are: use of used materials, environmentally friendly materials, use of refrigerants without ODP, certified wood, pre-fabricated materials, and regional materials. The IHC category has prerequisite criteria, namely, introduction of outside air, while the assessment criteria include: monitoring of CO₂ levels, control of cigarette smoke in the environment, chemical pollutants, view of the outside of the building, thermal comfort, and noise levels. The BEM category has prerequisite criteria, namely basic waste management, and assessment criteria, namely: GP (Green Professional) as a member of the project team, pollution and construction activities, advanced waste management, good and correct commissioning systems, submission of green building data, agreements in carrying out fit out activities, and surveying building users.

International Finance Corporation (IFC), a group member of the World Bank, has also issued a green building certification system for emerging markets, called EDGE (Excellence In Design For Greater Will). EDGE is a measurable step for construction actors to optimize building design, so that the product becomes more viable investment and more marketable, with efficient resource saving
oriented. The saving of resources and energy includes the consumption of energy, water and materials in buildings [7].

2.2. Regulation of the Mayor of Semarang regarding Green Buildings

Semarang Mayor Regulation Number. 24 of 2019 concerning Green Buildings [8], contains provisions regarding the construction of buildings with certain criteria in Semarang City which must meet the requirements as green buildings. Green buildings are buildings that meet building requirements and have significant measurable performance in saving energy, water and other resources through the application of green building principles in accordance with the functions and classifications in each stage of its operation.

Energy efficiency requirements for green buildings in Semarang City include provisions regarding: building envelopes; air conditioning system; artificial lighting system; the transportation system in buildings; and the electrical system [1,8]. The building envelope requirements include an OTTV value (not to exceed 40 watts / m²) and a roof thermal transmittance value (U-value) that does not exceed 1.2 watts / m² K. The requirements for a green building air conditioning system include: room temperature regulation (25°C and tolerance 1°C), at 60% relative humidity (10% tolerance). Artificial lighting requirements include: installation of motion sensors in the toilet room (area more than 25 m²); installation of electric photo sensor lighting systems (for open office spaces, conferences, lobbies or waiting houses with an area of more than 100 m² with windows; and the highest LPD rating of the lighting system is 8 watts / m² on average in one building. Transportation system requirements includes: Variable Voltage Variable Frequency (VVVF) control for elevators; and automatic control for escalators. Electrical system requirements include the need to use separate gauges (sub-meters) in the electrical power group including: lighting and power (socket); escalators. Air conditioning system requirements for water efficiency include: the highest flow rate; measuring sub-meters at building water sources (PDAM and deep wells); and rainwater harvesters stored in raw water reservoirs (size 0.025mx area ground floor) to be treated as primary water. Requirements for indoor air quality management include: CO and CO2 sensors mechanical ventilation systems in closed and fully automated parking spaces, as well as CO2 sensors for spaces larger than 100 m² with function of meeting rooms, auditoriums, conference rooms, theatre or classrooms and operating automatically.

3. Method

This study is a qualitative study with a focus on implementing green building regulations in the city of Semarang. The research methodology is data retrieval through interviews and case studies. The case study was carried out on buildings that are under construction that follow the provisions of green buildings in Semarang City, namely the UNDIP Serba Guna Building and the PU Polytechnic building. Interviews were conducted with the building construction actors either as consultants or executors (contractors). Respondents as the sample were selected purposively, with the following criteria: (1) occupying a key position in the organization (consultant / contractor); (2) mastering the problem area which is the research topic; (3) responsive and have high concern for the implementation of green buildings.

4. Result and Discussion

In the case of the Gedung Serba Guba (Multipurpose building) UNDIP, efforts to comply with the provisions regarding green buildings include saving energy, water and other resources. Energy efficiency is achieved through: (1) building orientation; (2) air condition system and chiller plant system; (3) double glazed low energy glass; (4) efficient light system; (5) atrium to allow for natural illumination; (6) cross ventilation. Efforts to save water are achieved through the following efforts: (1) rainwater harvesting; (2) effective landscape and vegetation; (3) water efficiency fitting; (4) sub metering, and efforts to maintain air quality are carried out by: installing a CO sensor and a CO₂ sensor.
In the second case (Ministry of Public Work Polytechnic Building), efforts to comply with the provisions regarding green buildings include saving energy, water and other resources. Energy efficiency is achieved by working at: (1) building orientation; (2) air condition system and chiller plant system; (3) natural ventilated lobbies; (4) deep overhangs and corridors; (5) cross ventilation; (6) screens to deflect excessive sunlight; (7) locally sources materials. Efforts to save water are achieved through the following efforts: (1) rainwater harvesting; (2) effective landscape and vegetation; (3) water efficiency fitting; (4) sub metering, and efforts to maintain air quality are carried out by: installing a CO sensor.

Based on the results of the interview, several facts were obtained regarding the fulfillment of the provisions of the Semarang Mayor Regulation Number 24 of 2019 concerning green buildings. There are several aspects that can be categorized as provisions that are difficult to achieve and provisions that are easier to achieve for various reasons. Provisions that are difficult to achieve with regard to energy efficiency include requirements for artificial lighting and requirements for indoor transportation systems. The difficulty in meeting the requirements for artificial lighting is related to the additional costs that must be incurred for the installation of motion sensors or photo-electric sensors and the planners’ lack of experience or knowledge regarding the exact and effective specifications to be applied to the building being designed. Likewise, the transportation requirements in buildings have similar reasons to the requirements for artificial lighting.

Relatively more accessible requirements for energy efficiency are: building envelopes, air conditioning systems and electricity. The ease of achieving the requirements regarding building envelopes is due to the requirements for the OTTV value stipulated in the Mayor Regulation (OTTV not exceeding 40 watts / m²) is lower than the requirements for the OTTV value in SNI 03-6389-2011 concerning the Conservation of Building Envelope Energy in Buildings and also terms of GBCI (≤ 35 watts / m²). An efficient and effective air conditioning system is a priority in planning because building owners or users will benefit from lower operating costs. Likewise, with the provision of a measuring device (sub meter) for the electricity system, it is relatively easy to implement both at the planning and implementation stages, even at the operational stage of the building, the building manager will be assisted in efforts to improve the efficiency of electricity use.

A difficult condition to achieve for the management of indoor air quality relates to the automatic system of CO and CO₂ sensors. The effectiveness of the automatic system during the operational stage of the building needs to be tested and evaluated for improvement at the future planning stage. Various requirements that are relatively difficult to achieve are related to the availability of experts who master green building techniques, both at the planning and implementation stages, where the availability of these experts is also an obstacle to the implementation of green construction according to research from Dewi and Diputra [9].

5. Conclusions
From the results of the study, it can be concluded that the constraints in implementing green buildings in Semarang City are related to the capacity and experience of parties involved in green building construction, such as designers, contractors, supervisors and work owners. In addition, inadequate access to suppliers or industries that provide goods, as well as technology in accordance with green building requirements, is also a dominant obstacle in the application of green buildings in Semarang City.

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