

GREEN BUILDING: APPROPRIATE SITE DEVELOPMENT EVALUATION OF UNIVERSITAS CIPUTRA SURABAYA EXISTING BUILDING FACILITIES

Gabriel Procellia^a, Gwyneth Jolin Lie^b, Agnes Ariella^c, Susan^d, Maureen Nuradhi^e

^{a/b/c/d/e}Architecture Department, School of Creative Industry, Universitas Ciputra,
Surabaya, Indonesia

Corresponding Email: susan@ciputra.ac.id^d

ABSTRACT

The topic discussed is about the application of one of the GBCI (Green Building Council Indonesia) rating tools, Appropriate Site Development (ASD), at Universitas Ciputra Surabaya. Categorized in Greenship's existing building, ASD consists of: site management policy, motor vehicle reduction policy, community accessibility, site landscaping, heat island effect, storm water management, site management, and building neighborhood. ASD itself has a maximum score of 16 points and contributes 13.68% to the overall total Greenship rating tools (100%). As the environment's conditions worsen, Surabaya is one of the many cities establishing Greenship criteria in various buildings' facilities, including existing and new buildings, interior spaces, and neighborhoods. CitraLand Surabaya, under the Ciputra Group Development, is recognized for its sustainable and smart city concept, which needs to be demonstrated through the evaluation of one of its properties, Universitas Ciputra. This university has consistently increased its student enrollment each year and has ongoing development of facilities both within the campus and the surrounding area. Using a qualitative descriptive analysis method, this study narrates the Universitas Ciputra grading of ASD. It proposes several solutions, including suggestions for cost estimation on the necessary materials and equipment to improve the Universitas Ciputra building facilities.

Keywords: Appropriate Site Development, Existing Building, Green Building, Universitas Ciputra

INTRODUCTION

Leading towards a sustainable city, buildings contribute as one of the important elements as it is recognized as an energy consumption sector (Mardiana, A., & Riffat, S. B., 2013). Buildings are accounted for in the contribution of GHG emissions, including electricity-related, black carbon emissions, and F-gases (Lucon et al., 2014), as it is also an important factor for health and the quality of life (Bauer, Möslle, and Schwarz, 2009). The Earth's surface temperature has increased by 0.74% over the last hundred years. Buildings account for 33% of CO₂ emissions, 17% clean water, 25% of wood products, 30-40% of energy use, and 40-50% of raw materials (Sujana, C. M., 2024). Furthermore, the United Nations Environment Programme (UNEP) has claimed that the building sector accounts for nearly 40% of global energy use and contributes around 30% of greenhouse gas emissions (Hong et al., 2021). Apart from the building's involvement in global changes, fossil-fueled transportation has significantly contributed to approximately 14% of global greenhouse gas (GHG) emissions, with an energy consumption of around 31,310 TWh. These components affect cities around the world, causing them to experience urban heat islands (UHI). As a result, climate change is occurring in many cities, especially in tropical climate cities (Sari, D. P., 2021). As it has increasingly affected the world's performance, a revolutionary movement has been started by applying green building standards to help solve the issue. The definition of green building is the practice of creating structures and using processes that are environmentally responsible and resource-

efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction (Purwaningsih et al., 2018). The green building concept can reduce carbon emissions through effective insulation, glazing, water heating, air conditioning, lighting, and other energy-efficient measures, resulting in significant operational cost savings (Yudelson, J., 2010). This is possible due to the participation of the entire building's cycle stages, design, construction, and operation considerations that concerns people, economy, energy, and surrounding environment (Liu et al., 2022).

Several countries have participated and attempted to establish the movement through certified green building institutions. Indonesia is one of the many countries that is in an attempt to achieve a sustainable city through green building strategies, which is certified by GBCI (Green Building Council Indonesia) (Girsang et al., 2020). The GBCI provides measurements for new buildings, existing buildings, interior space, and neighborhood. There are several categories of rating tools used by GBCI, including: ASD (Appropriate Site Development), EEC (Energy Efficiency and Conservation), WAC (Water Conservation), IHC (Indoor Health and Comfort), and BEM (Building Environmental Management). According to GBCI, the proper implementation of green building strategies in the building sector could achieve energy savings of 40% or more by the year of 2050 (Cantika, C. A., & Paramitadevi, Y. V., 2022). The first stage to earn the Greenship certification is ASD, as buildings and their facilities must be attentive to the land base selection, transportation

access, macro-climate, and rainwater management. The basic principle of ASD is to not harm the condition and can only make minimum changes of the existing site (Agusintadewi, N. K., Janiawati, N. L. E., & Widiastuti, W., 2021). The objective of ASD is to ensure an efficient use of the object for a nurtured environment for users to do their activities unbothered (Yasinta, R. B., Pradana, M. A., & Dahlia, D., 2024). More of the benefits result in significantly more efficient savings and a positive financial gain during the building construction and post-construction phases. Qualifying for ASD will result in a social benefit, lower carbon taxes, higher energy savings, less sickness, and higher productivity ("The Benefit of Green Building for Cost Efficiency", 2020).

Cities incorporating green building strategies may also result in sustainable development (Biswas, M. H. A., Dey, P. R., Islam, M. S., & Mandal, S., 2021) and play a role in the international construction world (Teddy, S. D., Priatman, J., & Susilo, N., 2018). Sustainable development refers to the concept of balancing economic, environmental, and social aspects (Bithas, K. P., & Christofakis, M., 2006). Additionally, sustainability has become a worldwide movement. Many strive to be sustainable. Ciputra Group is among the developers that are pursuing the application of green concepts to create a sustainable smart city. The idea is to plan a pleasant and safe environment to refine its quality of life (Sasanpour, F., 2017). To attain the concept, consumers and residents are made aware of the vision by promoting their products, such as CitraLand Surabaya (Alamsyah Sembiring, M. Ricky, Hilma Tamiami Fachrudin, and Dwira

Nirfalini Aulia, 2023). CitraLand Surabaya, known as "The Singapore of Surabaya", has been one of Surabaya's city satellites since 1993 (Ikmal, Miskan, and Najah, 2022a), making it a notable landmark. The green concept is transcribed into CitraLand Surabaya's development projects, including residential areas and commercial use buildings (Ikmal, Miskan, and Najah, 2022b). Numerous facilities have been built within the complex. This includes the infamous Universitas Ciputra, meant for education purposes, that connects people of all ages, genders, and professions. This raises the question of whether Universitas Ciputra has successfully implemented the initial tool, ASD, to qualify as a Green Existing Building. Generally, an existing building refers to a building that has been in operation for at least one year since its completion (Purbantoro, F., & Siregar, M., 2019). With the increase in student enrollment every year (Sujana and Jeremi, 2024b) and the ongoing development of facilities both on campus and in the surrounding area, Universitas Ciputra is well-positioned to implement green building strategies. Therefore, to achieve an excellent site development factor, the site should undergo an evaluation of several key factors, including on-site landscaping, heat island effect, motor vehicle reduction, stormwater management, site management, and building neighborhood. For existing buildings, ASD implementation must fulfill the prerequisite and assessment criteria. ASD has two prerequisite criteria that must be achieved before further appraisal. Afterwards, assessment criteria must be fulfilled according to the ability of the chosen building and can be optimized to reach a maximum of 16 points. Furthermore, the research

will also recommend alternative solutions and provide a cost estimate for the necessary materials and equipment to improve the Universitas Ciputra building facilities.

METHODS

The research selected Universitas Ciputra, which is categorized as a middle to high-rise existing building. The study focuses on the analysis of Universitas Ciputra’s Tower and its surrounding site for landscaping purposes. After the selection, an observation and evaluation are conducted to examine the building’s softscape, hardscape, vehicles, stormwater, heat, and its neighbourhood. The research output proposes strategies to enhance Universitas Ciputra Building’s achievement of Appropriate Site Development. The standard is based on GBCI Greenship Existing Building version 1.1.

Table 1. ASD Rating Tool Point Gain

Code	Rating	Maximum Point	%
ASD P1	Site Management Policy	P	
ASD P2	Motor Vehicle Reduction Policy	P	
ASD 1	Community Accessibility	3	
ASD 2	Motor Vehicle Reduction	2	13.68%
ASD 3	Site Landscaping	3	
ASD 4	Heat Island Effect	2	
ASD 5	Storm Water Management	2	
ASD 6	Site Management	2	
ASD 7	Building Neighborhood	2	
Total		16	13.68%

Source: Green Building Council Indonesia, 2016

After concluding the findings and discussions, the researcher counted points gained from each category and summarized the estimated cost of spending to improve Universitas Ciputra building’s performance.

RESULTS AND DISCUSSION

Appropriate Site Development Prerequisite 1 (Site Management Policy)

ASD P1 serves as a prerequisite that discusses the site owner’s commitment to adopt an integrated maintenance system for short- and long-term needs. This goal is to achieve a comprehensive approach that encompasses exterior maintenance, integrated pest management, weed control, and site maintenance practices, prioritizing the use of non-toxic materials. Universitas Ciputra has a regular schedule for site development and maintenance. Demonstrated by the issuance of an official work order for the maintenance of the gondola system, which is integral to the building’s exterior upkeep. This encompasses exterior, pest, and weed management policy.

Appropriate Site Development Prerequisite 2 (Motor Vehicle Reduction Policy)

The discussion on ASD P2 addresses policy issues regarding top management’s commitment to encouraging building occupants and visitors to reduce their use of private vehicles and instead utilise public transportation. This can be achieved through various ideas, including carpooling, feeder buses, public transportation vouchers, and differential parking tariffs. These efforts are supported by several

campaigns and written advocacy, including stickers, posters, and emails. Unfortunately, at Universitas Ciputra, there are currently no such campaigns or top management commitment to address these issues. Therefore, the proposed idea aims to fulfill the requirements of ASD P2 by establishing top management commitment to reduce the use of private motorized vehicles and support such campaigns.

Appropriate Site Development 1 (Community Accessibility)

The aim of ASD point 1 is to ensure good accessibility to facilitate the local community in reaching public facilities located within 500 meters from Universitas Ciputra, provide the availability of bus stops within a 300-meter radius, complemented by safe and comfortable pedestrian facilities that meet the requirements of PU No. 30/PRT/M.2006 BAB 2B regarding the Technical Guidelines for the Implementation of Infrastructure Development.

Table 2. Public Facilities Around Universitas Ciputra

Public Facilities	Distance, by walk (Meters)
Grab Point Pick Up	0 M
Women’s Musholla	0 M
Men’s Musholla	0 M
UC Walk	100 M
Bank BCA	160 M
Hokky Supermarket	180 M
Public Parking	250 M
Eagle Pool and Bistro	260 M
CitraLand Fitnessworks	260 M
Berlin 6 Pharmacy	280 M
Bangor Burger	290 M
Kozko’s Indomaret	350 M
Kozko’s Digital Printing	350 M

Source: Researcher’s Analysis, 2024

Table 3. Public Facilities Around Universitas Ciputra

Type of Public Facilities Within a Distance of 500 M From the Site	
Bank	✓
Public Places	✓
Public Parking	✓
Grocery Store	✓
Multipurpose Building	✓
Public Security/Police Post	x
Worship Place	✓
Library	✓
Public transport terminal/base	✓
Daycare	x
Pharmacy	✓
Health center/health facility	✓
Fire Station	✓
Local Government Offices	x
Market	x
Sport Field	✓

Source: Researcher’s Analysis, 2024

University Ciputra has fulfilled several points in ASD 1, including having more than five types of public facilities within a 500 m radius and providing pedestrian facilities that are safe, comfortable, and free from motorized vehicle access. On the other hand, some points remained unfulfilled, such as there are no public transportation stops or stations within 300 m of the building location, there are no stops or permanent waiting areas such as bus bays or bus stop lanes, and therefore, there are no pedestrian paths within the building area to get to the nearest public transportation stop or station.

To address the missing points, we conceived the idea of creating a bus stop located 160 meters from Universitas Ciputra, directly in front of the parking lot. The bus stop will be equipped with facilities such as

small tables and chairs, portable chargers, and free Wi-Fi, and will be publicly accessible. Additionally, the area is equipped with a comfortable pedestrian pathway leading to the bus stop.

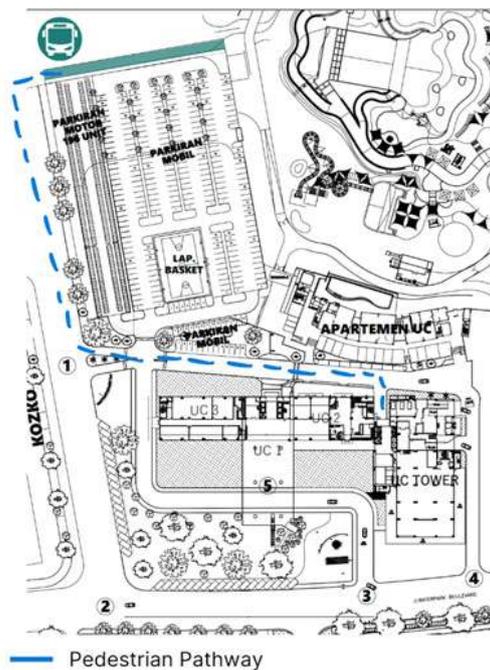


Figure 1. Universitas Ciputra Bus Stop and Pedestrian Pathway
Source: Researcher's Analysis, 2024

Appropriate Site Development 2 (Motor Vehicle Reduction)

ASD 2 discusses the importance of minimizing the use of private and fossil-fueled transportation. The signboard at the parking lot entrance, which offers free parking, somehow encourages and allows users to drive their own vehicles. In addition, Universitas Ciputra doesn't facilitate public transportation, such as feeder and shuttle buses, nor does it permit the use of private, fueled transportation. Therefore, a suitable idea to gain a point in the category is supplying a personal

shuttle bus, which can pick up several people at designated locations.

Table 4. Calculated Active Building Users

NLA area (m²)	11806.7
	NLA area : people density (10 m ²)
Total Active Users	= 1180.67
	= 1181

Source: Researcher's Calculation, 2024

In addition, the number of bicycle parking spaces is calculated based on the NLA calculation, which resulted in 1181 active users in Universitas Ciputra. Then the number is taken into account in the calculation of the ideal quantity for bicycle parking slots and showers.

Table 5. Calculated Need of Bicycle Parking Slot Number

(1 bicycle parking for every 30 building users)	
Total Bicycle Parking (unit)	Users (person):30 = 39.36666667 = 40 Researcher's calculation, 2024

Source: Researcher's Calculation, 2024

Table 6. Calculated Need of Shower Number

1 unit shower for every 10 bicycle parking space)	
Total Shower Unit	Total bicycle parking (unit):10 = 40:10 = 4

Source: Researcher's Calculation, 2024

Appropriate Site Development 3 (Site Landscaping)

The aim of ASD 3 is to extend the softscape to maintain, or even reduce, the surface area for water to flood. The researcher counted the total

surface area of Universitas Ciputra, the total landscape, and then separated the softscape and landscape.



Figure 2. Universitas Ciputra Surface Area
Source: Researcher's Analysis, 2024

Table 7. Universitas Ciputra Building and Landscape Area

Area category	Area (m ²)	Percentage
Land area	31397.69	100%
Building area	5781.14	18.41%
Green roof	-	-
Total landscape area	25616.55	81.58%
Paved area above		
basement pavement	-	-
Softscape area above		
basement pavement	-	-
Paved area free of		
basement pavement	17452.32	68.12%
Softscape area free of		
basement pavement	8164.23	31.8%
Total	57014.24	200%

Source: Researcher's Calculation, 2024

The outcome of the land calculation reveals a significant disparity between the landscape area and the functional building. Exceeding the standard requirement by 10% for the landscape and 30% for the softscape area.

Appropriate Site Development 4 (Heat Island Effect)

ASD 4 employs a strategy to mitigate heat effects generated by building construction and surrounding site activities. The target is met by utilizing materials with an average albedo value of no less than 0.3, as determined by calculations of the roof area covered by pavement.

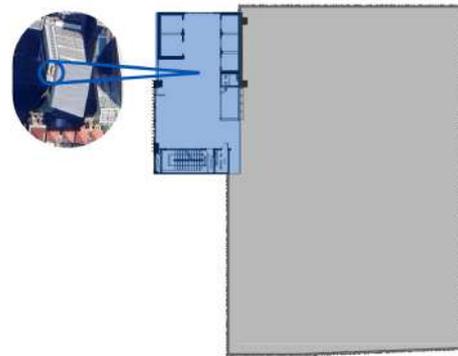


Figure 3. Universitas Ciputra Roof Surface Area
Source: Researcher's Analysis, 2024

Table 8. Albedo Value of Universitas Ciputra Roof Area

Surface Material	Albedo Value (An)	Area (Ln)	(An x Ln)
Land area	0.35	187	65.45
Average Albedo Value			0.35

Source: Researcher's Calculation, 2024

Universitas Ciputra uses concrete on the roof area that is covered by pavement, with an albedo value ranging from 0.10-0.35. Thereby meeting the required target. Additionally, the strategy extends to the non-roof areas of the site, where materials with the same minimum albedo value of 0.3 are employed in areas covered by pavement.



Figure 4. Universitas Ciputra Non-Roof Area
Source: Researcher's Analysis, 2024

Table 9. Albedo Value of Universitas Ciputra Non-Roof Area

Surface Material	Albedo Value (An)	Area (Ln)	(An x Ln)
Paving Blocks	0.35	187	65.45
Stone	0.35	24.7	8.64
White Cement Concrete	0.73	27	19.71
Vegetation	0.30	1056	316.8
Asphalt	0.20	1783.4	356.68
Average Albedo Value			0.38

Source: Researcher's Calculation, 2024

The non-roof area of Universitas Ciputra utilizes a variety of materials. Paving blocks are predominantly used in the pedestrian area, with vegetation surrounding the site, stone material placed at the entrance, asphalt for the access to the tower, and white cement concrete at the front. These materials were strategically selected to meet the required albedo value standards, achieving an average albedo value of 0.38 for the non-roof areas of Universitas Ciputra.

Appropriate Site Development 5 (Stormwater Management)

ASD 5 aims to reduce the volume load of rainwater runoff into city drainage by at least 75% of the total average daily rainfall volume. Unfortunately, Universitas Ciputra didn't originate the concept of rainwater harvesting, which is why ASD 5 has not been fulfilled.

Thus, to achieve the required score for this point, the approach involves implementing a rainwater harvesting system. In simple terms, this system reuses collected rainwater that has undergone several purification processes, such as rainwater filtration and sedimentation, and is then stored for future use in utilities, hydrants, and other purposes.

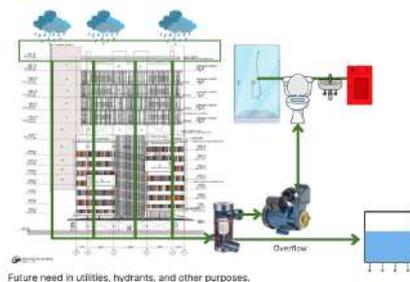


Figure 5. Universitas Ciputra Rainwater Harvesting System and Usage
Source: Researcher's Analysis, 2024

Appropriate Site Development 6 (Site Management)

ASD 6 aims to minimise the negative impacts on the environment and users, enabling the implementation of sustainable development. However, a letter commitment regarding pest and weed control, as well as the use of non-toxic materials across the site, has yet to be found. Therefore, to meet the required standard, researchers propose forming a formal letter of commitment addressing the current topic.

Green Building: Appropriate Site Development Evaluation Of Universitas Ciputra Surabaya Existing Building Facilities

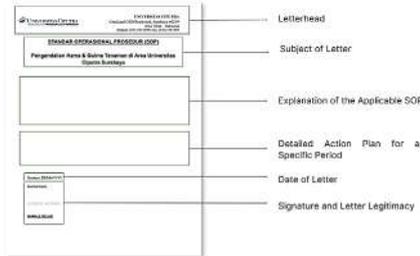


Figure 6. Letter of Commitment Template
Source: Researcher’s Analysis, 2024

Moreover, the strategy extends into provision of non-pet habitat of at least 5% of the total building site area, based on the animal activity area or home range.

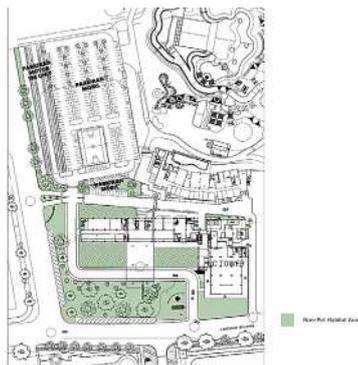


Figure 7. Non-Pet Habitat Area On Universitas Ciputra
Source: Researcher’s Analysis, 2024

Table 10. Non-Pet Habitat Area Calculation

Area category	Area (m ²)	Percentage
Land area	4356	100%
Non-pet habitat	1056	24%
Total non-pet Habitat Area		24%

Source: Researcher’s Calculation, 2024

The non-pet habitat area has been calculated to comprise 24% of the total building site area, exceeding the 5% standard.

Appropriate Site Development 7 (Building Neighborhood)

To improve the neighbors’ quality of life, ASD 7 must

be fulfilled by fixing a minimum of 5 units of sanitary facilities, providing a minimum of 1 unit of prayer room, a minimum of 5 units of public toilets, and a minimum of 1 program of human development. Universitas Ciputra has met the criteria, yet it still has future development opportunities for sanitary repairs.

Opening pedestrian access to neighboring buildings. Universitas Ciputra’s building is situated directly next to residential apartments from Cornell, Berkeley, and Denver.



Figure 8. Universitas Ciputra Neighborhood
Source: Google Maps, 2024

The dedication of private-use open spaces is beneficial for the users. Throughout the site of the building, there are open spaces such as Corepreneur for multiple use of organizations, UC Loop for a leisure area, and hills up on the South of the facade for a strategy to advocate privacy of the university activities.

Table 11. GBCI Greenship Point Gained

Code	Maximum Point	Point Gained	Simulated Point Gained
ASD P1	P	P	P
ASD P2	P	-	P
ASD 1	3	3	3
ASD 2	2	3	2
ASD 3	3		3
ASD 4	2	2	2
ASD 5	2	0	2
ASD 6	2	1	2
ASD 7	2	2	2
Total	16	11	16

Source: Researcher’s Calculation, 2024

Table 12. Spending Cost Estimation

Category	Product	Spending Cost
ASD P1	-	Rp0
ASD P2	Parking fee signage board	Rp2,000,000
	Paper printing	Rp500
	Poster printing	Rp100,000
ASD 1	Preparatory work and dismantling	Rp4,000,000
	Structural, soil, and foundation work	Rp85,000,000
	Architectural work (steelwork, roofing, etc.)	Rp63,000,000
	Electrical and utility mechanical work	Rp20,000,000
	Implementation construction of SMK3	Rp4,040,000
	Finishing work	Rp14,050,035
	Demolition work	Rp27,366,480
	Drainage work	Rp253,363,675
	Pedestrian work	Rp219,304,304
	Electrical work	Rp66,816,100
ASD 2	Shuttle bus (Hino RM 280)	Rp1,100,000,000
	Solar fuel (35 L/day)	Rp3,570,000
	Bus driver fee	Rp4,000,000
	Customized design	Rp250,000,000
	Parking fee signage board	Rp2,000,000
	Bicycle parking stand rack	Rp4,125,000
	Shower (TOTO - TX471SRR)	Rp6,100,000
	Set up service	Rp450,000
	PVC pipe (RUCIKA JIS 3/4 - 4 M/pcs)	Rp45,000
ASD 3	-	Rp0
ASD 4	-	Rp0
ASD 5	Rain water filtration	Rp10,000,000
	water pump	Rp300,000
	Rucika white pipe 1 inch AW (4 m standard/pcs)	Rp45,000
ASD 6	Printing	Rp5,000
ASD 7	-	Rp0
Total		Rp2,139,681,094

Source: Researcher's Calculation, 2024

Based on the ASD categories, Universitas Ciputra gained 11 points, falling short of the ultimate qualification for green building certification. The missing points are then addressed by developing personalized strategies tailored to the context. All the generated solutions are estimated in a spending cost simulation.

CONCLUSION

Appropriate Site Development is the first stage to

earn Greenship certification by the Green Building Council Indonesia. ASD discusses optimising land use through a sustainable development approach. ASD implementation can be fulfilled to achieve a maximum of 16 points. The research utilized Universitas Ciputra Surabaya as its location, which is categorized as a mid-to-high-rise existing building. An observation and evaluation is conducted to examine the building's

softscape, hardscape, vehicles, storm water, heat, and its surrounding neighborhood.

The final result of this study shows that Universitas Ciputra successfully meet one out of the two prerequisite points and also gains 11 points out of 16 points from the Appropriate Site Development factor. This research also goes further to estimate the solution efforts that can be made to fulfil the ASD criteria fully. Achieving the maximum 16 points in the ASD category is estimated to require a financial investment of Rp 2,139,681,094. The budget accounts for implementing multiple environmentally friendly measures across each factor.

ACKNOWLEDGMENT

We extend our sincere appreciation to all those who have supported and given significant contributions to the research, especially to our lecturers and Universitas Ciputra's Property Management.

REFERENCES

- Agusintadewi, N. K., Janiawati, N. L. E., & Widiastuti, W. (2021). Appropriate Site Development in the Application of the Green Building Concept: An Evaluation of the Planning of Gianyar Public Market. *Arsitektura: Jurnal Ilmiah Arsitektur dan Lingkungan Binaan*, 19(2), 195-204. <https://doi.org/10.20961/arst.v19i2.4768>.
- Alamsyah Sembiring, M. Ricky, Hilma Tamiami Fachrudin, and Dwira Nirfalini Aulia. (2023). "ANALYSIS THE APPLICATION OF GREEN BUILDING PRINCIPLES IN CITRALAND GAMA CITY HOUSING BASED ON THE GREENSHIP HOMES RATING SYSTEM VERSION 1.0." *International Journal of Education and Social Science Research* 06 (03): 256–78. <https://doi.org/10.37500/IJESSR.2023.6322>.
- Bauer, Michael, Peter Mösle, and Michael Schwarz. 2009. *Green Building: Guidebook for Sustainable Architecture*. Illustrated. Springer Science & Business Media, 2009.
- Biswas, M. H. A., Dey, P. R., Islam, M. S., & Mandal, S. (2022). Mathematical model applied to green building concept for sustainable cities under climate change. *Journal of Contemporary Urban Affairs*, 6(1), 36-50. <https://doi.org/10.25034/ijcua.2022.v6n1-4>.
- Bithas, K. P., & Christofakis, M. (2006). Environmentally sustainable cities. Critical review and operational conditions. *Sustainable development*, 14(3), 177-189. <https://doi.org/10.1002/sd.262>.
- Cantika, C. A., & Paramitadevi, Y. V. (2022). Implementation of Green Building Aspects Based on the Green Building Council Indonesia: A Case Study in the Regional Library Building of East Java Province. *Journal of Architectural Research and Education*, 4(1), 27-

36. <https://doi.org/10.17509/jare.v4i1.44459>.
- Girsang, Hamonangan, Aldila Septiana Hernasari, Fahmi, and Novika Candra Fetilia. 2020. "Analysis of Fulfillment Criteria of Green Building Concept in According to Green Building Council Indonesia (GBCI) at An Existing Conventional Building HKBP Ciputat Church." *World Journal of Innovation and Technology* 1 (1): 19–33.
- Green Building Council Indonesia. 2016. "Greenship Existing Building."
- Hong, C., Burney, J. A., Pongratz, J., Nabel, J. E., Mueller, N. D., Jackson, R. B., & Davis, S. J. (2021). Global and regional drivers of land-use emissions in 1961–2017. *Nature*, 589(7843), 554–561. <https://doi.org/10.1038/s41586-020-03138-y>.
- Ikmal, Novita Maulida, Miskan, and Nailun Najah. (2022a). "Analysis of The Economic Gap The Community of Citraland Surabaya and The Surrounding Region." *NeoRespublica: Jurnal Ilmu Pemerintahan* 4 (1): 145–54. <https://doi.org/10.52423/neores.v4i1.34>.
- . (2022b). "Analysis of The Economic Gap The Community of CitraLand Surabaya and The Surrounding Region." *NeoRespublica: Jurnal Ilmu Pemerintahan* 4 (1): 145–54. <https://doi.org/10.52423/neores.v4i1.34>.
- Liu, T., Chen, L., Yang, M., Sandanayake, M., Miao, P., Shi, Y., & Yap, P. S. (2022). Sustainability considerations of green buildings: a detailed overview on current advancements and future considerations. *Sustainability*, 14(21), 14393. <https://doi.org/10.3390/su142114393>
- Lucon, Oswaldo, Diana Üрге-Vorsatz, Azni Zain Ahmed, Hashem Akbari, Paolo Bertoldi, Luisa F. Cabeza, Nicholas Eyre, et al. 2014. "Chapter 9 - Buildings." In *In:; Climate Change 2014: Mitigation of Climate Change. IPCC Working Group III Contribution to AR5*, edited by Marilyn Brown and Tamá Pálvölgyi, 671–83.
- Mardiana, A., & Riffat, S. B. (2013). Review on physical and performance parameters of heat recovery systems for building applications. *Renewable and Sustainable Energy Reviews*, 28, 174–190. <https://doi.org/10.1016/j.rser.2013.07.016>
- Purbantoro, F., & Siregar, M. (2019, December). Implementation of Green Building Concept in Office Building Jakarta. In *Journal of Physics: Conference Series* (Vol. 1424, No. 1, p. 012023). IOP Publishing. <https://doi.org/10.1088/1742-6596/1424/1/012023>.
- Purwaningsih, R., Prastawa, H., Susanto, N., Saptadi, S., & Pirogo, B. (2018, October). Assessment of green building

- score based on greenship rating of the green building council of Indonesia. In *AIP Conference Proceedings* (Vol. 2019, No. 1, p. 040004). AIP Publishing LLC. <https://doi.org/10.1063/1.5061874>
- Sari, D.P. (2021). A review of how building mitigates the Urban heat Island in Indonesia and tropical cities. *Earth*, 2(3), 653-666. <https://doi.org/10.3390/earth2030038>.
- Sasanpour, F. (2017). Livable City One Step Towards Sustainable. *Journal of Contemporary Urban Affairs*, Vol. 1 No. 3, 2017, 1(3), 13-17. <https://doi.org/10.25034/ijcua.2018.3673>.
- Sujana, C. M. (2024, April). Analysis of the implementation of green building on the Syahdan Campus building based on the Green Building Council Indonesia (GBCI) specifications. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1324, No. 1, p. 012024). IOP Publishing. <https://doi.org/10.1088/1755-1315/1324/1/012024>.
- . 2024b. "Analysis of the Implementation of Green Building on the Syahdan Campus Building Based on the Green Building Council Indonesia (GBCI) Specifications." *IOP Conference Series: Earth and Environmental Science* 1324 (1): 012024. <https://doi.org/10.1088/1755-1315/1324/1/012024>.
- Teddy, S. D., Priatman, J., & Susilo, N. (2018). Kajian penerapan prinsip water conservation sesuai standar greenship new building versi 1.2 studi kasus: gedung P1 dan P2 Universitas Kristen Petra Surabaya. *Dimensi Utama Teknik Sipil*, 5(2), 9-16. <https://doi.org/10.9744/duts.5.2.9-16>.
- "The Benefit of Green Building for Cost Efficiency." (2020). *International Journal of Financial, Accounting, and Management* 1 (4). <https://doi.org/10.35912/ijfam.v1i4.152>.
- Yasinta, R. B., Pradana, M. A., & Dahlia, D. (2024). Analyzing Green Building of Appropriate Site Development Requirements in High Rise Building. *Jurnal Presipitasi: Media Komunikasi dan Pengembangan Teknik Lingkungan*, 21(1), 132-143. <https://doi.org/10.14710/presipitasi.v21i1.132-143>.
- Yudelson, J. (2010). *The green building revolution*. Island Press.