



THE CONCEPT OF ENVIRONMENTALLY FRIENDLY BUILDING (GREEN BUILDING) BASED ON THE ANGLE OF CIVIL ENGINEERING

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ABSTRACT

In an era that is increasingly aware of environmental issues, green building has become a priority in the civil engineering industry to reduce negative impacts on the environment and promote sustainability. The purpose of this research is to investigate the concept of green building from a civil engineering perspective. This research involves a qualitative approach and uses the Miles and Huberman interactive analysis model by analyzing the principles of sustainable design and construction techniques in the civil engineering industry, as well as the application and evaluation of their effectiveness in realized green building projects. The concept of green building from a civil engineering perspective has an important role in reducing negative impacts on the environment through the selection of sustainable construction materials, energy efficiency, efficient water management, waste management, and design that takes into account the safety and comfort of occupants. By applying these principles, we can create sustainable buildings and help achieve overall environmental sustainability.

Keywords: green building; civil engineering; environment

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INTRODUCTION

In this modern era, concern for the environment is increasing. One aspect that is getting attention is environmentally friendly buildings or also known as "*Green Building*". The concept of eco-friendly buildings involves the sustainable use of resources, the application of green technologies, and efficient design to reduce negative impacts on the environment (Roshaunda et al., 2019) and Work environment play a role in employee performance as said by (Yusriadi, 2021). In the context of civil engineering, this concept considers aspects such as energy efficiency, the use of environmentally friendly materials, efficient water management, and the reduction of construction waste.

Civil engineering has an important role in realizing environmentally friendly buildings. In building design and construction, civil engineering focuses on sustainable use of materials and resources, efficient water management, and efficient use of energy. The application of green technology in civil engineering practice can include the use of renewable energy, the use of recycled materials, wastewater treatment, as well as building design that minimizes the use of natural resources (Sipayung et al., 2021).

A number of previous studies have been conducted in the field of environmentally friendly building concepts based on the point of view of civil engineering. These studies cover various aspects, such as the development of environmentally friendly building materials, the design of energy-efficient structures, the use of innovative water management systems, and the use of green

technology in construction. The results of this study provide a better understanding of how to improve building sustainability through a civil engineering approach.

Recent research in civil engineering-based eco-friendly building concepts focus on developing innovative solutions that can improve energy efficiency, reduce greenhouse gas emissions, and optimize the use of natural resources. Some examples of research novelty include the use of new technologies in building construction such as the use of integrated solar panels, intelligent water management systems that use sensors, the use of environmentally friendly concrete with a mixture of recycled materials, and the design of structures that are lighter but still strong and safe (Sianturi, 2023).

The purpose of this study is to identify and analyze the latest methods and techniques in building environmentally friendly buildings based on the point of view of civil engineering. This research aims to increase understanding of the application of environmentally friendly building concepts in civil engineering practice, identify potential improvements in efficiency and sustainability in building construction, and encourage the development of innovative solutions that can be used in the design and construction of more sustainable buildings. Thus, this research is expected to make a positive contribution to global efforts in reducing the environmental impact of the building sector and improving the sustainability of infrastructure development.

LITERATURE REVIEW

Understanding Green Building

Green Building defined as a planning and designing a building through a process that pays attention to the environment and uses resources efficiently throughout the life cycle of the building from site processing, design, construction, occupancy, maintenance, renovation and alteration of the building (Andini & Utomo, 2014).

Green building is a form of concern for environmental sustainability in the construction sector. *Green building* Designed to reduce the overall impact of development on the environment and human health (Sianturi, Nofirman, et al., 2022). *Green building* Not only related to energy saving management and waste management, but also how to make building materials do not harm the environment, both short and long term. The use of materials in a building plays an important role related to energy-saving and environmentally friendly purposes (Musdinar, 2019).

Green Building Concept

Concept *Green Building* is an effort so that buildings can reduce energy consumption (maximize natural energy) and have minimal negative impact on the environment (Abas & Sianturi, 2020). Office building is one of the functions of the building that has a large level of energy consumption (Tasya & Putranto, 2017). The concept of environmentally friendly buildings is also the creation of construction from the planning stage, implementation and use of construction products that are environmentally friendly, efficient in the use of energy and resources, and low cost, and pay attention to the health, comfort of its residents who all adhere to the principle of sustainability (Kurniastuti, 2016).

Concept *Green Building* has developed and applied in various countries around the world, including cities such as Jakarta, Surabaya, and Yogyakarta. As a step to support the application of green buildings in Indonesia, the government has implemented various regulations related to green building. One of them is through the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 02 / PRT / M / 2015 concerning Green Building (Ketaren & Sianturi, 2017). Nonetheless, the concept of *Green Building* hasn't gone as expected. Application of the concept *Green Building* which runs slowly, one of which is due to the lack of

interest in investing from developers in the construction of concept buildings *Green Building* Because of the alleged need for large costs (Widiarsa et al., 2021).

As one of the infrastructures, environmentally friendly buildings need to have sufficient clean water channels both in quantity and quality, and must be available at all times (continuity) (Sianturi, 2014). From a civil engineering point of view, the importance of developing environmentally friendly buildings is an innovative solution that can improve energy efficiency, reduce greenhouse gas emissions, and optimize the use of natural resources (Sianturi, 2022).

Civil Engineering

Organization management is very important and needed; Organizational success affects organizational success through human resource potential. It will be difficult for an organization to achieve its goals without the intervention of human resources (Kusiani et al., 2021). One of the human resources who participated in the creation of the concept of environmentally friendly buildings is in the field of civil engineering.

The field of civil engineering cannot be separated from people's daily lives. Skyscrapers that can be seen everywhere, flourishing road traffic, beautiful bridges, and dams are like solid fortresses, and tunnels and subsurface buildings are part and parcel of human life (Sianturi et al., 2021). Civil Engineering must eliminate or reduce environmental problems that may arise in projects, such as water resource reduction, water quality degradation, land subsidence, soil erosion, landslides, liquefaction of residential buildings, cracks, and many other disasters, ranging from large-scale economic construction, so that such development can provide benefits to mankind and make the environment get continuous development and improvement (Sianturi et al., 2018) (Muntohar, 2021).

RESEARCH METHODS

The approach used in this study is a qualitative approach used to find out or describe the reality of the events studied so as to facilitate obtaining objective data (Adhimah, 2020). A qualitative approach is a process of research and understanding based on a methodology that investigates a social phenomenon and a human problem. In this approach, researchers create a complex picture, examine words, report detailed views of respondents, and conduct studies on the situation experienced (Arkandito et al., 2016). While the research model used is the Miles and Huberman interactive analysis model. Qualitative data analysis activities are carried out interactively and continuously until complete, so that the data is saturated. This analysis consists of 3 main things: data reduction, data presentation, and conclusion drawing (Lisabela, 2019).

In data collection, documentation techniques are used by collecting journals with keywords environmentally friendly buildings and civil engineering from various sources. Then data reduction is carried out, after several relevant journals are obtained that are classified and discard unnecessary data and organize. Next, the presentation of data. The presentation of this data began by presenting data from the analysis of various journals of environmentally friendly building concepts based on civil engineering angles. The last thing to do is draw conclusions. This conclusion is made after all the data has been analyzed and presented.

DISCUSSION

The uneven development of the region with other surrounding areas will cause incompatibility in the level of growth and progress (M. E. Lubis & Sianturi, 2012). Along with the increase in population in line with the growth of buildings as a shelter from extreme outdoor climates. Thus, Solutions so that construction activities can continue to be carried out with efforts

to reduce environmental impact. The solution that can be done is to use a development system that carries the concept of *Green Building* (Ottong et al., 2015).

Green Building Council Indonesia (GBCI), established in 2009, is an independent institution (*non-Government*) and non-profit (*non-for profit*) who are committed to community education in applying environmental best practices and one of the programs is to certify Green Buildings in Indonesia based on a typical Indonesian assessment tool called greenship. GBCI is an emerging member of *World Green Building Council* (WGBC) is headquartered in Toronto, Canada and has 94 members and there is only one GBC in each country (Surjana & Ardiansyah, 2013). But Indonesian *Green Building* It has not been built much because the government has not set the obligation to build green buildings as a whole. *Green building* in Indonesia it was only mandatory in the city of Jakarta in 2012, namely through Governor Regulation No. 38 of 2012 (Sucipto et al., 2014).

Green building is one of many forms of concern for environmental sustainability in the field of construction. According to Putri et al., (2012) There are several criteria *green building* Including:

1. *Alternative Water Resource*
2. *Energy Efficiency Measure*
3. *Thermal Comfort*
4. *Visual Comfort*
5. *Natural Lightning*
6. *Water Use Reduction*

The role of civil engineering in Eco-friendly buildings is very important in designing, constructing, and managing sustainable buildings. Civil engineering plays a role in the selection of environmentally friendly construction materials, such as recycled materials or materials that have a low carbon footprint. In addition, civil engineering also designs efficient energy systems, such as the use of renewable energy and energy-saving technologies (Sallu et al., 2023). Water management aspects are also a concern of civil engineering in developing environmentally friendly buildings, through the use of rainwater collection technology, wastewater treatment systems, and water-saving devices. In addition, civil engineering also pays attention to aspects of construction waste management and implements building practices that reduce waste.

According to Haratulisan et al., (2017) The Green Building Rating System is divided based on six categories, namely:

1. *Appropriate Site Development.*
2. *Energy Efficiency and Conservation.*
3. *Water Conservation.*
4. *Material Resources and Cycle.*
5. *Indoor Health and Comfort.*
6. *Building and Environment Management.*

According to the Regulation of the Minister of State for Environment in Simbolon & Nasution, (2017), a building can be categorized as an environmentally friendly building if it meets the following criteria, namely:

- a. Using environmentally friendly building materials.
- b. There are facilities, facilities, and infrastructure for the conservation of water resources in the building.
- c. There are facilities, facilities, and infrastructure for energy conservation and diversification.

- d. Using materials that are not ozone-depleting materials in buildings.
- e. There are facilities, facilities, and infrastructure for domestic wastewater management in the building.
- f. There is a waste sorting facility.
- g. Paying attention to health aspects for building occupants include:
 - 1) Manage the clean air circulation system;
 - 2) Maximize the use of sunlight.
- h. There are sustainable site management facilities, facilities, and infrastructure.
- i. There are facilities, facilities, and infrastructure to anticipate natural disasters.
- j. Using building materials that are resistant to extreme climates or weather, high rain intensity, drought and high temperatures.

One of the concepts *Green Building* is to minimize natural resources through more efficient utilization of non-renewable natural resources, land, water, and building materials and using materials from local resources, such as bamboo materials used in building facades (Cahyani, 2020). However, keep a significant eye on risks and damage thanks to its complex and dynamic environmental settings (Saad et al., 2023).

The development of development technology in the current century is so rapid that it requires humans to be stricter in choosing and processing building materials in accordance with existing technology. Factually, there is still a development process that uses the system traditionally. Traditionally, most of the building construction process takes place on the site (although some parts of the construction take place elsewhere, for example the part of the wood is patterned frame and brought to material production for subsequent processing) (Imran, 2018).

Along with the development of construction science and technology, many new innovations related to brick substitution in order to get a more environmentally friendly and economical brick substitute, this shows the relevance between scientific and technological advances. Bricks are building materials that function as nonstructural wall components that do not bear the load directly. Therefore, the use of *ecobricks* necessary for brick replacement as a nonstructural wall filler. *Ecobricks* is a PET bottle filled with plastic material. Substitution of brick with *ecobrick* Aimed at reducing the negative impact caused by brick making and utilizing plastic waste that pollutes the environment (F. A. S. Lubis & Erizal, 2021).

In addition, there are *paving blocks* which is a building material product made from a mixture of cement, aggregate and water with or without other added materials that do not reduce quality *paving blocks* And used as an alternative cover or hardening of the soil surface (Sianturi, Kamarudin, et al., 2022). *Paving blocks* Can be used for paving and beautifying road pavements in cities, paving roads in housing complexes or residential areas, beautifying parks, yards and yards, hardening parking areas, office areas, factories, parks and school yards, as well as in hotel and restaurant areas can even be used in special areas such as container ports, airports, bus terminals and train stations. Raw materials for plastic waste, mineral water packaging, and green clamshell waste as substitute materials for the mixture *paving blocks* It is expected to have a good bond so that *paving blocks* durable and reduces water absorption for durability *paving block* can increase as well as have higher compressive strength (Handayasari et al., 2018). Thus, civil engineering contributes significantly in reducing the environmental impact of buildings and creating more sustainable buildings, as does *green building*.

CONCLUSION

Based on the results of the study, it can be concluded that the role of civil engineering in environmentally friendly buildings is to design, build, and manage buildings using environmentally friendly construction materials, design efficient energy systems, manage water efficiently, reduce construction waste, and pay attention to aspects of health and comfort of residents. By applying these principles, civil engineering plays a role in creating more sustainable buildings and reducing negative impacts on the environment. However, to adopt the concept of environmentally friendly buildings more broadly, support from the government and regulations that require the construction of *green buildings are needed*.

BIBLIOGRAPHY

- Abas, S., & Sianturi, NM. (2020). Exploring Persuasive Communication Model Through Entrepreneurial Learning (EL) In Affecting Student Mindsets For Entrepreneurs. *Journal of Critical Review*, 7(13), 177–183.
- Andini, R., & Utomo, C. (2014). Analisa Pengaruh Penerapan Konsep Green Building Terhadap Keputusan Investasi pada National Hospital Surabaya. *JURNAL TEKNIK POMITS*, 3(2), 53–56.
- Cahyani, R. A. (2020). Konsep Bangunan Rumah Tinggal sebagai Penerapan Arsitektur Hijau pada Perumahan Sumber Indah Kudus dengan Material Daur Ulang. *Indonesian Journal of Conservation*, 9(2), 101–105.
- Handayasari, I., Artiani, G. P., & Putri, D. (2018). Bahan Konstruksi Ramah Lingkungan Dengan Pemanfaatan Limbah Botol Plastik Kemasan Air Mineral Dan Limbah Kulit Kerang Hijau Sebagai Campuran Paving Block. *Jurnal Konstruksia*, 9(2), 25–30.
- Haratulisani, I. S., Sucipto, T. L. A., Waluyo, & Rahmawati, A. (2017). Desain Rumah Ramah Lingkungan Sebagai Suplemen Mata Kuliah Konstruksi Bangunan Gedung. *Seminar Nasional Pendidikan Vokasi Ke 2*, 506–511.
- Ilham, A., Rahman, M., & Sumar, W. T. (2022). Community Empowerment Through Waste Management With Reduce, Reuse and Recycle System (3r) In Bulota Village. *Devotion Journal of Community Service*, 3(4), 353–360.
- Imran, M. (2018). Material Konstruksi Ramah Lingkungan Dengan Penerapan Teknologi Tepat Guna. *RADIAL – JuRnal PerADaban SaIns, Rekayasa Dan TeknoLogi Sekolah Tinggi Teknik (STITEK) Bina Taruna Gorontalo*, 6(2), 146–157.
- Ketaren, K., & Sianturi, N. M. (2017). Decision Making Modelling with Logistic Regression Approach. *International Journal of Applied Engineering Research*, 12(19), 9067–9073.
- Kurniastuti, N. (2016). Bangunan Ramah Lingkungan. *Forum Teknologi*, 5(1).
- Kusiani, E., Ansar, Syahrudin, Bakri, M., Syukrano, M., Yusriadi, Y., & Sianturi, NM. (2021). Increasing the Professionalism of Military Teachers with Training and Experience through Competence. *Proceedings of the International Conference on Industrial Engineering and Operations Management Sao Paulo, Brazil*, 1–7.
- Lisabela, M. (2019). Model Analisis Interaktif Miles and Huberman. *Universitas Bina Darma*.
- Lubis, F. A. S., & Erizal. (2021). Ecobrick Sebagai Solusi Dinding Nonstruktural Ramah Lingkungan. *JURNAL TEKNIK SIPILDAN LINGKUNGAN*, 6(2), 97–106.
- Lubis, M. E., & Sianturi, N. M. (2012). Penetapan Model Bangkitan Pergerakan Untuk Beberapa Tipe Perumahan di Kota Pematangsiantar. *Media Teknik Sipil*, 10(1), 27–34.
- Muntohar, A. S. (2021). Teknik Sipil dan Pembangunan Berkelanjutan. *Buletin TEKNIK SIPIL*, 1(1), 1–2.

- Musdinar, I. (2019). Penerapan Prinsip Rumah Tinggal Ramah Lingkungan Melalui Pemilihan Material (Studi Kasus: Rumah Tinggal Di Jalan Rambutan, Semarang). *Budi Luhur*, 1–10.
- Ottong, A. S., Yuwono, F., Alifen, R. S., & Nugraha, P. (2015). Penerapan Konsep Sustainable Pada Rumah Tinggal Dari Segi Material. *Jurnal Dimensi Pratama Teknik Sipil*, 4(1), 1–8.
- Putri, A. A., Rohman, M. A., & Utomo, C. (2012). Penilaian Kriteria Green Building pada Gedung Teknik Sipil ITS. *JURNAL TEKNIK ITS*, 1(1), 107–112.
- Roshaunda, D., Diana, L., Princhika, L., & Septiady, S. K. R. (2019). Penilaian Kriteria Green Building Pada Bangunan Gedung Universitas Pembangunan Jaya Berdasarkan Indikasi Green Building Council Indonesia. *Widyakala*, 6, 28–46.
- Saad, M. H. M., Kamarudin, M. K. A., Toriman, M. E., Noorjima, Wahab, A., Ata, F. M., Samah, M. A. A., Saudi, A. S. M., & Sianturi, N. M. (2023). Analysis Of The Flash Flood Event And Rainfall Distribution Pattern On Relau River Basin Development, Penang, Malaysia. *PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners*, 21(1), 58 – 71.
- Sallu, S., Sianturi, N. M., Purwoko, B., Herliansyah, Y., & Manuhutu, M. A. (2023). Learning in Higher Education Based on Artificial Intelligence (AI) with Case Based Reasoning (CBR). *Journal of Namibian Studies*, 34, 1049–1064.
- Sianturi, N. M. (2014). Performance of Clean Water Reservoir in Pematangsiantar, Indonesia, Affected by Earthquake. *Journal of Civil Engineering Research*, 4(3A), 237–244.
- Sianturi, N. M. (2022). Evaluation of Multi-Function Drainage Channels For Running Water Fish Culture For The Benefit of The Community In Pangururan District. *International Journal of Engineering, Science & Information Technology (IJESTY)*, 2(2), 118–128.
- Sianturi, N. M. (2023). Analisis Perlindungan Tebing Sungai Bah Bolon Sumatera Utara Menggunakan Blok Beton Segmental Dengan Perkuatan Geosintetik. *Jurnal Teknik Hidraulik*, 13(2), 113–126.
- Sianturi, N. M., Kamarudin, M. K. A., Damanik, D. R. S., Purba, V. E., & Saragih, D. S. (2022). Perilaku Mekanis Tanah Lunak yang Distabilisasi dengan Kapur dan Abu Vulkanik. *Media Komunikasi Teknik Sipil*, 28(1), 118–127.
- Sianturi, N. M., Kamarudin, M. K. A., Sudianto, S., & Umar, S. I. K. R. (2021). Analysis of the Impact of Surface Volume Reduction on River Height Sedimentation Around Pangururan District, Samosir Regency, North Sumatra, Indonesia. *London Journal of Research in Science: Natural and Formal*, 21(2), 79–91.
- Sianturi, N. M., Kamarudin, M. K. A., Toriman, M. E., Wahab, N. A., Hakparn, S., Lertbunchardwong, K., Potikengrith, T., Islam, M. S., & Harith, H. (2018). Assessment of Environmental Management in Lake Toba, Samosir Regency, North Sumatra Province, Indonesia. *International Journal of Engineering & Technology*, 7(3.14), 337–343.
- Sianturi, N. M., Nofirman, Yulianti, E. B., Fatmawati, E., & Hendriarto, P. (2022). Relevancy Technological Innovation and Community Economic Development in Indonesia. *Linguistics and Culture Review*, 6(S3), 117–130.
- Simbolon, H., & Nasution, I. N. (2017). Desain Rumah Tinggal Yang Ramah Lingkungan Untuk Iklim Tropis. *JURNAL EDUCATION BUUILDING*, 3(1), 46–59.
- Sipayung, K. T., Sianturi, N. M., Arta, I. M. D., Rohayati, Y., & Indah, and D. (2021). Comparison of Translation Techniques by Google Translate and U-Dictionary: How Differently Does Both Machine Translation Tools Perform in Translating? *Elsya: Journal of English Language Studies*, 3(3), 236–245.
- Sucipto, T. L. A., Hatmoko, J. U. D., Sumarni, S., & Pujiastuti, J. (2014). Kajian Penerapan Green Building pada Gedung Bank Indonesia Surakarta. *JIPTEK*, 7(2), 17–24.

- Surjana, T. S., & Ardiansyah. (2013). Perancangan Arsitektur Ramah Lingkungan: Pencapaian Rating GreenShip GBCI. *Jurnal Arsitektur Universitas Bandar Lampung*, 1–14.
- Tasya, A. F., & Putranto, A. D. (2017). Konsep Green Building Pada Bangunan Kantor (Studi Kasus: Spazio Office, Surabaya). *Jurnal Mahasiswa Departemen Arsitektur*, 5(4), 1–7.
- Widiarsa, K. B., Kumara, I., & Hartati, R. S. (2021). Studi Literatur Perkembangan Green Building Di Indonesia. *Jurnal SPEKTRUM*, 8(2), 37–47.
- Yusriadi, Y. (2021). *The Role of Work Environment and Leadership on Employee Performance through Employee Work Discipline*.