Global Scientific JOURNALS

GSJ: Volume 10, Issue 5, May 2022, Online: ISSN 2320-9186

www.globalscientificjournal.com

Use of Green Building Design Concept in Mixed-Use Building: Review of Selected Case Study in Pandu Street and Pemuda Street, Medan City

Wilcox Yiinebari Barisua[1], Dr. Anthony D. Enwin[2]

[1]Department of Architecture, Rivers State University, Nigeria.

[2]Department of Architecture, Rivers State University, Nigeria.

Email for correspondence: yiinebariwilcox@yahoo.com, Contact mobile no.: 08021163430

Abstract

The research examines the effects of green building design in urban mixed-use buildings. To mitigate the effects of climate change, a mixed-use building design using green building principles is the best option. Excess heat radiation both inside and outside the building can be reduced using green building design. Climate change and the depletion of natural resources are current issues that represent a "must-be-addressed-right-now" goal in the built environment's development. More than any other industrial process, growing building development has a negative impact on the environment. Green building design principles are crucial to implement in structures. Green building design in mixed-use buildings must take into account a number of factors, one of which is the level of comfort. The density of commercial buildings in Medan City reduces green open space, and many structures fail to meet the minimum green open space criteria, which can help the city's development to minimize environmental temperatures. The data gathering methodology is case studies, and the method employed is qualitative. The analysis was descriptive in nature in order to produce a mixed-use building model with a green design idea. The findings reveal that efficient land use, energy saving, material conservation, and water conservation may all be used to make buildings more pleasant.

Keywords: Green building, Comfort, Sustainability, Built environment

1.0 Introduction

Green building is one of the strategies proposed to reduce the negative effects of the built environment on society, the economy, and the environment. The concept of green building design should be taken into account when planning new structures, particularly commercial ones. The Green Building Council uses numerous criteria to evaluate green buildings around the world, including appropriate site planning, energy efficiency and conservation, water conservation, indoor air quality and comfort, material resources and cycle, and building environmental management. According to Tamiami et al., three factors of green building criteria should be adopted, in this case on campus, to improve students' quality of life: energy saving, indoor health and comfort, and building environment management. A city, according to Haughton and Hunter, is a territory in which people and their activities work to enhance the natural, man-made, and social environment of the region on a small scale up to regional scale, and always support the global aims of sustainable development. The increasing number

of concrete buildings in the form of buildings and shophouses that serve as residential and commercial areas can be attributed to the growing economy and population. The structure reduces the amount of green open space available, which is one of the community's primary sources of oxygen. Multi-story buildings are more common nowadays since they are thought to be more effective and efficient in today's land conditions. Low, medium, and high-rise buildings make up storied buildings. In addition to the minimal land conditions, especially in metropolitan areas, one of the elements encouraging the construction of multi-story buildings is the increase in population growth in urban regions. This study will examine the usage of green building design concepts in mixed-use buildings in urban locations, based on prior studies on green building design concepts in commercial buildings and mixed-use buildings.

1.1. Definition of Terms

Green Building is the discipline of constructing structures and employing procedures that are ecologically responsible and resource-efficient., from site selection to design, construction, operation, maintenance, renovation, and deconstruction (U.S. EPA).

Mixed-Use Development (MUD) is a typology that combines two or more building typologies and is directed by walkability, according to Washington's Municipal Research and Services Center (MRSC).

Built Environment refers to the human-made surroundings that provide a context for human activities, ranging in scale from buildings and parks or green space to neighborhoods and cities, and can sometimes include supporting infrastructure such as water supply and electricity networks (Freebase definition).

2.0 Literature Review

Green building goes beyond and complements the traditional considerations of economy, utility, durability, and comfort in building design. A sustainable or high-performance building is another term for green building.

Impacts of The Built Environment

Table 1: Impacts of The Built Environment (source: U.S. Environmental Protection Agency)

Aspects of Built Environment:	Consumption:	Environmental Effects:	Ultimate Effects :
• Siting • Design • Construction • Operation • Maintenance • Renovation • Deconstruction	• Energy • Water • Materials • Natural Resources	• Waste • Air pollution • Water pollution • Indoor pollution • Heat islands • Stormwater runoff • Noise	• Harm to Human Health • Environment Degradation • Loss of Resources

2.1 Environmental Benefits of Green Building

Our climate and the natural environment are two of the most essential sorts of benefits green buildings provide. Green buildings can have a positive impact on the environment (at the building or city scales) by generating their own energy or promoting biodiversity, in addition to reducing or eliminating negative environmental consequences by consuming less water, energy, or natural resources.

At a global level:

i. When compared to other major polluting industries, the construction sector has the greatest potential for dramatically reducing greenhouse gas emissions – UNEP, 2009.
ii. By 2050, direct actions in buildings such as energy efficiency, fuel switching, and the use of renewable energy are expected to save as much as 84 gigatons of CO2 (GtCO2) – UNEP, 2016.
iii. By 2050, the building sector may save up to 50% of energy, helping to keep global warming below 2°C (above pre-industrial levels) – UNEP, 2016.

At a building level:

i. Green buildings in Australia that have earned the Green Star certification have been demonstrated to emit 62% fewer greenhouse gases and 51% less potable water than buildings built to satisfy minimal industry standards.
ii. When compared to conventional structures in India, green buildings certified by the Indian Green Building Council (IGBC) save 40-50 percent on energy and 20-30% on water.
iii. When compared to the industry standard, green buildings that have earned the Green Star certification in South Africa have been demonstrated to save between 30 and 40 percent energy and carbon emissions per year, as well as between 20 and 30 percent potable water.
iv. LEED-certified green buildings use 25% less energy and 11% less water than non-certified buildings in the US and other nations.

2.2 Economic Benefits of Green Building

Green buildings provide a number of economic or financial benefits to a variety of people or groups of people. Cost savings on utility bills for tenants or families (due to energy and water efficiency); lower construction costs and higher property value for building developers;

increased occupancy rates or operation costs for building owners; and employment creation are some of these.

At a global level:

i. According to the European Commission, global energy efficiency measures may save €280 to €410 billion in energy costs (almost double the US annual electricity usage).

At a country level:

ii. In 2014, the green construction industry in Canada created $23.45 billion in GDP and approximately 300,000 full-time jobs, according to the Canada Green Building Council/The Delphi Group.
iii. By 2018, the green building industry is expected to employ more than 3.3 million people in the United States, according to the US Green Building Council and Booz Allen Hamilton.

At a building level:

i. According to Dodge Data & Analytics, green buildings fetch a 7% boost in asset value over typical buildings, whether new or retrofitted.

2.3 Social Benefits of Green Building

Green building has been proved to have beneficial social implications in addition to economic and environmental benefits. Many of these advantages revolve around the health and happiness of those who work in green offices or live in green houses.

i. Harvard T.H. Chan School of Public Health / Syracuse University Center of Excellence/SUNY Upstate Medical School, 2015 - Employees in green, well-ventilated workspaces have a 101 percent rise in cognitive scores (brain function).
ii. Employees who worked in workplaces with windows slept 46 minutes longer each night on average - American Academy of Sleep Medicine, 2013.
iii. According to Park and Yoon (2011), improved indoor air quality (low CO2 and pollutant concentrations, and high ventilation rates) can result in up to 8% improvement in performance.

3.0 Methodology

In this inquiry, a qualitative method is applied. Using a case study approach, this study looks at how green building design concepts are used and applied on Pandu and Pemuda Streets in Medan City. It focused on findings from a report that determined the area's natural and physical attributes, as well as activities and documentation. To fulfill research requests, the

benchmarks for calculating the green architecture index of a mixed-use building using the Green Building Council Indonesia's GREENSHIP grading system have been modified. To demonstrate the usage of a green building design idea that may be employed in mixed-use buildings, descriptive analysis was performed to examine the data.

4.0 Findings and Discussions

Green architecture, according to Priatman, is "environmentally sound design based on concern for the maintenance of the natural world environment, with an emphasis on energy efficiency (energy-efficient), sustainable patterns (sustainable), and a holistic approach." Green Architecture is a design approach that focuses on decreasing negative environmental consequences, boosting human comfort with efficiency, and conserving energy resources, land use, and waste management in the architectural order. Because it minimizes adverse effects on nature, the environment, and humans to produce a healthy place to live, green building is very appropriate in the use of designing public commercial buildings on Pandu Street and Pemuda Street, Medan Maimun Sub-District, which is a part of the city center of Medan and is a CBD area. This structure makes a positive contribution to Medan's commercial public spaces.

Figure 4.1 – Aerial View of a Part of Medan the City of Million Smiles (Source: Rahul Medan)

4.1. The Analysis and Application of Themes

Although new technologies are constantly being developed to complement the needs in creating green architecture, the general goal is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment. This mixed-use building refers to the efficiency of saving energy and building that integrates with nature. The Green Architecture indication that was applied to the mixed-use building is an indicator of the Green Building Council Indonesia (GBCI) on building green buildings in

Indonesia. Examining the area's very limited environmental land, with natural and natural concepts, combined with the concept of high technology, this building allows it to continue to survive in the long run because it does not damage the surrounding environment.

4.2. Use of The Application of Green Building Design Concept in A Mixed Use in Pandu and Pemuda Streets in Medan City

4.2.1. Efficient Land Use: In this case study, big tracts of land in the downtown region would be quite difficult to come by. As a result, it's critical to make efficient use of land. Particularly along Pemuda and Pandu Streets, which are dominated by businesses and private offices. The plans for a mixed-use building on this site were modified to meet the requirements of the Medan regional administration for urban spatial planning. Reduce development of valuable areas, habitats, and green open spaces that emerge from inefficient growth by minimizing scattered urban systems and reducing development of valuable areas, habitats, and green open spaces. There are criteria for requirements in the proper land use category, such as a green bay covering at least 10% of total land area. And, based on the building's site layout and the city's RDTR field standards, the total green bay space to be utilized is 20%. The green bay area is used not just for landscape purposes, but also for other purposes. Because sunlight is not directly absorbed by concrete, the green roof was also used as a water catcher and a natural air conditioner. It keeps the surrounding area cool during the day and cool at night. The green roof is often used as a social gathering spot. The green roof on the top of a building floor that is not too high, according to the Architect, has more aesthetic points because it can be viewed from Pandu or Pemuda Street.

4.2.2. Energy Efficiency: Light is vital in buildings that are partially used as workspaces because it allows people to see using one of their five senses, the eye. Visitors can do a variety of things in the building if the lighting is good. Artificial light or lighting that utilize a lot of electrical energy can also be employed in buildings. Natural light, for example, comes from the sun shining through the skylight roof. However, if natural light is utilized to its full potential, electricity usage can be reduced, and visual comfort can be improved. A well-designed building envelope, together with air flow temperature control over the air conditioning system, will also help to improve the thermal quality of the building. The lighting quality and energy efficiency of the structure will improve if a high-performance luminous environment is created by carefully integrating electricity and sunshine sources. As a result, a new energy source is required to meet large energy demands. One of them saves energy by installing Solar Cells on the side of the building that receives a lot of sunshine. Lighting zoning for the entire workspace with motion sensors in compliance with GBCI standards. The utilization of openings in the building that allow the most amount of light in

during the day. Other ways to save energy in the building include using energy-saving features on the elevator, using a motion sensor, and using the escalator's sleep mode. Solar panels are used as an extra source of energy in the diagram below.

Figure 4.2 – Use of Solar Panels as An Additional Energy Producer (Source: F.A.S Lubis and P.W Dari)

4.2.3. Material Efficiency: This parameter's goal is to reduce the use of non-renewable building materials by including energy engineering, efficient design, planning, and construction, as well as building material recycling. Using previously used materials with recycled content to the fullest extent possible. This notion is most commonly used in the construction industry. The use of refrigerants, ecologically friendly products, materials that do not deplete the ozone layer (Non-Ozone Depleting Substance = ODS), certified wood, and prefabricated materials are only a few of the more technical material and resource considerations. As a green building, the materials chosen are typically environmentally friendly, such as rough-textured ceramic floor coverings to prevent heat reflection from the glass walls. As a compliment to ecologically friendly designs, natural red brick can be used in buildings because it is low maintenance and doesn't need to be painted. Several elements of the structure are made of glass. Its purpose is to reduce building electricity consumption, particularly in terms of lamp lighting. The building's UV protection was provided by aluminum curtain walls. All of these things, of course, have a favorable effect on the life force. Figures 4.3 and 4.4 show the natural red brick material and the curtain wall.

Figure 4.3 – Natural Red Brick Material
(Source: F.A.S Lubis and P.W Dari)

Figure 4.4 – Curtain wall
(Source: F.A.S Lubis and P.W Dari)

4.2.4. Water Treatment Efficiency: In the field of water treatment, the presence of water meters in buildings is a requirement. As a result, a water meter is located in the plumbing room in this building's design. One major issue with water usage in Medan City's downtown region is the demand for necessities that exceed the city's capacity to meet. Facilities in this mixed-use building required to rely on water collected, used, cleaned, and reused on site as much as feasible. Water conservation and protection can be achieved throughout the life of a building by using double pipes that recycle water in the toilet. The presence of a greywater recycling system into landscape water demands, which also includes a sewage treatment system, is a plus for alternative water sources. The water from toilet buildings is initially treated at a sewage treatment plant (STP). Draining rainfall into the infiltration land by digging a ditch There is also the use of infiltration systems in conjunction with rainwater runoff control to minimize the flow of water into the channel or recyclable space. Toilet flushing can also be done using recycled water.

4.2.5. Efficiency of Accessibility and Circulation: Circulation spaces are an essential aspect of any building's organization and occupy a significant amount of space within the structure. A circulation room's breadth and height must be appropriate to the type and volume of traffic it accommodates. The smooth circulation paths on the building are determined not only by the site circulation paths, but also by the time achieved between the mixed-use building and the neighbouring buildings. Open pedestrian access to at least three public facilities within 300 meters of the site, excluding the main road that connects it to subsidiary roads and/or other people's land. One of the GBCI's points also states this. Making subsurface circulation corridors is one of the possible uses. This is done with the density of circulation on Pandu Street and Pemuda Street in mind; therefore, lowering the density of circulation on Pandu Street and Pemuda Street will not allow a connecting circulation path to be built.

5.0 Conclusion and Recommendations

Green isn't just a fad; it's a way of life for the future. We anticipate that the label "green" will vanish as the concept becomes more widespread, but for the time being, we are still in the early stages of conversion. Because the operation of a structure might be even more important than its design in making a difference, the huge possibility to incorporate green practices into the management of existing buildings can actually propel us forward in the sustainability sphere faster. In the planning of mixed-use building construction, the emphasis or theme Green Architecture is used, where this concept uses the approach of minimizing negative impacts on nature by paying attention to land use efficiency, energy efficiency, material or material efficiency, water treatment efficiency, accessibility and environmental

circulation efficiency to improve environmental quality and humans to produce a healthy place to live because they make use of it. The use of a water recycling system for flushing toilets and watering plants, the efficient use of materials such as solar panels as an alternative energy producer, and the use of natural materials such as rocks originating from nature to reduce the temperature in buildings are all recommendations based on the study's findings. Based on the findings and discussions, it can be concluded that the use of the green building design concept in the mixed-use buildings studied in Pandu and Pemuda streets in Medan has provided the city with significant environmental, economic, and social benefits, earning it the moniker "City of Million Smiles."

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