SUSTAINABILITY OF PUBLIC GREEN OPEN SPACES: EVALUATION OF IMPLEMENTATION MANAGEMENT IN ALAM SUTERA RESIDENTIAL, SOUTH TANGERANG, BANTEN

KEBERLANJUTAN RUANG TERBUKA HIJAU PUBLIK: EVALUASI MANAJEMEN PENYELENGGARAANNYA DI PERUMAHAN ALAM SUTERA, TANGERANG SELATAN, BANTEN

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ABSTRACT

Global warming and climate change have increased the need for green open space in urban areas to support environmental quality and urban sustainability. As a township, the Alam Sutera Residential Area is recognized as a pioneer of green living with a strong commitment to improving environmental quality and community well-being; however, the sustainability of its public green open spaces has not yet been fully realized due to limitations in management implementation. This condition indicates existing issues in the management of public green open space, which form the basis of this study. This study aims to evaluate the extent to which public green open space management in Alam Sutera supports sustainability using a quantitative descriptive-analytical approach. Data were collected through Likert-scale questionnaires distributed purposively to green space managers, professional landscape architects, academics, and public observers. The novelty of this study lies in an integrated evaluation framework that combines public green open space management stages with sustainable landscape design principles and site-specific landscape needs within a single assessment instrument. The results indicate that the sustainability of public green open space in Alam Sutera has not been optimally achieved, as all evaluated variables—Planning, Implementation, Operations and Maintenance, and Monitoring and Evaluation—have not reached the very good category, with Planning and Operations and Maintenance failing to meet the required sustainability criteria.

Keywords: Public Green Open Space, Public Green Open Space Management, Sustainability of Public Green Open Space

ABSTRAK

Dampak dari global warming dan perubahan iklim di dunia, menyebabkan Ruang Terbuka Hijau (RTH) di kawasan perkotaan menjadi sangat dibutuhkan. Perumahan Alam Sutera sebagai kawasan township, dikenal sebagai pelopor kehidupan hijau yang berkomitmen meningkatkan kualitas lingkungan dan kehidupan masyarakat. Namun, dalam perkembangannya, keberadaan RTH publik memerlukan manajemen penyelenggaraan yang baik agar keberlanjutannya dapat terjaga karena implementasinya di lapangan belum berjalan secara optimal. Kondisi tersebut menunjukkan adanya permasalahan pengelolaan RTH publik yang menjadi dasar penting dilakukannya penelitian ini. Penelitian ini bertujuan untuk mengevaluasi sejauh mana manajemen penyelenggaraan RTH publik di Perumahan Alam Sutera telah diupayakan. Penelitian ini menggunakan metode kuantitatif dengan pendekatan deskriptif analitis. Data dikumpulkan melalui kuesioner berskala Likert yang disebarkan secara purposive kepada pengelola RTH, arsitek lanskap profesional, akademisi, dan pemerhati RTH publik. Kebaruan penelitian ini terletak pada integrasi tahapan proses penyelenggaraan RTH publik dengan prinsip desain lanskap berkelanjutan dan kebutuhan lanskap kawasan sebagai variabel, subvariabel, dan indikator penelitian. Hasil penelitian menunjukkan bahwa keberlanjutan RTH publik di Perumahan Alam Sutera belum tercapai secara optimal, ditunjukkan oleh seluruh variabel evaluasi yang meliputi perencanaan, pelaksanaan, operasional dan pemeliharaan, serta monitoring dan evaluasi yang belum berada pada kategori sangat baik. Dua dari empat variabel tersebut berada pada kategori kurang, yaitu meskipun telah tercantum dalam peraturan pemerintah setempat namun implementasinya masih terbatas pada pemenuhan persyaratan kerja.

Kata Kunci: RTH publik, Manajemen Penyelenggaraan RTH publik, Keberlanjutan RTH Publik

1. INTRODUCTION

The impact of global warming and climate change in the world causes green open space in urban areas to be urgently needed. Law Number 26 of 2007 concerning Spatial Planning stipulates that the proportion of green open space in the city area is at least 30% of the city area. This provision is also applied to the Alam Sutera housing complex as a requirement for creating a balanced ecosystem.

As an area township, Alam Sutera Housing has been a pioneer in green living. This housing is also a dynamic icon of urban development committed to improving lives. The township covering an area of 800 hectares, is located in North Serpong, South Tangerang, Banten. Alam Sutera housing has more than 37 housing clusters. Each cluster consists of 150 – 300 houses supported by various facilities that provide comfortable living, one of which is public green open space.

Public green open space supports Alam Sutera Housing in building a better life and providing a comfortable living. Good management is needed in its implementation to maintain its sustainability. However, the management of public green open space in practice often faces implementation gaps between formal provisions and on-ground execution. Common issues include the limited availability of technical guidance for eco-friendly design and environmentally oriented maintenance, inconsistent operational routines, and weak coordination among stakeholders involved in planning, utilization, and maintenance. As a result, public green open space tends to function mainly as a compliance requirement for provision, while long-term sustainability outcomes—such as consistent ecological performance, user comfort, and continuity of maintenance quality—are not always achieved optimally. These practical management challenges provide the key justification for conducting an evaluation of the management process and its supporting documents and activities. Ministerial Regulation of Public Works Number 5 of 2008 and the Ministerial Regulation of Agrarian Affairs and Spatial Planning/National Land Agency (*Agraria dan Tata Ruang/Badan Pertanahan Nasional* – ATR/BPN) 14 of 2022 concerning the Provision and Utilization of Green Open Space states that green open space is expected to have ecological, economic, mitigation and aesthetic functions and social functions. Regarding the fulfillment of social functions, it is known as public green space because it provides a forum for interaction and activities (Parikesit, 2019).

Three things must be considered as a public green open space (Carr et al., 1992): responsive, democratic, and meaningful. Responsive means that it must be used for various activities and broad interests. Democratic means that it is used by the general public from various social, economic, and cultural backgrounds and accessible to various human physical conditions. Meaning means having links between people, space, the wider world, and social contexts. So, the role of public space includes economic aspects (positive influence on the property and encourages regional performance); health aspects (providing space for active community activities); social aspects (providing space for social interaction and learning for all ages and improving community life); as well as environmental aspects (enhancement of environmental quality and development of biodiversity) (Carmona et al., 2008). As a public good that is used for public purposes (Malik, 2018), public green space is expected to provide services for healthy community interaction, environment, and society, as well as community welfare (Firmansyah et al., 2018; Pakzad & Osmond, 2016).

Other functions mentioned in the regulations must be considered. Public green space is expected to impact realizing a comfortable life and a better one positively. This effort must be supported by good governance to create sustainable public open space that supports the sustainability of the urban landscape. Management of green areas in urban areas is indispensable for sustainable urban landscapes (Jansson et al., 2019) to prevent the degradation of land, water, and air (Syamili et al., 2023). Previous studies have shown that public green open spaces can positively contribute to environmental quality, public health, social interaction, and urban livability when they are designed and managed effectively (Chiesura, 2004; Carmona et al., 2008; Pakzad & Osmond, 2016). Best practices reported in the literature emphasize that high-quality public green open spaces require not only adequate provision but also integrated management, including clear planning documents, environmentally responsive design, regular maintenance, and continuous

monitoring (Dunnett et al., 2002; Jansson et al., 2019; Liu et al., 2018). However, most previous studies primarily evaluate the performance or functional outcomes of public green open space, while limited attention has been given to assessing the completeness and consistency of management-supporting documents and activities across all management stages. This gap highlights the need for an integrated evaluation approach that examines public green open space management readiness and implementation in a comprehensive and systematic manner.

To achieve sustainability, the management of public green space requires governance that refers to the principles of sustainable landscape design. This principle aligns with sustainable aspects, namely economic, social, and environmental. The principle of sustainable landscape design is a design principle that is used as a reference in designing a landscape composition, and related to this research is the design of public open space. This follows the results of research in England stating that design is the heart that makes quality urban green spaces (Dunnett et al., 2002). In the principle of sustainable landscape design, the availability of resources is very much taken into account. This effort is carried out through land use efficiency in effectively realizing multifunctional landscape spaces on limited land and can improve the quality of life (Yuslim & Indrawati, 2022). Therefore, in practice, the design made attempts to: 1) align the need for built-up areas with the local ecology in order to achieve efficient land use; 2) create attractive activities on site with easy accessibility and functioning in an inclusive manner; 3) pay attention to the proportion of the use of landscape materials related to the use of rigid materials and soft materials; 4) prioritize the use of energy in a sustainable manner, including saving water, through planning and an adequate water resources management system; 5) pay attention to social equality by paying attention to the value of cultural heritage in order to foster harmony between the quality of life of the community and nature; 6) consider the maintenance and operational management of the landscape through designs that harmonize environmental needs and community activities with the use of landscape design elements that pay attention to local wisdom and local environmental characteristics, which can provide public education and promote advocacy for sustainable environmental ethics.

Governance in this study includes planning, implementation, operations, maintenance, monitoring, and evaluation. At the planning stage, various documents and activities must be prepared to provide a solid foundation for the design of public green open space (Yuslim et al., 2022). Data collection and study of environmental conditions related to existing site conditions, biodiversity (Chen & Den, 2017), and infrastructure (Yoong et al., 2017) are urgently needed so that local natural potential can be utilized according to needs while still paying attention to sustainability natural system. This information is for consideration and input in the design of public green space. The design of public green space must also refer to the principles of sustainable landscape design. The principle of sustainable landscape design is to pay attention to the availability of regional resources and utilize land and energy use efficiency in realizing an adequate public landscape space that can improve the quality of life (Yuslim & Indrawati, 2022). The design must also consider the technical implementation, operation, maintenance of its utilization, monitoring, and evaluation. Therefore, design and other technical documents are covered in Design Engineering Development (DED), which is the key to realizing functional green open space (Sarchenko et al., 2018). In order to maintain the sustainability of public green spaces, practical management is needed to include a framework for sustainable public open space operational management (Liu et al., 2018).

As an endless system, sustainability will continuously evolve and adapt to advances in science and technology (Huang & Chen, 2015). Commitment and understanding of stakeholders on sustainable landscape design principles (Axelsson et al., 2011; Wirahadikusumah et al., 2021); involvement of stakeholders in an integrated manner (Opdam & Steingröver, 2018; Southern et al., 2011; Zuniga-Teran et al., 2020), especially the community, to build a strong sense of ownership of public green space early (Geberemariam, 2016; Yuslim, 2020) is support for achieving sustainability (Kumar et al., 2016). The government's role is needed to facilitate (Hersperger et al., 2020; Stefano et al., 2021); an interdisciplinary approach and good management (Grunewald et al., 2019; Opdam, 2018) based on regulation in the form of a complete and beneficial legal framework (Miyagawa et al., 2023; Nguyen et al., 2020; Zuniga-Teran et al.,

2020); to facilitate engagement with the private sector (Bilal et al., 2014); and local community involvement (Baycan & Nijkamp, 2012; Fernandes et al., 2019). Regulations related to rules and policies that support the implementation of integrated sustainable principles with sustainable landscape designs are urgently needed (Gersonius et al., 2016). This effort can save maintenance costs that are incurred continuously (Herman et al., 2018; Yuslim, 2020). Collaboration also requires joint control and mechanisms between related government agencies and other service providers (Arditi & Gunaydin, 1998).

This research was conducted to evaluate the extent to which the management of the implementation of public green open space in Alam Sutera housing has referred to a management process that is packaged in an integrated manner with the principles of sustainable landscape design. The study's results aim to provide input in the form of evaluation results on the management of the implementation of public green open space in Alam Sutera Housing so that the efforts needed to achieve the sustainability of public green open space can be identified. An evaluation form is needed that integrates the management process with sustainable landscape design principles regarding the fulfillment of the public green open space function in the Alam Sutera residential area.

Previous research related to the management of public green space, namely discussing the performance of public green open space related to ecological functions (Malek et al., 2010), social functions (Pakzad & Osmond, 2016); function of beauty (Geberemariam, 2016; Telichenko et al., 2017); and social functions (Zhou & Rana, 2012), as well as all of these functions (Chiesura, 2004; Firmansyah et al., 2018; Sugiama, 2013). Research on sustainable design principles (Opdam, 2018; Yuslim & Indrawati, 2022) is adopted in this study to frame public green open space as a social–ecological system in which ecological processes and human activities jointly shape landscape performance. In this context, sustainable design principles refer to an integrated set of ecological, social, and governance-oriented considerations applied throughout the management stages of public green open space. Ecologically, they emphasize maintaining landscape functions through site-appropriate vegetation, biodiversity support, soil and water management, and resource-efficient practices, including energy efficiency and waste reduction. Socially, they highlight inclusive access, safety, comfort, and the capacity of public green open space to provide benefits and values for diverse users. Institutionally, they require landscape-wide coordination, stakeholder collaboration, and adaptive management supported by consistent monitoring and evaluation. Because landscape services often overlap and operate beyond site boundaries, these principles also stress coordinated interventions across the wider landscape and shared responsibilities among stakeholders to sustain services for future generations. Accordingly, in this study, the sustainable design principles are operationalized as evaluation criteria integrated into the assessment instrument, alongside site-specific landscape needs, to examine the extent to which management practices support long-term sustainability. The link between sustainable development and sustainable landscape design (Axelsson et al., 2011), integration of urban green space development with sustainable development (Yuslim & Indrawati, 2022), and sustainable green space management which emphasizes ecological, economic, social, and planning aspects (Southern et al., 2011; Telichenko et al., 2017; Yoong et al., 2017). Based on previous research, it appears that there has been no research that discusses document tools and activities to manage each stage in the process of implementing public green open space, which consists of planning, implementation, operation, and maintenance supported by monitoring and evaluation efforts referring to the principles of sustainable landscape design. The novelty of this research is that in managing the implementation of public green open space, it is necessary to prepare documents and activities for each stage of its implementation, monitoring, and evaluation.

This research examines the documents and activities that must exist and become a reference in the management of the implementation of public green space, especially in Alam Sutera Housing so that their sustainability can be achieved. In the management of the implementation of public green space, the sustainability of its existence is an ultimate goal. This means that public green space will always be functional (beneficial for the community and the surrounding environment) and managed continuously. The results of this study will provide input to the Alam Sutera Housing Management in the form of complete documents

and activities that must be prepared for improving the management of public green space there. Through this input, it is hoped that the public green space in Alam Sutera housing can be sustainable.

2. DATA AND METHODS

Based on Article 3 paragraph (1) of Ministerial Regulation of Agrarian Affairs and Spatial Planning/National Land Agency 14 of 2022 concerning the Provision and Utilization of Green Open Space, Alam Sutera Housing has public green open space, which is in a typology of green open space areas/zones consisting of sub-district parks, village parks, and green lanes. This public green open space is spread out in each Alam Sutera housing complex cluster. This study uses 6 clusters representing the economic level of the community based on the selling price of houses, namely the middle to upper economic level with selling prices ranging from 7-8 billion (Sutera Magnolia and Telaga Biru Sutera), middle economic level with selling prices ranging from 3.6-3.8 billion (Sutera Narada and Sutera Lavender), and middle to lower economic levels with selling prices ranging from 1-1.5 billion (Sutera Flamboyan and Sutera Jelita).

The research uses quantitative methods, with an analytical descriptive approach with a questionnaire as a research instrument distributed to research respondents. As the subject to be studied (Arikunto, 2019), the respondents are representatives of a team of experts determined by purposive sampling. The criteria are: 1) experts involved as managers of public green space in Alam Sutera housing; 2) professional expert Landscape Architects who work in the field of public green space management with a minimum of 3 years' experience; 3) academics and 4) public green open space observers with min 5 years' experience in their field. A total of 20 experts were selected, with five respondents representing each professional group. This number was determined by considering the limited availability of qualified experts in landscape architecture and public green open space management who met the predefined criteria, while ensuring balanced expert representation. The research questionnaire is in the form of an evaluation form for the management of the implementation of public green space in Alam Sutera, compiled based on the results of previous research and discussions with a team of experts, which is then given a score using a Likert scale. The use of a Likert scale on each form is carried out with a rating scale range of 4, namely: very poor (not available): 1; less (available, but not implemented): 2; good (available, implemented but inconsistent): 3; and very good (available and implemented consistently): 4 (modification (Janti, 2014). The determination of the evaluation scale of the form is in Table 1.

The quantitative method processes the results of the questionnaires that have been distributed and quantified for statistical analysis of a predetermined sample (Sari, 2013). The results of distributing the questionnaires describe the characteristics of the population or phenomenon studied, which are then analyzed to find the causes of the phenomena from the research subjects/respondents and provide solutions (Bailey, 2007).

Table 1. Criteria for Determining the Rating Scale of the Assessment Form

No.	Score	Category	Criteria
1.	1	Very less	Not found in local government regulations
2.	2	Less	It is contained in local government regulations, contained in work requirements
3.	3	Good	There are local government regulations, contained in work requirements, implemented, but inconsistent
4.	4	Very good	It is contained in local government regulations, contained in work requirements, applied consistently

The data analysis in the research is based on the recapitulation of the results of filling in the public green open space's maintenance management evaluation form in Alam Sutera housing. The data analysis technique uses the categorization of values determined based on interval classes, with the formula:

Data Region	=	Highest Score – Lowest Score
		Total Respondents x Total Study Objects x Total
The highest score	=	Score of each sub-variable/each variable x Largest Weight
Interval	=	Data Region / Number of Interval Classes
The total rating for each sub-variable/each variable for the Study Object in each Cluster	=	∑ (Respondents x Weight) for each sub-variable/each variable of the Study Object in each Cluster

The data analysis steps are as follows:
1. The calculation of the total evaluation of each sub-variable in the public green open space's maintenance management evaluation form is the result of the accumulation of the achievement of all indicators from the sub-variable. The results are grouped based on the categorization of values determined with interval classes from each sub-component of public public green open space's maintenance management (Table 2).

Table 2. Determination of Evaluation Interval Class for each Sub Variable on the Evaluation Form Management of Public Green Open Space in Alam Sutera Housing

No.	Variabel	Sub Variabel	Interval Class Assessment Results for each Sub-Variable in Each Type of Cluster			
			Very Less	Less	Good	Very Good
1.	Planning	PrL: Legality	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320
		PrKW: Regional Studies	40 < N ≤ 70	70,1 < N ≤ 100	100,1 < N ≤ 130	130,1 < N ≤ 160
		PrKD: Availability of Funds	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320
		PrD: Data Collection	120 < N ≤ 210	210,1 < N ≤ 300	300,1 < N ≤ 390	390,1 < N ≤ 480
		PrDT: Technical Guide regarding Eco-Friendly Design	120 < N ≤ 210	210,1 < N ≤ 300	300,1 < N ≤ 390	390,1 < N ≤ 480
		PrDRL: Eco-Friendly Design	240 < N ≤ 420	420,1 < N ≤ 600	600,1 < N ≤ 780	780,1 < N ≤ 960
		PrKS: Coordination between Stakeholder	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320
		PrS: HR Competence	40 < N ≤ 70	70,1 < N ≤ 100	100,1 < N ≤ 130	130,1 < N ≤ 160
2.	Implementation	PlRL: Technical Guide regarding Green Open Space Development	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320
3.	Operations and Maintenance	OPRL: Technical Guidance related to Environmentally Friendly Maintenance (prioritizing energy efficiency and recycle waste)	40 < N ≤ 70	70,1 < N ≤ 100	100,1 < N ≤ 130	130,1 < N ≤ 160
		OPKS: Engagement stakeholder in its utilization	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320

No.	Variabel	Sub Variabel	Interval Class Assessment Results for each Sub-Variable in Each Type of Cluster			
			Very Less	Less	Good	Very Good
4.	Monitoring and Evalation System	MEPP: Planning Process	40 < N ≤ 70	70,1 < N ≤ 100	100,1 < N ≤ 130	130,1 < N ≤ 160
		MEFRTH: Fulfillment of public green open space function aspects	200 < N ≤ 350	350,1 < N ≤ 500	500,1 < N ≤ 650	650,1 < N ≤ 800
		MEPPl: Implementation Process	120 < N ≤ 210	210,1 < N ≤ 300	300,1 < N ≤ 390	390,1 < N ≤ 480
		MEPOP: Operational and Maintenance Process	80 < N ≤ 140	140,1 < N ≤ 200	200,1 < N ≤ 260	260,1 < N ≤ 320
	Description: N is Value					

Based on the evaluation framework, the management of public green open space in Alam Sutera Housing can be assessed systematically through integrated variables representing all management stages, including Planning, Implementation, Operations and Maintenance, and Monitoring and Evaluation System. The use of interval class determination provides a clear and objective basis for categorizing performance levels and enables comparative analysis among sub-variables. This framework ensures that sustainability assessment is conducted comprehensively, covering legal, technical, environmental, institutional, and functional aspects rather than focusing solely on physical development.

From a policy and management perspective, the findings imply that strengthening public green open space sustainability requires more than regulatory compliance. Local government and residential area managers should prioritize improving planning quality and operations and maintenance practices, particularly by enhancing technical guidelines, ensuring adequate funding allocation, strengthening stakeholder coordination, and increasing human resource capacity. In addition, monitoring and evaluation mechanisms need to be implemented more consistently to ensure that public green open spaces fulfill their ecological, social, and environmental functions. Overall, the evaluation framework developed in this study can serve as a practical decision-support tool for policymakers and practitioners in identifying management gaps and formulating targeted strategies to improve the sustainability of public green open space in urban residential areas.

2. Calculation of the total assessment of each variable for the management of public green open spaces is the result of the accumulated achievement of all sub-variables of these variables. The results are grouped based on the categorization of values determined by the interval class for each variable in the management of public green space (Table 3).

Table 3. Determination of Evaluation Interval Class for each Variable on the Public Green Open Space Maintenance Management Evaluation Form at Alam Sutera Housing

No.	Variabel	Interval Class Assessment Results for each Variable in each type of Cluster			
		Very less	Less	Good	Very good
1.	Planning	800 < N ≤ 1400	1400,1 < N ≤ 2000	2000,1 < N ≤ 2600	2600,1 < N ≤ 3200
2.	Implementation	80 < N ≤ 144	144,1 < N ≤ 208	208,1 < N ≤ 272	272,1 < N ≤ 336
3.	Operations and Maintenance	120 < N ≤ 210	210,1 < N ≤ 300	300,1 < N ≤ 390	390,1 < N ≤ 480
4.	Monitoring and Evaluation System	440 < N ≤ 770	770,1 < N ≤ 1100	1100,1 < N ≤ 1430	1430,1 < N ≤ 1760
	Description: N is Value				

At the variable level, the management of public green open space in Alam Sutera Housing can be evaluated comprehensively at the variable level through four main management stages, namely Planning, Implementation, Operations and Maintenance, and Monitoring and Evaluation System. The interval class classification provides an objective and standardized basis for assessing overall management performance and enables comparison across variables. The results emphasize the strategic importance of Planning as the foundation of sustainable management, supported by the Monitoring and Evaluation System as a mechanism to ensure consistency, accountability, and continuous improvement. From a policy and management perspective, enhancing public green open space sustainability requires integrated efforts across all management stages, including strengthening planning capacity, ensuring effective implementation, improving environmentally friendly operations and maintenance practices, and reinforcing monitoring and evaluation mechanisms to support adaptive and sustainable management in urban residential areas.

Based on the results of the assessment on each cluster, the calculation of the total assessment of all variables for the management of public green space in each cluster is the result of the accumulation of all variable achievements from the management of public green space in each cluster. The results are grouped based on the categorization of values determined based on the interval class of all variables from the management of public green open spaces in each cluster (Table 4).

Table 4. Determination of Assessment Interval Classes for All Form Variables Management Evaluation of the Implementation of Public Green Open Space for each Cluster Type in Alam Sutera Housing

Public green Open Space on Cluster	Interval Class			
	Very Less	Less	Good	Very Good
	$1440 < N \leq 2880$	$2880,1 < N \leq 4320$	$4320,1 < N \leq 5760$	$5760,1 < N \leq 7200$

The classification framework is used to categorize the total score (N) of public green open space management performance for each cluster type in Alam Sutera Housing. The total score (N) is obtained from the accumulation of achievement scores across all management variables, namely Planning, Implementation, Operations and Maintenance, and Monitoring and Evaluation System. The interval classes defined in this table serve as classification thresholds to interpret the total score into four performance categories: Very Less, Less, Good, and Very Good.

Accordingly, this framework does not present the evaluation results of each cluster. Instead, it provides a standardized and objective classification framework that is used to convert the aggregated management scores of public green open space implementation into overall performance categories. This framework ensures consistency in interpreting evaluation outcomes and enables comparable analysis of management performance across different cluster types.

3. RESULT AND DISCUSSION

The results of the analysis of each sub-variable (sub-component) based on filling out the management evaluation form for the implementation of public green space for each type of cluster in Alam Sutera Housing are presented in Table 5.

Table 5. Determination of Assessment Interval Classes for All Form Variables Management Evaluation of the Implementation of Public Green Open Space for each Cluster Type in Alam Sutera Housing

No	Components (Variabel)	Sub-Components (Sub Variabel)	Calculation Results and Rating Categories		
			Cluster *Magnolia* and *Telaga Biru*	Cluster *Lavender* and *Narada*	Cluster *Flamboyan* and *Jelita*
1.	Planning	Legality	210 (good)	202 (good)	204 (good)
		Regional studies	108 (good)	104 (good)	104 (good)
		Availability of funds	232 (good)	228 (good)	224 (good)
		Data collection	350 (good)	332 (good)	326 (good)
		Eco design technical guide	192 (very less)	172 (very less)	158 (very less)
		Eco design	450 (less)	456 (less)	454 (less)
		Intercoordination stakeholder	190 (less)	194 (less)	188 (less)
		HR competence	130 (good)	130 (good)	130 (good)
2.	Implementation	Technical guide regarding the development of environmentally friendly green open space	222 (good)	218 (good)	216 (good)
3.	Operations and Maintenance	Technical guidance on environmentally friendly maintenance	50 (very less)	50 (very less)	50 (Very less)
		Stakeholder engagement in its utilization	180 (less)	180 (less)	188 (less)
4.	Monitoring and Evaluation System	Planning process	146 (very good)	146 (very good)	146 (very good)
		Fulfillment of public green open space function aspects	554 (good)	554 (good)	556 (good)
		Implementation process	386 (good)	386 (good)	382 (good)
		Operational and maintenance process	98 (very less)	100 (very less)	104 (very less)

Based on the analysis of each sub-variable, all cluster types—including clusters representing middle to upper economic levels, middle economic levels, and upper-middle to lower economic levels—exhibit almost identical assessment results. This relatively uniform performance pattern indicates that differences in socio-economic characteristics among clusters do not substantially influence the quality of public green open space management implementation. A similar tendency has been reported in previous studies, which suggest that management performance is more strongly influenced by institutional capacity and governance mechanisms than by the socio-economic profile of users (Chiesura, 2004; Jansson et al., 2019).

Only one sub-variable is classified in the very good category, namely the Monitoring and Evaluation Planning Process (MEPPr), accounting for approximately 6.7 percent of the assessed sub-variables. This finding indicates that formal procedures related to monitoring and evaluation planning are well established and consistently applied. However, as emphasized by Dunnett et al. (2002) and Liu et al. (2018), strong planning frameworks alone are insufficient if they are not supported by effective implementation and operational practices.

Sub-variables categorized as good constitute approximately 53.3 percent of the total and include Legality (PrL), Regional Studies (PrKW), Availability of Funds (PrKD), Data Collection (PrD), Technical Guidelines for Environmentally Friendly Green Open Space Development (PlRL), Fulfillment of Public Green Open Space Functional Aspects (MEFRTH), and the Implementation Process (MEPPl). These results suggest that administrative that administrative, financial, and procedural components of public green open space management are generally well implemented. Similar findings have been reported by Carmona et al. (2008) and Pakzad & Osmond (2016), who note that formal compliance is often easier to achieve than long-term sustainability outcomes.

Meanwhile, sub-variables classified as less represent around 20 percent of the total and include Eco-Friendly Design (PrDRL), Stakeholder Coordination (PrKS), and Stakeholder Engagement in Utilization (OPKS). These results reflect limited integration of sustainable design principles and participatory approaches within management practices. The remaining 20 percent of sub-variables fall into the very less category, particularly those related to Eco-Design Technical Guidelines (PrDT), Environmentally Friendly Maintenance Practices (OPRL), and Monitoring of Operational and Maintenance Processes (MEPOP). These findings highlight critical weaknesses in translating sustainability principles into day-to-day operational and maintenance activities (Dunnett et al., 2002; Jansson et al., 2019; Liu et al., 2018).

Taken together, the results in Table 5 demonstrate that while planning and formal implementation mechanisms of public green open space management in Alam Sutera Housing are relatively well developed, substantial gaps remain in eco-friendly design application, environmentally oriented maintenance practices, stakeholder participation, and operational monitoring. This condition suggests that sustainability-oriented management has not yet been fully institutionalized at the implementation and operational levels, despite the presence of adequate regulatory and procedural frameworks (Chiesura, 2004; Jansson et al., 2019). The accumulated evaluation of the sub-variables forms the basis for assessing performance at the variable level, as summarized in Table 6.

Table 6. Results of Accumulation Assessment Sub-Variables Influencing Variables (Components) in the Public Green Open Space Management Evaluation Form in Alam Sutera Housing

No.	Components (Variabel)	Calculation Results and Rating Categories		
		Cluster *Magnolia* and *Telaga Biru*	Cluster *Lavender* and *Narada*	Cluster *Flamboyan* and *Jelita*
1.	Planning	1862 (less)	1818 (less)	1788 (less)
2.	Implementation	222 (good)	218 (good)	216 (good)
3.	Operations and Maintenance	230 (less)	230 (less)	238 (less)
4.	Monitoring and Evaluation System	1184 (good)	1186 (good)	1188 (good)

At variable level, the Planning variable is consistently classified in the less category across all cluster types, with scores of 1862 for Cluster Magnolia and Telaga Biru, 1818 for Cluster Lavender and Narada, and 1788 for Cluster Flamboyan and Jelita. Similarly, the Operations and Maintenance variable also falls into the less category for all clusters, indicating insufficient availability and implementation of documents and activities required at the operational maintenance stage. These findings suggest that weaknesses identified at the sub-variable level, particularly related to eco-friendly design integration, stakeholder involvement, and environmentally friendly maintenance practices, cumulatively affect performance at the variable level.

In contrast, the Implementation variable shows a good rating across all cluster types, reflecting that public green open space development generally follows the established technical guidelines. The Monitoring and Evaluation System variable is also categorized as good, indicating that monitoring and evaluation activities are formally conducted and supported by adequate documentation, especially at the planning and implementation stages. However, as noted by Liu et al. (2018), monitoring systems that are not strongly linked to operational feedback may have limited impact on long-term sustainability. The overall management performance of public green open space implementation in each cluster types is synthesized in Table 7.

Table 7. Results of Accumulation Assessment All Variables in the Public Green Open Space Management Evaluation Form for Each Cluster as the Research Object in Alam Sutera Housing

No.	Type of Cluster	Calculation Results and Rating Categories	
		Assessment	Category
1.	Upper – middle – level	3276	less
2.	Middle level	3234	less
3.	Middle lower level	3214	less

The accumulated assessment results indicate that all cluster types are classified in the less category. The total assessment scores indicate that all clusters—upper-middle level, middle level, and middle-lower level—are classified in the less category, with scores of 3276, 3234, and 3214, respectively. These results demonstrate a consistent pattern of overall management performance across different cluster types.

The classification of all clusters in the less category indicates that, although the required documents and activities for public green open space management are formally stipulated in local government regulations and work requirements, their implementation tends to be compliance-oriented. In practice, these documents and activities primarily function to fulfill administrative requirements for the provision of public green open space rather than to support long-term sustainability objectives (Chiesura, 2004; Jansson et al., 2019; Pakzad & Osmond, 2016).

Furthermore, the overall less rating is strongly influenced by weak performance in the planning and operations and maintenance variables, which were also categorized as less in Table 6. In particular, limitations in the availability and application of planning documents, environmentally friendly design guidelines, and operational maintenance procedures hinder the effective and sustainable management of public green open spaces after their initial provision. As a result, while public green open spaces have been successfully established within the housing clusters, their sustainability has not yet been optimally achieve (Dunnett et al., 2002; Southern et al., 2011; Yuslim & Indrawati, 2022).

Based on the research, the sustainability of public green space in Alam Sutera housing has not been achieved. Because the management of the implementation of public green space could have gone better. The availability of documents and activities required for the implementation, monitoring, and evaluation stages are generally in the good category. However, the availability of documents and activities at the planning and maintenance operational stages still needs to be in the low category. On the variable availability of documents and activities at the planning stage, two sub-variables are in the less category, namely the environmentally friendly design sub-variable and the sub-variable related to involvement stakeholders, as well as one variable that is included in the very lacking category, namely the sub-variable related to the availability of technical guidelines for environmentally friendly design. For the variable availability of documents and activities at the maintenance operational stage, there is one sub-variable that is in the less category, namely the sub-variables related to the involvement of stakeholders in the continuous utilization of public green space and the sub-variables related to the availability of environmentally friendly maintenance technical guidelines. Apart from that, there is also one sub-variable of the Monitoring and Evaluation variable, which is included in the very poor category, namely the sub-variable related to the monitoring and evaluation process in the operational maintenance of public green open space.

4. CONCLUSION

The sustainability of public green open space in Alam Sutera Housing has not been optimally achieved, as indicated by the evaluation results showing that none of the management stages reached the very good category in terms of the availability of supporting documents and activities. In particular, deficiencies were identified at the planning stage and the operations and maintenance stage, both of which remain in the less category. This condition highlights the need for serious and systematic efforts to strengthen management preparedness, especially through the formulation of comprehensive planning documents that integrate

sustainable landscape design principles, stakeholder coordination mechanisms, and site-specific environmental considerations. Complete and well-structured planning documents can serve as a critical reference for effective implementation, while adequate operational and maintenance guidelines are essential to support consistent monitoring and evaluation processes. These findings are consistent with sustainable landscape governance theories, which emphasize that long-term sustainability depends not only on design quality but also on integrated management across planning, implementation, operations, maintenance, and monitoring stages. Practically, the results of this study provide a valuable basis for housing estate managers and policymakers to identify priority actions needed to improve public green open space sustainability, while academically, they contribute an integrated evaluation framework that shifts attention from outcome-based assessments toward management readiness. Future research is therefore required to further elaborate and adapt the required documents and activities to local community needs and environmental characteristics to ensure sustainable public green open space management.

5. ACKNOWLEDGMENTS

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