GREEN SUPPLY CHAIN PERFORMANCE BASED ON GREEN BUILDING ASSESSMENT (CASE STUDY OF SUKAWATI ART MARKET CONSTRUCTION STAGE, GIANYAR REGENCY)

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ABSTRACT

Over the last decade the construction industry has made efforts to develop green building practices. With the stipulation of PUPR Ministerial Regulation 21 of 2021 concerning Performance Assessment of Green Buildings, the Government requires the Government to implement green construction in every stage of construction, both in planning, development, supervision, operation and maintenance. In addition to planners, contractors have an important role in the principles of green building sustainability. The Sukawati Art Market as a public building has gone through a green building planning certification process by the Ministry of Public Works and Public Housing in 2019. The purpose of this study is to identify and analyze the application of green construction in the implementation of the Sukawati Art Market development focusing on the parameters of the Green Supply Chain. This study begins with the identification of the parameters according to the checklist for the performance assessment of the BGH construction implementation phase for New Buildings. Then proceed with doing a comparison to evaluate the field data obtained with the assessment standard and perform an analysis on the parameters of the green supply chain. The research method used is qualitative which includes case studies of construction implementation and qualitative interviews with the parties involved. The results obtained are that the construction of the Sukawati Art Market has met the criteria as a building that has an environmentally friendly construction process with a total value of 101 points or 61% and is included in the pratama predicate.

Keywords: green building; green construction; sukawati art market.

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INTRODUCTION

Infrastructure development is one of the government's main priorities under the leadership of President Joko Widodo, who is paying attention in the midst of the 2019 Coronavirous Disease Pandemic. Development is one of the hopes of national economic recovery, so it must be supported by the availability of a supply chain of construction resources. The construction industry is one of the largest sectors of the economy in Indonesia which contributes to Gross National Product every year (Central Bureau of Statistics, 2021). The construction sector covers the activities of demand (demand) and supply (supply) of goods and services from the construction supply chain to produce infrastructure (Maulani et al., 2014; Suraji, 2020). The construction sector contributes 8-9% of GDP and as many as 7 million permanent employees are absorbed as well as 10,000,000 contract workers days (Central Bureau of Statistics, 2021) but the construction sector has a negative impact on the use of greenhouse gas (GHG) emission energy.

In the Indonesian Construction bulletin (2016), the Indonesian construction sector in 2012 is said to have contributed to 435.5 Mt or 4.5% of all emissions on earth. The construction sector is seen as a link that has an important role in the recycling cycle of natural resource sustainability through processing which consists of: distribution of materials, assembly of components on site, demolition of buildings, construction processes and disposal of waste generated. The concept of sustainable construction aims to minimize the environmental impact of the construction process by ensuring that buildings are constructed in an environmentally friendly manner. According to Rosenberd, Merson & Funkhouser who are cited in several books on green construction explain that contractors play an important role in green buildings but receive less attention and support compared to the design community in general" (Adros & Abidin, 2019; Kubba, 2016). Construction implementers'

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understanding of sustainable development can be seen from the establishment of various organizations engaged in sustainable construction such as Edge Buildings Indonesia or Green Building Council Indonesia (GBCI). The central government has also initiated green building standardization through Minister of Public Works and Public Housing Regulation No. 2 of 2015 concerning green buildings which have been renewed with the issuance of Regulation no. 21 of 2021 concerning Performance Assessment of Green Buildings.

The development process of the Sukawati Bali Art Market is a public building construction process by prioritizing sustainable development practices in Indonesia from the planning stage to the construction stage. Sukawati Market has now gone through the green building certification process by the Ministry of PUPR in 2019 with the results of the Primary predicate in the Planning Stage (Directorate of Building Arrangements, 2019). So to maintain the Government's vision, the construction process must be applied according to sustainable development practices. The purpose of this study is to assess the extent to which the Sukawati Market contractor can implement green construction practices in the field and assess the parameters or aspects that have the highest importance. This study is different from several previous studies from literature study references, this study does not apply the instrument (rating tools) from the Green Building Council as an assessment, but with the criteria parameters provided by the Government according to the Regulation of the Minister of Public Works and Public Housing No. 21 of 2021. regarding Green Building Performance Assessment. This study was initiated by identification followed by comparison to evaluate field data obtained with assessment standards by focusing on the analysis of green supply chain parameters.

Construction problems are the most decisive in human life. Including the construction of residential houses with good and measurable planning. This includes the construction of green houses and environmentally friendly houses that require special handling so that buildings with good construction and good architecture need to be handled (Alimudin A, 2020; Sinabariba D, et.al, 2021).

RESEARCH METHODS

Qualitative methods are used in this study by conducting an assessment of the green building assessment parameters. A qualitative approach is used in order to convey descriptive information from the data about what they are doing, and what they feel is focused on the research (Moleong, 2018; Sugiyono, 2016; Tracy J Sara, 2013). In the discussion, the approaches used in this study are case studies (Saxena & Saxena, 2019; Wang & Groat, 2013; Yin, 2014, 2017) and comparative (Caiden et al., 1988; Esser & Vliegenthart, 2017; Pennings & Keman, 2020) on the construction of the Sukawati Art Market.

According to Yin (2014, 2017) and Hidayat (2019), the case study research method is an appropriate strategy to be applied in studies with the core questions of how and why, shorter duration for researchers in controlling the phenomenon to be studied, and referred to as contemporary phenomena.. In another sense, in the case study method, the researcher focuses on the concept and application of the study. The case study researched is one of the Sukawati Art Market Buildings called the Block A Market Area.

Sukawati Art Market is located on Jalan Raya Sukawati, Gianyar, Bali. The building has a land area of 3,753 m2 and a building area of 5,796 m2. The western and southern parts are bordered by shops and houses, the eastern part is bordered by Jalan Raya Sukawati, while the northern part is bordered by Jalan Lettu Wayan Sutha. The location can be seen in Figure 1. Sukawati Art Market Building is a people's market revitalization carried out by the Ministry of Public Works and Public Housing by prioritizing local wisdom and environmental harmony and in accordance with the function of Gianyar Regency as a tourism destination (Indonesia & National, 2015).

Figure 1. Location of Sukawati Art Market in Gianyar Regency. Source: Personal analysis results, 2021

The source of data in this study comes from primary data and secondary data as consideration in determining data collection (Fitrah & Lutfiyah, 2017; Sugiono, 2013; Sugiyono, 2016). Primary data is obtained by field observations at research locations such as the development implementation process which is equipped with periodic reports, planning documents, as built drawing documents, as well as BGH planning performance assessments. While secondary data in the form of data collected from agencies involved in the development of the Sukawati Bali Art Market such as supporting documents and related regulations. The collection of information was obtained by using a question and answer method to construction actors, especially contractors and field supervisors to record a list of data requirements.

Comparative analysis is used in this study as an approach based on secondary data in the form of design and primary data generated from interviews and field observations. In the book Caiden (1988) explains that the majority of researchers agree that there is no standard methodology for comparative studies, but comparability analysis investigates two or more alternatives, processes, products, qualifications, data sets, systems, and others side by side. A comparative approach is used by looking at the results of planning and implementation, then a comparison is made between evidence of field performance and parameters so that an assessment of performance achievement in the form of the required value can be obtained. This value provides information on how big the gap is between the achievement value in conditions in the field and the maximum required value.

The regulation issued by the Minister of Public Works and Public Housing No. 21 of 2021 concerning Performance Assessment of Green Buildings is a guideline for construction actors in carrying out the implementation of green buildings. At the construction implementation stage, the assessment table is used as an instrument for assessing the construction process for the application of green construction from a BGH plan before the building can be utilized. The Performance Assessment System for the BGH Construction Implementation Phase for New Buildings has a maximum score of 165 points, overall assessing construction aspects with 4 criteria requirements. The minimum score can be obtained with a value of 45% – 65% which is a Primary BGH rating, a value of 65% – 80% for an Intermediate BGH rating, a value of 80% – 100% for a Primary BGH rating. Conformity analysis is obtained by comparing the "performance appraisal system for the construction implementation stage" comparison table with green practice conditions. After a comparison is made, the values for each parameter are obtained and then added up to become the

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total value as a reference for the ranking category for the implementation of construction in green buildings.

Table 1. Assessment of BGH performance during construction

No	Rating	Value	BGH Primary	BGH Middle	BGH Main
A	**Conformity of the performance of the construction of bgh**		45% s.d. 65% Performance achievement according to slf	More than 65% s.d. 80% According to the parameters of the PUPR Ministerial Regulation, BGH performance assessment	More than 80% s.d. 100% According to the parameters of the PUPR Ministerial Regulation, BGH performance assessment
	Quality assurance and quality control of bgh . construction work	58			
	Handover	16			
B	**Green construction process**				
	Application of green construction implementation methods	4			
	Optimization of equipment use	5			
	Implementation of construction waste management	13			
	Application of water conservation in construction implementation	20			
	Application of energy conservation in construction implementation	14			
C	**Practice green behavior**				
	Implementation of occupational health and safety management system	9			
	Application of environmentally friendly behavior	12			
D	**Green supply chain**				
	Use of construction materials	10			
	Selection of suppliers and/or subcontractors	9			
	Energy conservation	4			
	Total	**165**			

Source: Attachment to the Minister of Public Works and Public Housing No. 21 of 2021 regarding the assessment of BGH criteria

From the analysis of the green building performance assessment that has been carried out by Arndarnijariah (2021) in the Prawirotaman Market using the Analytical Hierarchy Process (AHP) method to determine the ranking of the importance of parameters for the assessment of BGH criteria during the construction period, it is concluded that the most important parameter in the construction implementation period is the supply chain. green. So that the detailed discussion in this study will be carried out on the parameters of the green supply chain.

RESULTS AND DISCUSSION

According to the World Green Building Council, a green building is a building that, in planning, implementing and using it, the building can reduce or eliminate negative impacts but have a positive impact on our earth (Kurniawan & Simanjuntak, 2019; Wayan et al., 2021), Meanwhile, according to Setyowati (2014) green building is a building where from the initial design process to maintenance it pays attention to the protection, savings, and reduction of the use of natural resources, maintains air quality in the room, and pays attention to the health of the occupants. Apart from the literature above, according to the Government itself, a green building is a building that meets building requirements technically and is able to measure itself in reducing energy, water, and other resources through the application of green building requirements according to the functions and criteria of the building at the implementation stage (Minister of Works). Public and Public Housing of the Republic of Indonesia, 2021).

In terms of the implementation of development, green construction is part of sustainable construction in a holistic way which intends to protect and balance the artificial and natural environment, as well as build housing that explains human dignity and urges economic equality (Du Plessis et al., 2002). ; Ervianto, 2014, 2015; Glavinich, 2008; Hartman, 2012). Another study states that green construction or what is called green construction is part of sustainable construction or sustainable development which has a way of implementing construction that pays attention to a green process and green supply chain as well as the application of efficient construction so as not to leave or reduce construction waste (Abduh , 2012; Bon-Gang, 2018; McGraw Hill Construction, 2012; Shi et al., 2013; Vale, 2009). Based on some of the literature and opinions above, it can be summarized that Green Construction is the implementation of a construction project (which runs according to the rules in the contract document) in order to reduce or eliminate the negative impact of the construction process on the sustainability of natural resources so that continuity between human needs and resource capabilities can be created. nature for future generations.

Other studies that serve as reference examples in this study tend to use the majority of the assessments from the Green Building Council. Research with GBCI Greenship parameters as library study material includes public buildings such as offices (Muhammad Fadel Andika et al., 2021), Educational buildings (Roshaunda et al., 2019) and hospitals (Firnando & Andi Putra Rambe, 2016). Studies with a list refer to the Minister of Public Works and Public Housing Regulation No. 2 of 2015 are still little done but found several studies with different loci and approaches in office buildings (Arthasari, 2020) and market public buildings (Arndarnijariah, 2021).

Table 2. Assessment of BGH performance during the construction of Sukawati Art Market

No	Parameter	Value	Claim
A	**Conformity of the performance of the construction of bgh**		
	BGH Construction Work Quality Assurance and Quality Control Activities	58	10
	Handover	16	16
	Total Green Construction Process Criteria Assessment	74	26
B	**Green construction process**		
	Application of green construction implementation methods	8	6
	Optimization of equipment use	12	12
	Implementation of construction waste management	7	7
	Application of water conservation in construction implementation	20	20
	Application of energy conservation in construction implementation	13	4
	Total Green Construction Process Criteria Assessment	60	49
C	**Practice green behavior**		
	Implementation of occupational health and safety management system	14	12
	Application of environmentally friendly behavior	6	4
	Total Assessment of Green Behavior Practice Criteria	20	16
D	**Green supply chain**		
	Use of construction materials	6	6
	Selection of suppliers and/or subcontractors	3	3
	Energy conservation	2	1
	Total Green Supply Chain Criteria Assessment	11	10
	Total All Parameter Rating	**165**	**101**

Source: Personal analysis results, 2021

After being assessed during the construction process, 101 (one hundred and one) rating tools were obtained from a maximum value of 165 (one hundred and sixty five) points. If described in each of the parameters above, then the percentage assessment of each can be seen in table 3 below:

Table 3. Percentage of the results of the performance assessment of the Sukawati Art Market BGH construction implementation

No	Condition	Claim	%

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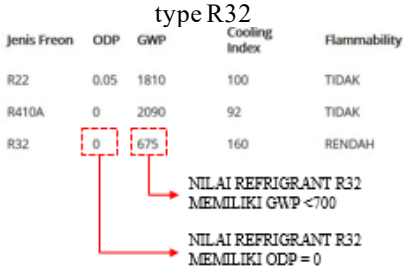
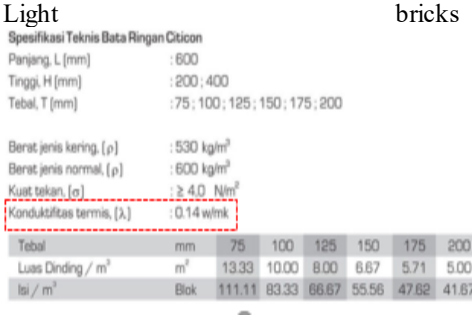
A	Conformity of the performance of the construction of bgh	26	35,14
B	Green construction process	49	81,67
C	Practice green behavior	16	80,00
D	Green supply chain	10	90,91
	Total All Parameter Rating	101	61,21

Source: Personal analysis results, 2021

The percentage results above suggest that the highest parameter assessment is obtained in the Green Supply Chain parameter assessment of 90.01%. This shows that the Green Supply Chain parameter is a parameter successfully applied by the contractor in the Sukawati Art Market construction process. In line with the research conducted by Arndarnijariah (2021), the Green Supply Chain parameters with their requirements criteria can be implemented and fulfilled in the assessment of the use of environmentally friendly materials.

Overall the percentage value obtained is 61.21% stating that most of the components working in the construction process have a high commitment to the application of the rules, as well as behaviors that support the realization of green buildings in the work. Some points that cannot be assessed in the construction implementation process are found in one of the points in the energy conservation parameter, namely the preparation of energy audit reports from equipment. This is due to the absence of experts owned by the service provider because the required experts are not required by the previous auction criteria. Based on the results of the analysis above and the analysis of the green building performance assessment by Arndarnijariah (2021), a detailed discussion on the implementation study of the Sukawati Art Market construction process in Gianyar Regency will be carried out on the parameters of the green supply chain.

Table 4. Assessment of green supply chain criteria

Use of construction materials		
a	Domestic component level (TKDN) portion of at least 40%	
	Architectural Jobs 1. Lightweight Bricks – Mojokerto 2. Instant Cement – Tuban 3. Homogeneous Tile – Indonesia 4. Ceramics – Surabaya 5. Interior Exterior Paint – Cikarang 6. Bata Press – Tulikup 7. Paras Tulung Agung – Tulung Agung 8. Aluminum – Indonesia 9. Kalsiboard Ceiling – Indonesia 10. Gypsum Ceiling – Indonesia 11. Sanitary – Indonesia 12. Furniture – Indonesia 13. Sandy Metal Tile – Indonesia 14. Listplank Fibersement – Indonesia	Structure Work 1. Sand – Karangasem 2. Cement – Gresik 3. Reinforcing iron 4. Multiplex – Indonesia 5. Kaso – Indonesia 6. Nails – Indonesia 7. Steel WF – Indonesia 8. Mild Steel Piles – Indonesia 9. Mild steel battens – Indonesia
b	Using environmentally friendly raw materials	
	1. Air Conditioner (AC) with refrigerant type R32  	2. Light bricks 

3. Sanitary

Sertifikat ISO 14001

Sertifikat SNI

4. Elevator

Sertifikat ISO 14001

5. Pump

Sertifikat ISO 14001

6. Traformer

7. Ceiling and lisplank

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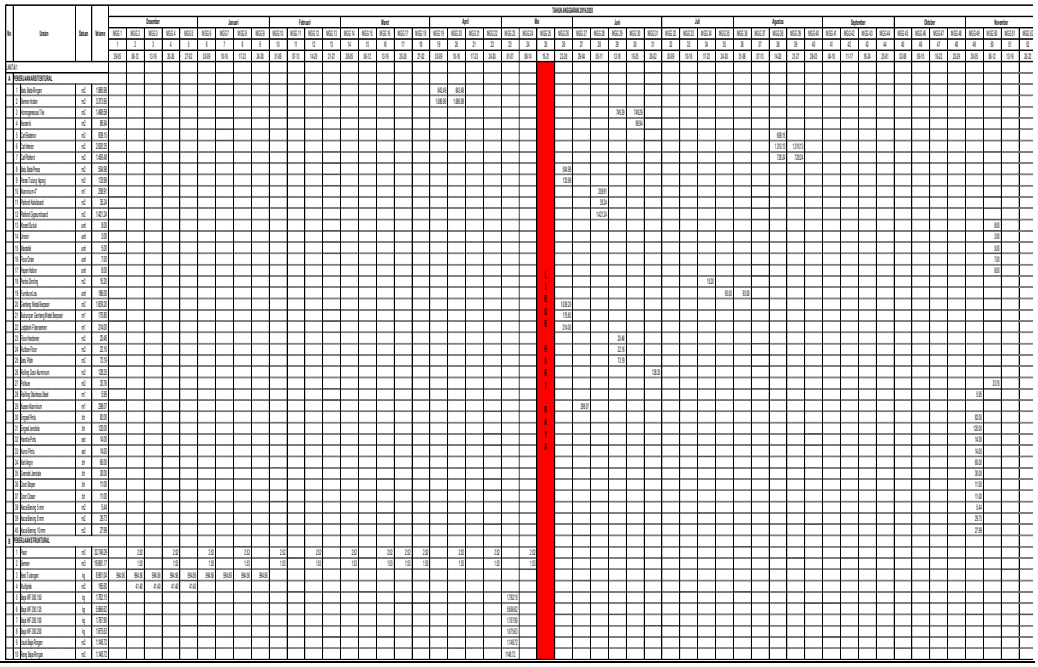
c Proper delivery and use of materials

1. Arrival schedule



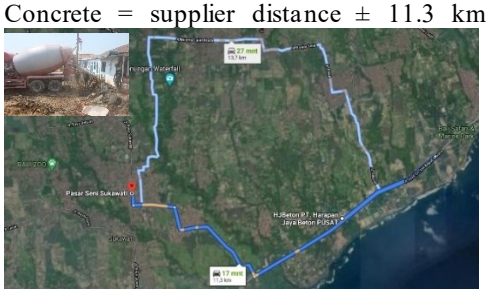
2. Material arrival documentation

3. Attachment of travel documents

Selection of suppliers and/or Subcontractors

a Have material and/or equipment suppliers located in the same area zone (with a maximum distance of 200 km) as much as at least 50% of the total raw material needs

Concrete = supplier distance ± 11.3 km

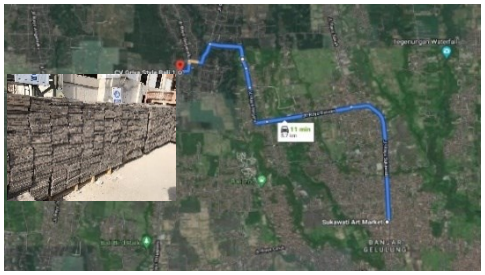


Iron = supplier distance ± 20.1 km

Drymix = supplier distance ± 8.9 km

Sand = supplier distance ± 58.4 km

Paras tulung agung = supplier distance ± 5.7 km



Bricks = supplier distance ± 21.4 km

b	Have a mechanism for identifying material and tool needs in accordance with the scope, schedule of arrivals and the right amount/volume

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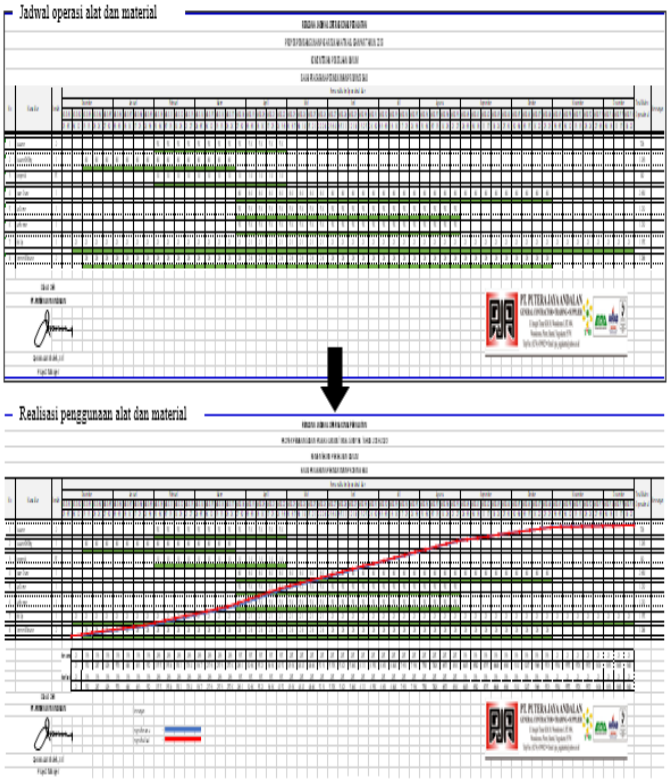
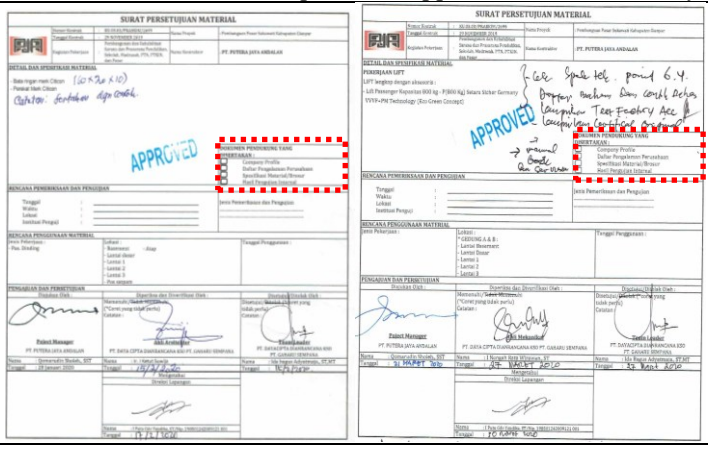


c Selection and evaluation of potential suppliers in environmentally friendly production processes



Material approval letter is given if the supplier provides supporting data:

- Company profile
- List of company experience
- Material specifications / brochures
- Internal test results
- Include proof of ISO 14001 certification

Material approval recapitulation

No.	Nama Material	Merk Material	Dokumen Pendukung		Diajukan kepada MK Tanggal	Disetujui oleh MK Tanggal
			Brosur/Spesifikasi Material	Hasil Pengujian Internal		
1	Aluminium foil tebal 4 mm	Isoflex Type Premium AF4	O	X	01 Juli 2020	13 Juli 2020
2	Atap metal t = 0,3 mm	Primaroof	O	X	12 Agustus 2020	18 Agustus 2020
3	Bata ringan (60x20x10)	Citicon	O	X	28 Januari 2020	15 Februari 2020
4	Perekat Bata	Bintang Persada	O	X	28 Januari 2020	15 Februari 2020
5	Besi Ulir dan Polos	Master	O	X	10 Desember 2019	12 Desember 2019
6	Beton Mutu K300	Harapan Jaya Beton	X	O	10 Desember 2019	12 Desember 2019
7	Semen plester	Drymix D-200	O	X	17 Juli 2020	17 Juli 2020
8	Semen acian	Drymix S-100	O	X	17 Juli 2020	17 Juli 2020
9	Semen skimcoat	Drymix S-200	O	X	17 Juli 2020	17 Juli 2020
10	Granite guiding block uk.30x30 cm	VID	O	X	28 Januari 2020	16 Februari 2020
11	Granite guiding block uk.20x20 cm	VID	O	X	02 Oktober 2020	08 Oktober 2020
12	Homogeneus tile 60x60 cm, polish dan unpolish	Valentino gress	O	X	28 Januari 2020	14 Februari 2020
13	Homogeneus tile 40x40 cm, polish	Valentino gress	O	X	28 Januari 2020	14 Februari 2020
14	Plint Homogeneus tile 10x60 cm	Valentino gress	O	X	28 Januari 2020	14 Februari 2020
15	Plint Homogeneus tile 10x40 cm	Valentino gress	O	X	28 Januari 2020	14 Februari 2020
31	dll……					

Energy Conservation

a	Have done and have an energy audit report of equipment	X
b	Have rules regarding energy conservation in the company (green policies)	

SOP konservasi energi

PT. PUTERA JAYA ANDALAN
GENERAL CONTRACTOR • TRADING • SUPPLIER

A. Konservasi Energi

Salah satu inefisiensi biaya energy tersebut disebabkan oleh keterlambatan proyek yang dapat mencapai 30-40 % secara rata-trata terhadap durawi awal. Ini adalah faktor utama inefisiensi biaya energy di proyek. Umumnya keterlambatan proyek disebabkan oleh faktor seperti tabel di bawah ini :

Factor	Aggregate Rating Based On Previous Studies	Rangking
Late Delivery Or Slow Mobilization	8	1
Damaged Materials	22	2
Poor Planning	27	3
Equipment Breakdown	31	4
Improper Equipment	34	5
Unreliable Supplier/Subcontractor	34	6
Inadequate Fund Allocation	35	7
Poor quality	36	8
Absenteeism	44	9
Lack of Facilities	44	10

Faktor inefisiensi yang lain adalah pada penggunaan genset yang tidak efisien. Genset sering digunakan pada posisi standby atau pada load yang rendah.

PT. PUTERA JAYA ANDALAN
GENERAL CONTRACTOR • TRADING • SUPPLIER

- Aktif berkomunikasi dengan pekerja mengenai kesulitan pelaksanaan dalam event meeting atau safety talk.
- Tenaga kerja harus disebar pada area pekerjaan sedemikian dan masih tetap dapat dimonitor dengan baik.

2. Melakukan Optimasi Penggunaan Alat Berat dan Ringan

a. Melakukan pengecekan antara kapasitas dan durasi penggunaan alat terhadap kebutuhan actual.
(Grafik Schedule Kebutuhan Listrik)

b. Melakukan langkah perubahan metode yang dapat menghemat biaya energy sesuai dengan kondisi.

3. Optimasi Procurement Genset

a. Pemilihan sewa genset yang tingkat fuel consumptionnya relative rendah.
b. Meminimalisir penggunaan genset untuk penghematan konsumsi energi.
c. Penataan waktu penggunaan genset, dipertimbangkan waktu penghidupan genset dalam satu waktu.

4. Pengendalian Tingkat Load Penggunaan Genset

a. Penggunaan genset dengan laod yang tinggi dan tidak menggunakan genset jika sedang standby atau laod yang rendah.
b. Peningkatan produktifitas lapangan secara bersama

5. Pemakaian Listrik Kantor dan Mess Proyek

a. Mengganti lampu TL dengan lampu essensial. Terdapat jenis lampu yang jauh lebih irit yaitu jenis lampu LED
b. Mengganti dispenser panas-dingin dengan dispenser biasa.

Source: Personal analysis results, 2021

Table 5. Recapitulation of performance appraisal of the Sukawati Art Market BGH construction implementation

No	Persyaratan	Claim
A	Conformity of the performance of the construction of bgh	26
B	Green construction process	49
C	Practice green behavior	16
D	Green supply chain	10
	Total All Parameter Rating	101

Source: Personal analysis results, 2021

CONCLUSION

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Sukawati Art Market Building is a building that has been certified pratama in the Planning BGH stage with the issuance of Minutes of Meeting on Performance Assessment of Green Buildings in the Sukawati Market Planning Stage (2019) by the Directorate of Building Arrangements of the Ministry of PUPR. The results of this study indicate that the performance of green buildings at the time of construction was scored 101 (one hundred and one) points out of 165 (one hundred and sixty five) points, so that if certification is carried out, Sukawati Art Market can get a BGH pratama implementation rating.

The assessment that cannot be achieved during the implementation process lies in the need for special Experts. Energy experts are personnel who are able to audit energy reports during the construction process. This inability lies in the requirements for experts set out in the procurement process, so to add special experts in the energy sector, a large amount of financing is required.

With a strong commitment through efforts that can be achieved in the implementation stage, in the green building certification stage, accompanied by governance, supervision, rewards, and other completeness components, the Sukawati Art Market Building has met the minimum assessment criteria as a building that has environmentally friendly construction process.

The existence of a gap describes how far the achievements can be achieved and realized in the future construction process in order to narrow the gap or eliminate the assessment gap between the construction points and the maximum points required.

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REFERENCES

Abduh, M. (2012). Kajian Sistem Assessment Proses Konstruksi pada Greenship Rating Tool Strategic Logistics Services for Small-size Contractors View project Gambaran Perkembangan Teknologi Konstruksi di Indonesia View project. https://www.researchgate.net/publication/331718031. (Indonesian).

Adros, N. A., & Abidin, D. N. Z. (2019). An Investigation of the Diversification Roles of Contractor. SEISENSE Journal of Management, 2(2). https://doi.org/10.33215/sjom.v2i2.93

Alimudin Alimudin. (2020). STUDY OF ENVIRONMENTAL IMPACT ON SCHOOL BUILDING CONSTRUCTION (CASE STUDY: SDN HARJAMUKTI 5, DEPOK CITY). ASTONJADRO: CEAESJ 9 (2), 80-92

Arndarnijariah, F. F. (2021). Analisis Penilaian Kinerja Green Building pada Proyek Rehabilitasi Bangunan Pasar Prawirotaman Kota Yogyakarta. Reviews in Civil Engineering, 5(1). https://doi.org/10.31002/rice.v5i1.3587. (Indonesian).

Arthasari, A. H. (2020). Peningkatan kinerja hijau melalui retrofitting Peningkatan Kinerja Hijau Melalui Retrofitting Studi Kasus : Pekerjaan Pengubahsuaian Bangunan PIP2B DIY. https://doi.org/10.14710/mdl.20.1.2020.57-65. (Indonesian).

Badan Pusat Statistik. (2021). Berita Resmi Statistik Pertumbuhan Ekonomi Produk Domestik Bruto NO.13/02/TH.XXIV, 5 Februari 2021. (Indonesian).

Bon-Gang, H. (2018). Productivity Performance and Improvement of Green Construction Projects. In Performance and Improvement of Green Construction Projects. https://doi.org/10.1016/b978-0-12-815483-0.00012-0

Caiden, N., Dierkes, M., Weiler, H. N., & Antal, A. B. (1988). Comparative Policy Research. Public

Administration Review, 48(5). https://doi.org/10.2307/976910

Darwin Sinabariba, Syamsulsyah Lubis, Giatwin Giatwin. (2021). SPORTS ARENA AND ENTERTAINMENT DESIGN. ASTONJADRO: CEAESJ 10 (2), 352-372

Direktorat Bina Penataan Bangunan, K. P. (2019). Penilaian Kinerja Bangunan Gedung Hijau Tahap Perencanaan Pasar Sukawati. (Indonesian).

Direktorat Jenderal Bina Konstruksi Kementerian Pekerjaan Umum dan Perumahan Rakyat. (2016). MEA 2015 – 2025 Action PlAn Vs PlAn to Acts di sektor konstruksi MEA 2015 – 2025 Action PlAn Vs PlAn to Acts di sektor konstruksi. (Indonesian).

Du Plessis, C., International Council for Research and Innovation in Building and Construction., & UNEP International Environmental Technology Centre. (2002). Agenda 21 for sustainable construction in developing countries : a discussion document. CSIR Building and Construction Technology.

Erma Setyowati, A., Nurfajri Alfata, M., & Wibowo. (2014). Sistem Rating Bangunan Hijau Indonesia Rating System of Green Building in Indonesia. In Jurnal Permukiman (Vol. 9, Issue 2). (Indonesian).

Ervianto, W. I. (2014). Kendala Kontraktor dalam Menerapkan Green Construction untuk Proyek Konstruksi di Indonesia. Seminar Nasional X Teknik Sipil ITS Surabaya. (Indonesian).

Ervianto, W. I. (2015). Inplementasi Green Construction sebagai Upaya Mencapai Pembangunan Berkelanjutan di Indonesia. Makalah Konferensi Nasional Forum Wahana Teknik Ke-2. (Indonesian).

Esser, F., & Vliegenthart, R. (2017). Comparative Research Methods. In The International Encyclopedia of Communication Research Methods. https://doi.org/10.1002/9781118901731.iecrm0035

Firnando, N., & Andi Putra Rambe, D. (2016). Penilaian Kriteria Green Building Pada Bangunan Gedung Rumah Sakit Universitas Sumatera Utara. (Indonesian).

Fitrah, M., & Lutfiyah. (2017). Metodologi penelitian: penelitian kualitatif, tindakan kelas & studi kasusKelas & Studi Kasus. In Jejak Publisher. (Indonesian).

Glavinich, T. E. (2008). Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. In Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. https://doi.org/10.1002/9780470259979

Hartman, H. (2012). Is sustainability just another "ism." Architectural Design, 82(4). https://doi.org/10.1002/ad.1444

Hidayat, T. (2019). Pembahasan Studi Kasus Sebagai Bagian Metodologi Penelitian. ResearchGate, August. (Indonesian).

Indonesia, S. N., & Nasional, B. S. (2015). Pasar rakyat. (Indonesian).

Kubba, S. (2016). Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes: Second Edition. In Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes: Second Edition.

Kurniawan, B., & Simanjuntak, M. R. (2019). Perbandingan Persyaratan Green Building di Indonesia dan Singapura. (Indonesian).

Maulani, F., Suraji, A., & Istijono, B. (2014). Analisis Struktur Rantai Pasok Kontruksi pada Pekerjaan Jembatan. Jurnal Rekayasa Sipil (JRS-Unand), 10(2). https://doi.org/10.25077/jrs.10.2.1-8.2014. (Indonesian).

McGraw Hill Construction. (2012). Construction Industry Workforce Shortages: Role of Certification, Training and Green Jobs in Filling the Gap. In Bedford, MA: McGraw-Hill

pISSN 2302-4240
eISSN 2655-2086

Volume 11, Issue 1, February 2022, pp.94-107
DOI: http://dx.doi.org/10.32832/astonjadro.v11i1

Construction.

Menteri Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia. (2021). Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia Nomor 21 Tahun 2021 Tentang Penilaian Kinerja Bangunan Gedung Hijau. https://jdih.pu.go.id/detail-dokumen/2882/1. (Indonesian).

Moleong, L. J. (2018). Metodologi Penelitian Kualitatif, cet. In PT Remaja Rosdakarya. (Indonesian).

Muhammad Fadel Andika, Fadhil Putra Noviadi, & Darman Ferianto Saragih. (2021). Evaluasi Penerapan Kriteria Green And Smart Building Pada Proyek Pembangunan Gedung Kantor PT. INALUM (PERSERO). Jurnal Ilmiah Teknik Sipil Agregat, 1(1), 23–32. https://doi.org/10.51510/agregat.v1i1.58. (Indonesian).

Pennings, P., & Keman, H. (2020). 3. Comparative Research Methods. In Comparative Politics. https://doi.org/10.1093/hepl/9780198820604.003.0003

Roshaunda, D., Diana, L., Princhika, L., Khalisha, S., & Septiady, R. (2019). Penilaian Kriteria Green Building Pada Bangunan Gedung Universitas Pembangunan Jaya Berdasarkan Indikasi Green Building Council Indonesia. 6. (Indonesian).

Saxena, A., & Saxena, A. (2019). Case study: A Research Method. Voice of Intellectual Man - An International Journal, 9(2). https://doi.org/10.5958/2319-4308.2019.00018.5

Shi, Q., Zuo, J., Huang, R., Huang, J., & Pullen, S. (2013). Identifying the critical factors for green construction - An empirical study in China. Habitat International, 40. https://doi.org/10.1016/j.habitatint.2013.01.003

Sugiono. (2013). Sugiyono, Metodologi Penelitian Kuantitatif, Kualitatif. In Mode Penelitian Kualitatif (Vol. 5, Issue January). (Indonesian).

Sugiyono. (2016). Sugiyono, Metode Penelitian. Sugiyono. (Indonesian).

Suraji, A. (2020). Improving the performance of Indonesia's construction industry. In Improving the Performance of Construction Industries for Developing Countries. https://doi.org/10.1201/9780429322471-9

Tracy J Sara. (2013). Qualitative Research Methods Collecting Evidence, Crafting Analysis, Communicating Impact. In Systematic data collection (Vol. 10).

Vale, B. (2009). Sustainable Facilities Green Design, Construction, and Operations. In Architectural Science Review (Vol. 52, Issue 4).

Wang, D., & Groat, L. N. (2013). Architectural research methods / David Wang, Linda N. Groat. In 感染症誌 (Vol. 91).

Wayan, N., Mustika, M., Ketut, N., & Dwijendra, A. (2021). Preliminary Study of Green Material for Green Building in Bali. International Journal of Engineering and Emerging Technology, 6(2).

Yin, R. K. (2014). Case Study Research Research: Design and Methods 5th Edition. In SAGE Publications (Vol. 26, Issue 1).

Yin, R. K. (2017). Designing Case Studies. In Case Study Research and Applications: Design and Methods.