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Regional Case Study

Green Building Assessment of Cilacap State Polytechnic: Building A

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Abstract

Buildings to achieve sustainable development must meet environmental criteria. This environmentally friendly building design is often referred to as a green building. The Green Building concept aims to reduce the negative impact on the environment from the construction and utilization of buildings. This study will discuss the criteria and requirements that must be met by company buildings to be categorized as Green Buildings according to the Green Building Council Indonesia (GBCI) and obtain a Greenship certificate, as well as any components at the construction and maintenance stage that affect the fulfillment of these requirements. This study uses a quantitative method by the green ship standard version 1.1. The greens criteria assessment in Building A resulted in 51 points. The results of this assessment explain that Building A is included in the silver category. This result explains that 44% of Building A's facilities have met the green building criteria. Upgrading from silver to gold category needs to increase 7 points by adding facilities, standard operating procedures, and policies.

Keywords: Assessment; greenship; silver category

1. Introduction

Building activities have consequences for using natural resources, energy, and the resulting waste (Andika et al., 2021). Limited natural resources and energy need to be saved by expanding the concept of sustainable development (Diniari et al., 2021). Buildings to achieve sustainable development must meet environmental criteria (Berawi et al., 2019). Environmentally sound development is expected to reduce emissions and impact air pollution, improve health and quality of life, increase productivity, and increase energy security (Mahmoud et al., 2019). Conventional building design concepts generally discuss the function and safety of the building. It also needs to be integrated with environmental criteria to become an effective and efficient building. This environmentally friendly building design is often referred to as a green building (Putra et al., 2020).

Green Building is a sustainable building whose construction and operation consider environmental aspects. The aspects include the use of resources throughout the life cycle of the building, from site selection to design, construction, operation, maintenance, renovation, and use (Widyawati, 2018). The green building meets the requirements based on measurable performance in terms of saving water, energy, and other resources (Ardhiansyah and Azizah, 2020). There are six

general green building criteria: land use, energy efficiency and water conservation, eco-friendly materials, air quality, and waste management (Samosir, 2020). In Indonesia, there is already a green building assessment standard, green ship, issued by the Green Building Council Indonesia (GBCI). GBCI has been an independent green building appraiser since 2009 and registered with the Indonesian Ministry of Environment. GBCI issues green building assessment criteria for new buildings and existing buildings. The benefits of green building assessment are for improving building services to its users, which impact the effectiveness of activities in the building (Febrina and Maulina, 2020). The Green Building concept aims to reduce the negative impact on the environment from the construction and utilization of buildings. However, there are differences in the priority of the criteria or detailed requirements for Green Building which are adapted to the conditions of each country (Kurniawan et al., 2020). Green Building Certification in existing buildings by implementing some changes to the building to make them more environmentally friendly (Sudarsana and Harmayani, 2020).

This study will discuss the criteria and requirements that must be met by company buildings to be categorized as Green Buildings according to the GBCI and obtain a Greenship certificate, as well as any components at the construction and maintenance stage that affect the fulfillment of these requirements. This research is limited to existing buildings and their application in the territory of Indonesia based on Greenship for New Buildings version 1.1. Building A of Cilacap State Polytechnic is the main building of Cilacap State Polytechnic, established in 2010. Building A of Cilacap State Polytechnic is used for the boardroom, meeting rooms, and academic and administrative services. Building A consists of 3 floors with a building area of 1700 m^2. The occupancy in Building A reaches 300 people per day. The average user density is five people per m^2. It is necessary to make efforts to improve the comfort of the building by conducting a green building assessment of the building. This green building assessment is expected to produce recommendations for maintenance and repairs that impact the productivity of academic and administrative activities at Cilacap State Polytechnic.

2. Literatur Reviews

The engineering world is familiar with Green Building and Green Architecture concepts. 'Green' can be interpreted as sustainable, earth-friendly, and high-performance building, as well as low-energy or zero-energy building. Green building is a building concept with certain requirements regarding location, planning, design, renovation, and operation systems, which adhere to the principle of energy-saving and must positively impact the environment, economy, and society. Green Building is a 'sustainable building' concept that refers to structures and uses environmentally responsible processes and efficient resources throughout the entire building life cycle from site determination, design, construction, operation, maintenance, renovation, durability, utility, and comfort (Sudarwani, 2013). Green building or green building is the science of building structures that are built using environmentally responsible processes that include the efficient use of natural resources throughout the entire building cycle, starting from determining building design, construction, operation, and maintenance to building renovation (Saka et al., 2021). The concept of green building includes the principle of saving energy and natural resources and minimizing negative impacts on the environment, economy, society, and humanity. Some of the principles of green building include the following :

1. Efficient in energy use

   The scope of energy use referred to in this case includes the energy needed to mine building materials, process building materials, energy to transport from the source to the construction site, energy during the process of installation or construction of buildings, as well as energy for operating activities in buildings (building operational activities). One of the applications to streamline the use of energy is the use of solar energy as a backup energy source for buildings and as natural lighting for rooms with installations optimal windows to reduce the need for electricity for lighting during the day (Sudarwani, 2013; Yüksek and Karadayi, 2017).

2. Efficient in water use
   Efficiency in water use includes reducing water consumption, non-disposable water use, for example, the use of greywater, and water recycling. The reduction or saving of water consumption is assisted by the implementation of technologies such as ultra-low toilet flush, the use of showers instead of dippers, the use of greywater for irrigation or watering, and so on (Sudarwani, 2013).
3. Efficient use of natural resources (building materials/ materials)
   The use of natural resources for efficient building materials or materials can be done through the use of renewable materials such as plant parts (wood, straw, plant fiber, hemp, or bamboo) or recycled materials (Yüksek and Karadayi, 2017).
4. Improving the quality of the environment
   Aspects covered in environmental quality include comfort, well-being, air quality, light quality, and increased productivity of its occupants (Sudarwani, 2013).
5. Maintain the health of building occupants
   Building materials and activities in buildings must not emit harmful gas emissions or produce waste that can interfere with the human health of its residents (Vafadar, 2019).
6. Optimal use and maintenance of buildings
   Green buildings that are environmentally friendly need to implement good and responsible operational processes and maintenance based on the applicable green criteria (Anastasia, 2016).
7. Reducing waste and pollution
   A well-designed, environmentally friendly building can minimize the amount of waste generated by residents' activities and also provide waste management units or facilities or garbage, such as composting or channels that use greywater (Sudarwani, 2013).
8. Prevent or minimize environmental degradation
9. Well-designed eco-friendly buildings apply facilities and infrastructure construction techniques that will prevent or minimize environmental damage such as the creation of infiltration wells or the construction of yards with bio porous water infiltration systems or paving blocks (Sudarwani, 2013).

Green buildings are designed to reduce the overall impact on human health and the natural environment by efficient use of energy, water, and other resources so that with less operational costs, it has excellent energy performance, reducing waste, pollution, and environmental degradation, the use of locally available natural ingredients. Green Architecture is a building architecture concept that seeks to minimize negative impacts on the natural and human environment and produce a better and healthier place to live through energy sources and natural resources efficiently and optimally, so the green architecture is closely related to green building (Sudarwani, 2013; Vafadar, 2019). An architecture is referred to as 'green' if in architectural design it involves environmentally friendly components such as the use of renewable resources (renewable sources, solar cells of power plants, the use of plants for roofs and rain reservoirs, the use of compacted gravel for pavement areas, and so on. Green architecture is more than just planting grass or adding more plants in a building, but also empowering architecture or buildings to be more beneficial to the environment, creating new public spaces, creating community empowerment tools, and so on (Sudarwani, 2013).

Sustainable architecture is an architectural concept that aims to keep natural resources sustainable and resilient in the long term associated with the life of the strong potential of natural resources and the human ecological environment. Green Architecture is an architectural concept that seeks to minimize adverse influences on the natural and human environment and produce a better and healthier place to live, which is done by utilizing energy sources and natural resources efficiently and optimally. The principles of green architecture include:(Sudarwani, 2013).

1. Environmentally friendly buildings: save electricity use, use natural energy such as sunlight as lighting, natural air circulation and green plants as air conditioning, and environmentally friendly building materials.
2. Incorporating the concept of sustainability (*sustainable building*): buildings can survive in the long term to save resources and minimize damage to the surrounding environment
3. Thinking about aspects of human health: buildings must create a healthy atmosphere for residents in them such as cool air, a quiet and not noisy environment, scenery that relaxes the mind, and others.
4. Supporting a healthy earth's climate: having water infiltration so that it can reduce the risk of flooding in the rainy season, many green plants to absorb carbon dioxide gas in the air.
5. Thinking about the useful aesthetic value: the choice of materials and shapes of the building is not only beautiful to look at but also provides benefits to the building itself and the residents in it.

The application of the principle of green building in building construction must start from the use of land that follows the rules of urban spatial planning and allotment areas in an area. The arrangement of buildings to create order will also facilitate the installation and provision of facilities and infrastructure that can ultimately save energy consumption. The regulations in erecting buildings include, among others, the basic efficiency of the building, the coefficient of the floor of the building, the line of buildings, and green open space (Karuniastuti, 2015). The basic coefficient of a building is the percentage of the maximum land area built against the total land area. The greater the percentage of the basic coefficient of the building, the smaller the green open space will be. Green open space is directly related to the ability of the land to absorb water from above ground level (runoff). Environmentally friendly buildings can absorb as much surface water as possible to enter the ground to minimize runoff. The selection and use of land in an area are usually regulated in a general plan of urban spatial planning and a detailed plan of urban spatial planning (Karuniastuti, 2015).

Land selection and use must be carefully considered because it is related to land or forest clearing activities, which are the source of CO_2 gas emissions that will impact global warming (Karuniastuti, 2015). The issue of global warming has long arisen. It continues to be a global concern that has become an urgent issue because its impact has become increasingly real and endangers human beings' life. Some of the impacts that have been felt include (Al-Yasiri and Géczi, 2021)::

1. The occurrence of temperature increases which was recorded in the last 3 decades there was a very successful warming of the earth's surface temperature where in 2016 the earth experienced its hottest temperature with an increase of more than 1 ^{o}C within 1 year from 2015
2. Sea level increase
   A report from The American Meteorological Society (AMS) states that there was an increase in sea level by 77 mm in 2017 when compared to 1993
3. The occurrence of heat waves
   The heat wave will directly have an impact on the occurrence of wild forest fires and human health , including hypertension, heart disease, diabetes to the risk of death.

Architecture or green buildings become a 'movement' in responding to the impact of environmental conditions that have occurred in recent decades in the form of efforts to design and manage buildings and the environment more wisely to prevent or reduce the minimum possible negative impacts on the environment. Green or environmentally friendly architecture has complex, dense, and vital properties because it contains various dimensions such as time, natural environment, space, building engineering, society, and culture to form harmony between humans and their natural environment (Karuniastuti, 2015). Architecture or green buildings are, of course, more than a step towards installing solar panels and efforts to save electricity consumption, plant grass, or plant more plants in a building, will but broader than that is creating more benefits for the environment, creating tools to empower communities, and creating new spaces for the public. Architecture or green buildings

must also be sustainable, namely the concept of conserving natural resources. Sustainable natural resources certainly have a long vital potential life, are protected from damage, and can support human life in the long term and down-down. Sustainability is influenced by how the management of natural resources is utilized so that it does not lead to excessive and destructive exploitation so that it can meet needs in the present without compromising the ability of future generations to meet their needs (Sudarwani, 2013).

The properties of buildings that apply the concept of green building or green architecture include:

1. High performance building

A high-performance building means that the building can integrate and function building attributes optimally in the cycle of daily activities carried out on the building. The attributes of a building include aspects such as energy efficiency, security, environmental ecology, resilience, access, financing, productivity, sustainability, function, and Operational Building (Question Of The Week: What Is A High-Performance Building?, 2016).

2. Earth friendly building

Earth-friendly or eco-friendly or environmentally friendly is a building that minimizes the use of natural resources and emissions and waste produced and is even expected to create a positive impact, improve environmental quality, and lower the impact of global warming. Earth-friendly buildings have the characteristic of providing benefits for the people in them so that there is an increase in the quality of life, health, and productivity. Eco-friendly buildings have the main goal of minimizing the negative impacts caused and together with it maximize the positive contribution to the surrounding environment (Eco-Friendly Building Explained and 5 Mind-Blowing Examples, 2022)

3. Sustainable building

A sustainable building must be environmentally friendly or earth-friendly. A sustainable building is a building that can maintain and even improve the quality of life and function in harmony with the climate, traditions, and culture in the surrounding environment, maintain the preservation of energy and natural resources, reduce the amount of waste that is harmful to humans and other organisms and maintain local and global ecosystems in a unified life cycle (Srinivas, 2015).

Designing a sustainable building incorporates the role of multidisciplinary science, including mechanical engineering, electronics, communication, acoustics, architecture, and Structure. A common view on sustainable buildings is buildings that preserve energy and water resources and reduce CO_2 gas emissions. Still, from the point of view of Structure, the sustainable building can integrate computing technology, sensors, and life cycle cost optimization (Wang and Adeli, 2014). The structural system in building a sustainable building includes land use, materials, and energy. The selection of materials that have a thermal mass will be able to adjust or release excess heat in the material without the material undergoing significant temperature changes. Thermal mass is the combined material property of density, heat conductivity, and heat of a specific type. The focus of sustainable building design in terms of Structure can be divided into 3, namely material Structure, system structure, and design optimization

The building structure system is a method to assemble and arrange the structural elements to support and deliver the load it has safely into the ground without exceeding the allowable pressure limit on each component (Britannica, 2020). Material structure considers the energy and environmental performance of a type of material. The system's structure involves the size, dimensions, angles, shapes, or series of building structures. In contrast, the design of a design building involves using intelligent technology to optimize building operations (Wang and Adeli, 2014). Optimization of the design of a sustainable building includes interior and exterior design. The use of LED lamps (light-emitting diodes) that save electricity for room lighting, the use of solar panels to reduce PLN electricity needs, and minimize the number of air conditioners or air conditioners is some application of design optimization from the interior side. In contrast, the design of the roof of the building into a roof garden is an example of optimization from the exterior side (Karuniastuti, 2015).

Figure 1. Roof garden (Churchill, 2020)

Figure 2. Solar panel roof (Puiu, 2022)

Figure 3. Optimum windows for lighting (Sanchez, 2022)

4. Healthy building

A healthy building is a building that considers the health aspects of the occupants of the building. Healthy buildings must meet the standards that, according to research conducted at Harvard, there are nine foundations of a healthy building: air quality, ventilation, lighting and viewing angles, noise, temperature, humidity, water, building safety, and cleanliness (Allen, 2022).

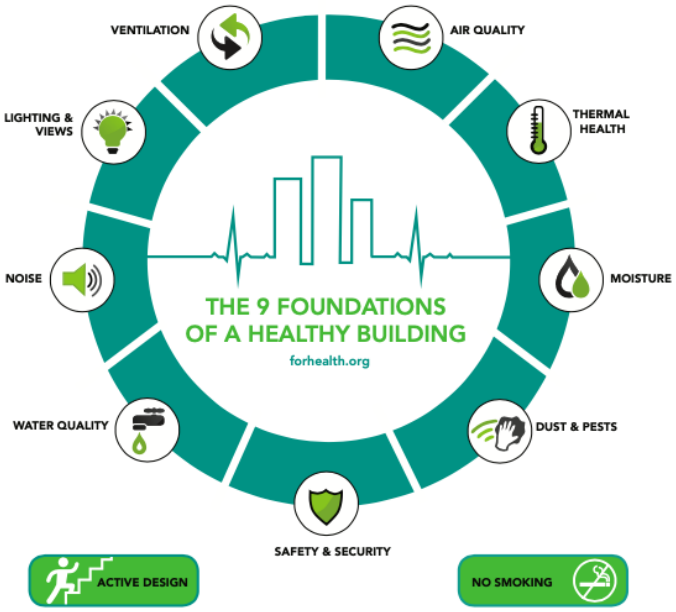

Figure 4. Foundations of healthy building (Allen, 2016)

Sustainable green buildings also affect the human health of their residents in the mental aspect (Vafadar, 2019). The concept of modern health includes the complex interaction between environmental, organizational, and personal factors in the context and place in which humans live. A broad environmental issue involves the health of the human population. Several studies mention the hypothesis regarding the existence of a close relationship between the environment and health where humans have genetic factors that indicate the instinct of the need for nature to relieve stress and provide calm (Matilda Annerstedt et al., 2012). Annerstedt's research shows a synergistic effect between mental health and the quality of a green environment in addition to physical activity factors, where access to a beautiful environment will improve the condition of poor mental health by 80%.

5. Climate support building

Climate support building is related to the problem of global warming. A climate-supporting building has the minimum possible contribution to the rate of global warming. That means that the building has low CO2 emissions. Climate support building also has the principle of adapting to the climate of the surrounding environment; for example, in a tropical climate, a building needs to have a greening concept and a water infiltration system to provide coolness to the air during the dry season and have the ability to hold water during the rainy season (Sudarwani, 2013).

6. Aesthetic usefully

Environmentally friendly buildings should not abandon aesthetic principles, so green architectural technology's role is very important in designing environmentally friendly buildings but still attractive or aesthetically pleasing (Sudarwani, 2013). In the late 1960s, the public did not receive sustainable buildings well in terms of their appearance. Although not all sustainable buildings are unattractive, in general, they cannot be accepted by society. Marcus Vitruvius, a Roman architect, suggested that a good build must contain three aspects: resilience, usefulness, and beauty (Chan, 2010). The sustainable aesthetic concept of a building will show the quality of human life and ecology, both of which are an inseparable part of the activity of inhabiting a building's buildings. Aesthetic value depends on the interaction of the architecture components, the environment, the community of residents of the building, culture, and social conditions. A sustainable environment integrated into living systems through processes in the biosphere shapes human character (Mako, 2013).

3. Methods

The Building A of Cilacap State Polytechnic is included in the existing buildings category. Greenship assessment in Building A uses the existing building assessment method. Assess existing buildings using the green ship standard version 1.1. This study uses a quantitative method by the green ship standard version 1.1. Research data consists of data from observations, surveys, and user interviews. Secondary data is also needed to assess the existing condition. The primary data is combined with secondary data to produce green rating information at Building A of Cilacap State Polytechnic.

Observations were made at Building A of Cilacap State Polytechnic by carrying out activities including measuring the area of the room, lighting level, air conditioning level, room humidity level, and noise level. Review the condition of facilities and infrastructure for each room in Building A. Review the sanitation system in building A. The survey was conducted on 100 respondents from the total building users regarding air temperature, room lighting level, sound comfort, building cleanliness, and pests. Interviews were conducted with the Head of the Learning Centre and Education Quality Assurance Unit (P4MP), State Property Facilities and Infrastructure Officer (BMN), and the Head of the General Section of Cilacap State Polytechnic to obtain data related to policies and processes in the maintenance of Building A. The interview method used to collect secondary data related to energy and water consumption in Building A. Secondary data was required to include the amount of electricity consumption, amount of water use, As-Built Drawing, and Standard Operating Procedure (SOP) documents related to building management.

The next step is to compare the results of data analysis with literature and theories relevant to the cases and problems found. These references are searched from books, journals, articles, research reports, and websites on the internet (Roshaunda et al., 2019). The output of several works of literature produces several effective alternative options to increase the green rating of Building A. This data processing is expected to produce effective and efficient recommendations to increase the green rating. GBCI is an independent (non-governmental) and non-profit organization that creates assessment criteria for parts in terms of design, construction, and operation called "Greenship," including an assessment of technological integration in the construction of a building. GBCI is an institution concerned that the construction sector has contributed the largest carbon emissions globally, which directly affects global warming. Greenship from GBCI has five types of assessments, namely assessments for new buildings, existing buildings, interior, homes, and neighborhoods. The purpose of creating Greenship is to implement optimal environmental management in a building to improve health and life quality. The criteria in Greenship are also a guide and solution to problems related to the environment through the rating and weighting system (Anastasia, 2016).

Greenship standards for existing buildings version 1.1. consists of 6 (six) criteria with ten prerequisites and 40 credit criteria with a maximum credit point of 117. The maximum number of credit points for each criterion is regulated in the green ship assessment form for the built building version 1.1. Assessment criteria include:

1. Appropriate Site Development by 13.68%
2. Energy Efficiency and Conservation by 30.77%
3. Water Conservation by 17.09%
4. Material Resource and Cycle by 10.26%
5. Indoor Health and Comfort by 17.09%
6. Building Environment Management by 11.11%

The final achievement value at the final assessment stage will determine the level or rating of application of green ship in the building, where there are four categories including platinum, at least 74 points, gold, at least 58 points, silver, at least 48 points, bronze at least 35 points. The results of the green ship assessment are then analyzed to provide recommendations for improvement. Recommendations for increasing the green rating are divided into two types, namely design or architect

and management recommendations. Recommendations must be able to help improve the quality and predicate of green building to a higher level (Busono et al., 2021).

4. Result and Discussion

Building A of Cilacap State Polytechnic is located on Dr. Soetomo Street No. 1, Sidakaya, South Cilacap, Cilacap Regency. The astronomical location of Building A of Cilacap State Polytechnic is at -7.717115294260996 latitude, 109.019913171718439 east longitude. Building A is the central building of Cilacap State Polytechnic. The electrical energy consumption of Building A of Cilacap State Polytechnic has increased every month. Buildings consume energy in every stage of the cycle and account for a significant portion of energy consumption globally, reaching 40% of the total energy consumption on earth. The impacts caused cannot be ignored. The topography of the development land plays an important role in saving the energy of a building because it affects the angle of incidence of sunlight radiation, slope, and soil orientation so that it can optimize the use of sunlight during the day and natural ventilation.

The physical and structural components of the building, such as windows, doors, floors, and walls, as well as the thermal characteristics, thickness, and color of the materials used, play an important role in the energy consumption of the building because it can affect the amount of heat absorbed or lost by the establishment. Landscape designs that are made accurately and account for energy conservation can reduce energy costs for heating or cooling a room by 30%. The type of material also determines the amount of energy consumption of a building. Renewable materials consume less energy than artificial materials because making and working on natural materials requires little energy and cost. These factors make buildings have enormous potential for energy efficiency (Yüksek and Karadayi, 2017). The data collected by GBCI is that more than 60% of emissions containing carbon dioxide (CO_2), sulfur dioxide (SO_2), and methane gas (CH_4) are produced by the construction sector, including the real estate development sector that the housing (building) sector is the sector most responsible for overcoming it as well. Greenship was created to educate the public to apply sustainability principles and facilitate changes in the Indonesian construction world in line with what is developing globally. GBCI's commitment is more obvious by rewarding buildings that have high value in meeting the Greenship criteria for both buildings that are already operating, new facilities, and housing (Anastasia, 2016).

Based on data obtained from PLN, the average electrical energy consumption of Building A is 8953 kWh/month. The calculation results brought an energy consumption intensity of 5.21 kWh/month/m2. Building A's energy consumption intensity is included in the very efficient category. Building A of Cilacap State Polytechnic can be seen in Figure 5.

Figure 5. Building a of Cilacap State Polytechnic

Government Regulation Number 16 of 2021 concerning Implementing Regulations of Law Number 28 of 2002 concerning Buildings mandates that the provision of facilities and accessibility for persons with disabilities and the elderly is mandatory for all buildings except residential houses (Anonymus, 2021). Buildings must have easy accessibility for user convenience (Rakyat, 2018). The results of the observations concluded that Building A was not yet accessible for persons with disabilities. The results of field observations can be seen in Table 1 (Supplementary).

People living in urban areas live in settlements with limited views because the city structure has many tall buildings. Most also work indoors because the work model is generally office. This indoor work makes working with artificial fractions a very common thing. Artificial lighting with a source of electrical energy is certainly different from natural lighting in light intensity, light color, and time of exposure to sunlight. Naturally, humans develop biological rhythms that are affected by fluctuations in the time of day and night. This natural rhythm is related to the moment, length of time, and intensity of light exposure. Inconsistent lighting cycles that the body receives can lead to sleep disturbances. According to the Illuminating Engineering Society of North America, comfortable lighting for a classroom or office ranges from 300 – 500 lux (horizontal). Lighting that is too bright, too dim, or that causes a lot of flickering can cause negative impacts on eye health. Research continues to be carried out to optimize the positive effects of restoration from the existence of an outside view in a building on its occupants. From the observations, students whose classrooms have access to outdoor scenery through windows are found to cope with stress quickly, and mental fatigue and pay attention are higher than those in closed classes (Allen, 2016).

Noise is an annoying or unwanted sound that affects normal human activities such as sleeping, working, and talking. Noise can be sourced from outside or from indoors. Sources of noise from outside the room include the sound of airplanes, traffic density, train noise, and others in the room, such as building mechanical equipment, industrial machinery, vacuum cleaners, crowds of indoor people, and so on. Noise can cause direct impacts such as deafness. Still, it can also have indirect effects such as difficulty hearing speech clearly, inhibiting concentration and attention, causing stress and fatigue, and non-auditory impacts such as hypertension for chronic exposure to violent sounds between 55 - 60 dB. Traffic crowds are known to be associated with an increase in the mortality rate due to hypertension in women, causing stroke in older adults, and even death from exposure to loud sounds above 60 dB. In an office environment, noise can increase the risk of accidents and interfere with workers' work performance and productivity, especially for jobs with a high level of complexity (Allen, 2016).

Cleanliness is associated with nine healthy building foundations. Then it falls into the category of dust and pests. The mass of dust that enters the body every day affects human health because dust acts as a reservoir for various harmful substances or microorganisms such as viruses, bacteria, chemical substances, allergens, animal hair or scales, clothing fibers, etc., particles-particles of paint containing lead. The pests referred to here are animals that are kept or that are in the home environment, such as mites, cockroaches, rats, cats, and dogs. These pests carry allergens into the room in the house, which causes immune reactions in humans such as allergic rhinitis and other allergies from mild ones such as sneezing, runny nose, and watery eyes to heavy ones such as asthma attacks (Allen, 2016).

The term thermal health encompasses any impact caused by thermal conditions on human health until the worst is the risk of death. It is not only limited to infections or discomfort due to thermal constraints. Pain caused by heat is influenced by factors such as air temperature, air flow rate, and humidity, including aspects from within the human body such as metabolic activity and clothing that inhibit heat. Thermal health tends to highlight the health impacts caused by heat. The invention of an air conditioner (AC) allows for regulating heat in a room or environment. The temperature of a room is influenced by several factors, including the design of two buildings, geography and orientation, occupant density, ventilation arrangements, building structures, and ventilation models. In many buildings today, ventilation systems play an important role in controlling indoor temperature and humidity. Ventilation, temperature control, and moisture contribute significantly to determining the

comfort of the workplace and the ability to work. The study results showed that thermal conditions are related to workers' health. When the thermal requirement of the workplace is uncomfortable, the workers can experience health problems such as hives, watery eyes, headaches, and throat irritation. When a room is too hot, there is an increase in the symptoms of sick building syndrome, lowering the mood of workers, an increase in heart rate, respiratory disorders, and a sense of fatigue. Temperature and humidity can also affect the spread of the disease. Influenza viruses spread faster in cold and dry environments, whereas fungi and molds quickly develop in warm but humid climates (Allen, 2016).

Water is an important need for human life because it is used to maintain body temperature, lubricate joints, protect sensitive body tissues, and improve the quality of body excretion through urine, sweat, and bowel movements. Drinking water contaminated with harmful substances is one of the main causes of global disease. Water is a pathogenic conducting medium such as cholera, dysentery, typhus, and polio. Various conditions originating in the waters have caused great deaths: diarrheal diseases that cause the deaths of hundreds of thousands of humans worldwide, millions of souls infected with aquatic parasites, and millions more exposed to neurotoxic heavy metals such as lead (Allen, 2016).

The results of a survey of 100 respondents show that 80% agreed the air temperature was quite good, 81% agreed the lighting level was quite good, 71% said the noise level was quite good, 93% said cleanliness was quite good, and 84% said the pest control was quite good. Respondents consisted of 50 students and 50 employees who were active in Building A of Cilacap State Polytechnic. The results of measuring noise level with a sound level meter can be seen in Table 2, while the green ship assessment criteria for Building A can be seen in Table 3 (Supplementary).

Assessment of greenship criteria at Building A of Cilacap State Polytechnic resulted in 51 points. The Results of this assessment explain that Building A is included in the Silver category. This result illustrates that 44% of Building A's facilities have met green building criteria. Upgrading from Silver category to Gold category needs to increase 7 points by adding facilities, standard operating procedures, and policies. Recommendations that can be made to increase Building A's green rating points include improve the drainage system by adding infiltration wells and connecting rainwater sewers with city drainsAdding solar panels for building lighting electrical energy supply, improve the lighting system according to the needs of each room referring to SNI 6197:2011, install air conditioners according to the needs of each room referring to SNI 6390:2020 and using materials that do not have the potential to damage ozoneRecording the use of electrical energy every month, scheduled air conditioning system filter cleaning, carry out water quality testing every 6 months, carry out air quality testing every 6 months, adding a minimal water filter to the kitchen, create standard operating procedures for waste management, develop traditional operational strategies for hazardous waste management, make standard operating procedures for pest control with environmentally friendly chemicals, make standard operating procedures for plumbing system maintenance and repair, cooperating with certified hazardous waste treatment agencies or building a Waste Water Treatment Plant (WWTP), perform periodic maintenance and repair reports every 3 months, have at least one greenship certified worker, have an occupational Health, Safety, and Environment (HSE) training program at least once every 6 months.

5. Conclusions

Cilacap State Polytechnic Building A is located on Dr. Soetomo Street No. 1, Sidakaya, South Cilacap, Cilacap Regency. The astronomical location of Building A of Cilacap State Polytechnic is at -7.717115294260996 latitude, 109.019913171718439 east longitude. Building A is the central building of Cilacap State Polytechnic. Assessment of green ship criteria at Building A of Cilacap State Polytechnic resulted in 51 points. The results of this assessment explain that Building A is included in the silver category. This result illustrates that 44% of Building A's facilities have met green building criteria. Upgrading from silver to gold category needs to increase 7 points by adding facilities, standard operating procedures, and policies.

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