



Systematic Literature Review (SLR): Evaluation of the Sustainable Public Space's Indicators

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Abstract

Growing discussions on public space highlight the need for a more structured understanding of sustainability indicators across diverse urban contexts. This study examines these indicators across 22 selected articles using a Systematic Literature Review (SLR) and then tests them through an empirical example of the Prawirotaman Street corridor in Yogyakarta to observe how the theoretical concepts operate in practice. The analysis integrates SLR findings with primary data such as field observations and interviews to assess the degree of indicator fulfilment in real public-space conditions. The study offers a comprehensive indicator model and demonstrates its partial applicability in the local context, providing a novel evaluative framework for future public space assessments in Indonesia.

Keywords: Accessibility, Governance, Public Space, Sustainability, Vitality

Systematic Literature Review (SLR): Evaluasi Indikator Ruang Publik Berkelanjutan

Abstrak

Perkembangan kajian ruang publik menunjukkan perlunya pemetaan indikator keberlanjutan yang lebih terstruktur untuk memahami kualitas ruang di berbagai konteks perkotaan. Penelitian ini menelaah indikator tersebut pada 22 artikel terpilih dengan metode Systematic Literature Review (SLR) lalu mengujinya pada contoh empiris koridor Jalan Prawirotaman di Yogyakarta untuk melihat bagaimana konsep teoretis bekerja di lapangan. Analisis dilakukan dengan memadukan hasil SLR dengan data primer seperti observasi dan wawancara guna menilai keterpenuhan indikator pada kondisi aktual ruang publik. Temuan penelitian ini menghadirkan model indikator keberlanjutan yang komprehensif serta memperlihatkan bahwa penerapannya bersifat parsial dalam konteks lokal, sehingga memberikan kontribusi baru bagi pengembangan kerangka evaluatif ruang publik di Indonesia.

Kata-kunci: Aksesibilitas, Keberlanjutan, Ruang Publik, Tata Kelola, Vitalitas

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Introduction

Public spaces are fundamental elements in shaping the quality of urban life, where public spaces serve as providers of venues for social interaction, cultural activities, and daily mobility. The increasingly complex dynamics of the city due to urbanization, the growth of economic activities, and the intensity of space usage are putting pressure on the function of public spaces as communal areas. Therefore, discussions regarding the quality and sustainability of public spaces are becoming increasingly important to ensure that public spaces remain inclusive, comfortable, and adaptive to social and environmental changes.

Along with the changing academic approach in highlighting the function, meaning, and performativity of public spaces, the understanding of these spaces is also evolving. Several previous studies have highlighted how “publicness” has become a fundamental aspect in explaining open access, the diversity of activities, and the capacity of public spaces to support meaningful social interactions [1]. Other studies show how public spaces can grow through community activities, such as urban gardening, which create new social environments and expand the meaning of public spaces themselves [2]. At the same time, normative design approaches, such as those offered by Matthew Carmona, have outlined principles for enhancing the quality of public spaces through aspects of comfort, diversity, and user engagement [3].

Various previous studies have shown that the quality of public spaces is understood through various lenses, such as publicness, inclusivity, vitality, comfort, and user experience. However, most of these studies have not specifically framed the quality of public spaces within the context of sustainability. For example, the study analyzing the quality of Beyazit Square developed space quality parameters based on physical and social factors without directly linking them to a broader framework of environmental, social, and economic sustainability [4]. There is also a study on the inclusivity of public spaces in the city of Jalandhar that formulates an inclusive space matrix with numerous indicators, yet remains focused on social inclusion without placing it within the comprehensive discourse of urban sustainability [5].

Each previous study developed indicators or parameters for evaluating public spaces according to their respective case contexts. For example, there is a participatory digital evaluation in Mexico that offers nine dimensions of public space quality [6], while other studies use a machine learning approach to

calculate comfort and activity levels in specific public spaces [7]. Although diverse and rich in methodology, these indicators remain fragmented and have not yet been consolidated into a framework for evaluating the sustainability of public spaces. These studies do not present a systematic synthesis of these indicators to understand the general patterns that have emerged in public space research in recent years.

In addition to the theoretical gaps, there are also empirical gaps related to the application of public space indicators in actual contexts. Most existing studies focus on city parks, historic squares, or specific areas in cities in developed countries (global north) such as Istanbul [4], Mexico [6], or London [3], which have social, cultural, and spatial morphological characteristics different from cities in developing countries (the Global South). For example, a study on the challenges of public space management in the Netherlands [8] shows how its institutional and managerial conditions are difficult to parallel with the context of urban public spaces in Southeast Asia. This raises an important question regarding the possibility of applying global north sustainable public space indicators to urban public space conditions in the global south, which have different characteristics.

Based on the gaps in the research, this study uses a Systematic Literature Review (SLR) to answer the following research questions:

- 1) What indicators have been used to assess the sustainability of public spaces in the past 5 years, and how does each indicator explain the dimensions of sustainability of public spaces?
- 2) How do the indicators of sustainable public space in the last 5 years of research align with the actual conditions of public spaces in Indonesia?

Thus, this research can contribute to the formation of a more comprehensive, adaptive, and contextual framework for sustainable public space indicators.

Methods

The research on sustainable public space indicators is based on the post-positivism paradigm, which emphasizes the understanding of social reality through systematic observation of empirical data, while remaining open to interpretation and critical reflection [9], [10]. Additionally, this research also employs a mixed-method approach, namely Systematic Literature Review (SLR), to identify indicators from the found literature and then test their relevance on empirical data [9], [11].

Data Collection and Analysis Methods

Data were collected through the Scopus search engine using keywords determined based on the PICO approach as a search strategy across the entire database, as shown in Table 1 below.

To determine the scientific articles to be selected, keywords in the form of a string/key string are needed that do not use just one of them. This is because not all researchers use the same terminology in their article writing. The final key string used is *TITLE-ABS-KEY ("public space*" OR "social space*" OR "urban public space*" OR "communal space*") AND ("sustainability" OR "sustainable development") AND (indicator* OR parameter* OR variable*) AND ("urban" OR "built environment" OR "urban environment" OR "urban design" OR "urban planning")*.

Table 1. The keyword terms used in the search on Scopus

PICO	Similar Keyword
Public space	Parameter, variable Built environment, social space, urban, urban design, urban environment, urban planning, urban public space
Sustainability	Sustainable development
Indicator	

In the search for scientific articles, inclusion and exclusion criteria are applied to enhance the discovery of articles with appropriate quality in the systematic review. The range of publication years for the articles used is between 2021-2025 (the last 5 years). In addition, the document type was chosen to be articles to shorten the working time. The search for articles is also specifically for those that are "open access" to facilitate data collection.

After the data is collected, a quality assessment is conducted through a screening process that can be seen in the PRISMA diagram (Figure 1).

A total of 2,708 scientific articles found in the search through the Scopus database were filtered down to yield 22 selected articles (Figure 2). These articles will undergo a reviewing stage to dissect the objectives, methods, and results of the research as shown in Table 2.

In addition to using the SLR method, primary data in the form of field observations, field surveys, and in-

depth interviews were also used to obtain information about the Prawirotaman Street corridor in Yogyakarta. This corridor serves as empirical data to assess the compatibility of local public spaces with sustainable public space indicators generated through the SLR method.

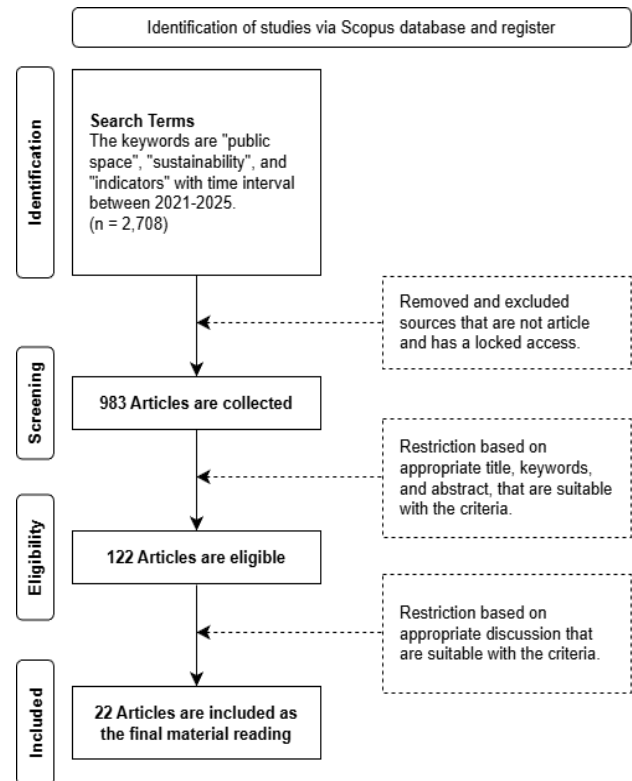


Figure 1. PRISMA diagram for the identification stage of article collection

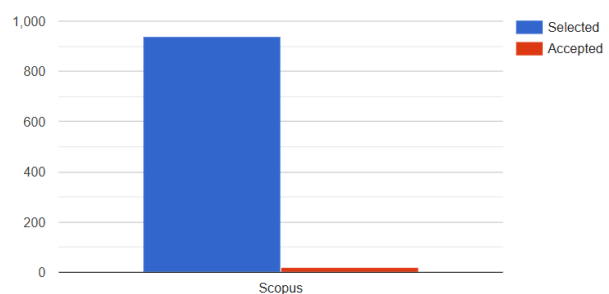


Figure 2. Comparison graph of the number of articles rejected and accepted

Results and Discussion

Details of the objectives, methods, and results of 22 articles with a focus on the discussion of sustainable public space indicators are presented in Table 2.

Table 2. Data of 22 selected articles

No	Article	Purpose	Method	Results
1	[10]	Developing criteria for sustainable public space design	Analytical Hierarchy Process (AHP)	Most important elements: comfort, social interaction, spatial continuity, and access.
2	[11]	Evaluating the quality of public spaces through the SDG 11.7 framework	Analyzing urban projects, SDG indicators, and space quality scoring	Public spaces that meet SDG standards tend to have better accessibility, social vitality, and environmental quality.
3	[12]	Identifying how walkability and pedestrian facilities affect the use of city parks	User surveys, walkability measurements, and regression analysis	Walkability and pedestrian facilities have a significant impact on usage frequency; access and connectivity are the main indicators.
4	[13]	Developing a quick instrument to assess the quality of public spaces	Questionnaire preparation, statistical validation, and field testing	Six main indicators were formed: comfort, safety, activity, access, physical quality, and satisfaction.
5	[14]	Measuring the vitality of a street through visual and auditory perception	Field observation, soundscape analysis, and visual rating	Vitality is influenced by sound intensity, activity density, and visual legibility.
6	[15]	Evaluating public spaces through 7 principles of universal urban design	Observation, universal design checklist, and scoring	Accessibility, safety, and comfort as the most determining aspects of public space inclusivity.
7	[16]	Identifying behavior patterns and activities in open spaces with surfaces dominated by hard materials	Observing behavior and mapping activities	High social activity appears in areas with indicators such as good access, shading, and seating facilities.
8	[17]	Evaluating the quality of the city based on the 15-minute-city principle	Space syntax and configurational analysis	Access to daily services, proximity of functions, and pedestrian networks as indicators of urban space quality.
9	[18]	Determining the best public space alternatives through criteria weighting	AHP, COPRAS, and multi-criteria evaluation	The most important criteria: accessibility, comfort, social function, environmental quality.
10	[19]	Evaluating the performance of city parks based on social and environmental dimensions	Surveys, observations, and performance indicators	There is a quality gap between recreational areas and social areas; shading and seating are important indicators.
11	[20]	Identifying the role of lighting in the comfort of public spaces at night	Lighting experiments & perception surveys	The intensity and color of light affect users' perceptions of safety and comfort.
12	[21]	Measuring the quality of public spaces and the walking environment in residential areas	Pedestrian walkability index & urban space quality survey	Walkability and environmental comfort are indicators of the sustainability of residential areas.
13	[22]	Analyzing the accessibility of public spaces for people with disabilities	Mobility survey & accessibility audit	Physical access barriers are the biggest factor in the low utilization of public spaces by people with disabilities.
14	[23]	Examining the potential of smart technology to enhance inclusivity	Case studies, technology analysis, & user feedback	Internet of Things (IoT), sensors, & digital signage enhance access & comfort for vulnerable groups.
15	[24]	Measuring the social benefits of small public spaces in coastal cities	SEM (Structural Equation Modelling)	There are 4 latent variables & 35 observed variables; community engagement is the most influential indicator.
16	[25]	Assessing the injustice of access to city parks	GIS & spatial equity analysis	The uneven distribution of parks causes certain social groups to be underserved; spatial access becomes an important indicator.
17	[26]	Optimizing village public spaces based on self-organization theory	Modelling & multi-criteria evaluation	Environmental quality and social participation are the main drivers of sustainability.
18	[27]	Assessing the sustainability of public spaces in heritage areas	Observation, design evaluation, & interviews	Visual preservation, pedestrian access, and social function become indicators of the quality of heritage space.
19	[28]	Evaluating public spaces in historic districts through governance & neural network	Neural network model & governance analysis	The quality of governance & community engagement affects the performance of public spaces.
20	[29]	Developing a conceptual model for the management of public spaces and meeting areas	Conceptual model, policy study	Four pillars of APSM were formed: governance, spatial quality, social cohesion, & sustainability.
21	[30]	Identifying the impact of densification on the microclimate quality of public spaces	Microclimate simulation & physical measurement	Variations in building density affect shading, temperature, and spatial comfort, which are environmental indicators.
22	[31]	Developing sustainable public seating design methods	Mixed-method, ergonomic evaluation, and user observation	Materials, shapes, and seating layouts affect comfort, length of stay, and social sustainability.

A total of 22 selected articles from the Systematic Literature Review (SLR) indicate that public space sustainability indicators develop through a multidisciplinary approach focusing on social, environmental, spatial, economic, and managerial quality. Each study uses different frameworks and instruments, resulting in a wide variety of emerging indicators. Nevertheless, these indicators exhibit consistent patterns that can be grouped into five dimensions. This pattern then forms a model of sustainable public space indicators that reflects how a public space is defined, used, and managed in a contemporary urban context. Thus, this SLR method produces a comprehensive understanding of sustainability indicators used in the last five years of research, where these indicators are grouped into five main dimensions (Table 3).

Table 3. Indicators of public space sustainability in five dimensions

Dimension	Indicator
Social	Vitality, inclusivity, social interaction, & social comfort
Environmental	Thermal comfort, lighting, & physical ecology
Spatial & Accessibility	Walkability, universal access, & spatial justice
Economy & Space Utility	Utilization intensity, attractiveness, & functional flexibility
Managerial & Technological	Governance, maintenance, smart technology, & design adaptation

Social Dimensions

The social dimension emerges as the most dominant indicator category in the 22 articles used. Various articles show that the sustainability of public spaces itself relies on the intensity of social interactions, the vitality of activities, and user comfort [13], [14], [16], [19]. A study on street vitality in Guangzhou emphasizes that the dynamics of visual and auditory activities are important indicators of a lively public space that is adaptive to user needs [14]. Meanwhile, research in Jeddah and Semarang confirms that the presence of seating, shade, and patterns of space usage fosters sustainable social interactions while creating an environment that supports community attachment [16], [19].

Inclusivity indicators often appear in research that highlights accessibility for vulnerable groups, especially people with disabilities. A study in Algiers emphasizes that the quality of physical access, such as the presence of ramps and mobility paths, determines the level of public space utilization by people with disabilities, making accessibility an important component of social sustainability [22]. This universal approach also provides evidence that public spaces

classified as safe, friendly, and easily accessible have encouraged more equitable use of space across various age groups and physical abilities [15]. Thus, social sustainability is not only about activities but also about justice in access to public spaces.

In addition, several studies have highlighted the importance of users' subjective experiences as social indicators of the sustainability of public spaces. Research using questionnaires as instruments shows that feelings of safety, perceptions of comfort, and user satisfaction play a significant role in shaping the social quality of public spaces [13]. Studies assessing the comfort of public spaces at night also indicate that positive perceptions of space are directly related to the long-term usage levels of public spaces [20]. Overall, these findings affirm that social sustainability encompasses not only physical conditions but also psychological interpretations and user perceptions of the space.

Environmental Dimensions

Environmental indicators frequently appear in research highlighting microclimate quality, thermal comfort, and the ecological response of public spaces. Research on urban densification in Serbia shows that variations in building density impact air temperature, shading availability, and users' thermal comfort levels [30]. This shows that environmental sustainability is greatly influenced by how the physical configuration of the city and passive design minimize heat exposure. A study in Jeddah also shows that shading and the quality of the physical environment significantly contribute to the ecological comfort of public spaces [19].

Another important indicator in this dimension is the quality of environmental lighting. Studies on waterfronts emphasize that light intensity and lighting colour can enhance the perception of safety, extend the duration of space usage, and create a more positive ecological experience [20]. Additionally, the research also highlights the role of lighting as a design element that enables public spaces to function optimally at night. Thus, lighting not only plays a technical role but also an ecological and psychosocial one.

Other ecological elements, such as vegetation and the quality of surface spaces, also emerge as important indicators in several articles. A study in heritage areas in Spain shows that the presence of vegetation, shading elements, and the preservation of visual character support sustainable environmental comfort [27]. Research that assesses the quality of public

spaces using questionnaire instruments also shows that cleanliness, maintenance, and the physical quality of surfaces are indicators that influence ecological comfort [13]. Overall, the environmental dimension emphasizes that sustainable public spaces should be able to respond effectively to climatic and ecological conditions.

Spatial and Accessibility Dimensions

Spatial dimensions frequently appear in research on walkability and spatial connectivity. Studies in India and Lisbon show that the quality of pedestrian paths and the ease of access between urban functions can increase the frequency of public space usage [12], [21]. Furthermore, research on the 15-minute city shows that the proximity of services and spatial connectivity contribute to the sustainability of urban mobility [17]. These findings indicate that spatial sustainability is influenced by the structure of the city's network.

Universal accessibility is also an important indicator, especially for vulnerable groups. Studies based on universal design show that the availability of ramps, guiding blocks, sloped paths, and safe pedestrian walkways increases the likelihood of public spaces being utilized by various user groups [15]. An article from Algiers reinforces this finding by showing that physical barriers directly reduce the level of social engagement of people with disabilities in public spaces [22]. Thus, spatial sustainability encompasses equal access to space for all citizens.

The issue of spatial justice has also received more attention in several literatures. Research on the distribution of urban parks in Taiyuan found disparities in access to public spaces among social groups, indicating that the uneven distribution of public spaces has created spatial injustice [25]. This emphasizes that the sustainability of public spaces not only measures physical quality but also distribution and accessibility.

Economy and Space Utility Dimensions

Economic indicators appear in several studies that assess the intensity of public space usage and its contribution to socio-economic activities. A study on park usage in India shows that good pedestrian facilities can encourage an increase in the number of visitors, thereby strengthening the function of public spaces as communal areas with economic value [12]. Research on street vitality in Guangzhou also shows that the dynamics of public activities play a role in enhancing the socio-economic value of a corridor [14].

These findings affirm that the sustainability of public spaces is closely tied to their intense and diverse usage patterns.

The physical appeal of public spaces also emerges as an indicator of sustainability in the economic context. A study of heritage areas in Spain found that the aesthetics of public spaces, visual quality, and historical character contribute to tourist attraction and local activities [27]. Additionally, sustainable seating research in Shanghai shows that ergonomic seating design with the right materials can increase dwell time and space utilization [31]. Thus, the aesthetic quality and utility of a space become important factors in economic sustainability.

Several other studies show that flexible and multifunctional public spaces have greater economic potential. The AHP-COPRAS study in Palu emphasizes that accessibility, comfort, and the diversity of space functions are the main criteria in determining the quality of alternative public spaces [18]. Similar finding was also shown by a study on Jeddah, which confirmed that public spaces capable of accommodating various social activities strengthen the sustainability of the space's function [19].

Managerial and Technological Dimensions

Managerial dimensions frequently appear in studies discussing public space management, highlighting the importance of governance and space maintenance. A study in the Netherlands on public space management practices found that inter-agency coordination, sustainable maintenance, and policy adaptation are important elements in maintaining the quality of public spaces, while a conceptual model from Colombia shows that good public space management involves the integration of spatial quality, social cohesion, and sustainability [29]. This research emphasizes that governance is the foundation for the long-term sustainability of public spaces.

Technological indicators also appear in several studies that examine smart public spaces. Articles on smart public spaces show that the application of technologies such as sensors, information systems, and responsive devices can enhance accessibility, safety, and user comfort [23]. This technology helps public spaces adapt to user needs in real-time, thereby supporting operational sustainability. In addition, several studies have also developed design optimization methods, such as self-organization models for public spaces in rural areas, which show that data-based adaptation can improve the quality of the space [26].

The physical management of space, including maintenance and design adaptation, also serves as an indicator of sustainability. A study on seating in Shanghai emphasizes that the design of public furniture that is ergonomic, durable, and easy to maintain can contribute to the operational sustainability of public spaces [31]. Thus, the managerial-technological dimension encompasses not only digital devices but also long-term design and maintenance strategies that ensure public spaces remain functional.

The Suitability of Sustainable Public Space Indicators with the Actual Conditions

The application of sustainable public space indicators from the SLR results can be seen in their suitability with actual conditions in the field. An empirical example can be seen in the tourism corridor of Jalan Prawirotaman in Yogyakarta (Fig. 3), where the previously collected primary data shows an uneven pattern of alignment with these indicators. From the perspective of socio-economic vitality, this corridor has high activity dynamics with a variety of businesses, visitor intensity, and informal activities such as hanging out and social interactions, reinforced by music from cafes/bars (Fig. 4) that can be heard on the street. The indicators of spatial vitality also appear to be appropriate when applied to the Prawirotaman corridor, although the social sustainability that is formed is more influenced by commercial functions than by the provision of non-consumptive public spaces. This shows that some of the social indicators can be achieved even without a planned public space design.



Figure 3. Prawirotaman Street Corridor, Yogyakarta

For the indicators of accessibility and environmental comfort, there is quite a significant discrepancy. On a macro level, this area is easily accessible and popular among tourists, but on a micro level, the quality for

pedestrians is very poor, where the sidewalks are narrow, interrupted, obstructed by parking, and not inclusive for users with disabilities. The lack of shade vegetation also causes thermal discomfort, leading visitors to prefer staying in air-conditioned rooms. At night, the lighting from street lamps is also uneven, creating a sense of insecurity for some users. These findings clearly contradict the indicators of sustainable public space from the SLR method related to walkability, microclimate comfort, and physical environmental quality.



Figure 4. Tilldrop, a crowded bar on Prawirotaman Street

The aspect of inclusivity also shows discrepancies when this corridor is tested with the SLR method indicators. Observational data reveal that vulnerable groups such as children, the elderly, and people with disabilities face physical barriers when moving in this corridor due to its narrow, uneven sidewalks and lack of proper ramps. Non-commercial public seating is also almost non-existent, so social interactions in outdoor spaces largely depend on consumption in cafes or restaurants. While inclusivity and universal design indicators were important findings in the SLR, the Prawirotaman corridor itself has not adequately reflected these principles.

Changes in spatial character also impact social attachment, although this aspect does not appear as a separate indicator in the SLR results except in the context of one heritage area study. Interviews with residents also show that there has been a shift in the function of the corridor from residential and local activity centers to highly commercial tourist areas, making the interactions that occur in the public space more transient and tourist-oriented. Although economic dynamics and social activities remain high, the form of social sustainability that emerges does not fully align with the SLR outcome indicators that emphasize equal access, non-commercial interaction

spaces, and community involvement in space usage. Thus, the social indicators in the sustainable public space according to the SLR are only partially met, focusing more on the intensity of activities rather than the quality of access and long-term social sustainability.

From a managerial perspective, the Prawirotaman Street corridor shows informal space management practices and has not yet met the governance indicators, which are indicated as one of the indicators of sustainable public space. Business operators and local residents do coordinate regarding parking, waste, and security, but this form of management does not operate within a consistently structured system. Recurring issues are still found, such as waste, problematic drainage, and irregular use of sidewalks. This indicates that the principles of routine maintenance and space management have not been well integrated. Meanwhile, in the SLR results, the managerial aspect is considered important for maintaining the sustainability of public spaces, so the inconsistency in this context is a significant note.

Overall, the application of sustainable public space indicators from the SLR on empirical data from the Prawirotaman Street corridor shows partial alignment. The dimension of socio-economic vitality appears to be in line because this corridor is lively, bustling, and has a variety of activities; however, other indicators, such as universal accessibility, environmental comfort, spatial inclusivity, and governance do not show alignment. This emphasizes that although the Prawirotaman Street corridor functions well as a dynamic tourist corridor, its application as a sustainable public space still requires improvements in physical design, provision of non-commercial spaces, enhancement of accessibility, and strengthening of space management mechanisms.

Conclusion

This study concludes that the indicators of sustainable public spaces obtained through 22 articles using the SLR method encompass 5 dimensions, namely social vitality, accessibility, environmental comfort, economic utility, and managerial aspects. When the indicators from these dimensions were applied to the empirical data of the Prawirotaman Corridor, their suitability was partial: socio-economic vitality appeared to be appropriate, while universal accessibility, environmental comfort, inclusivity, and governance had not yet met the sustainability principles as reflected in the literature findings.

The novelty of this research lies in the systematic development of a public space sustainability indicator

model from international literature and its testing in a local empirical context. This approach demonstrates how theoretical indicators can reveal the gap between the ideal conditions according to research and the actual conditions of public spaces that develop organically, such as in the Prawirotaman corridor.

This research has the advantage of integrating the SLR method with empirical data, but it is limited to one location as an application example, so the results cannot be widely generalized. Subsequent research is recommended to apply this indicator model to various types of public spaces and to develop more comprehensive measurement instruments so that the evaluation of public space sustainability can be conducted in greater depth.

AI Use Declaration

The authors acknowledge the use of ChatGPT-4 for helping the creation of the keyword terms (PICO) used in the search on Scopus and the key string. The prompts used are "Help me to create PICO keyword terms based on a topic: evaluation of sustainable public space indicator" and "create a key string for Scopus search engine based on that PICO". The authors also used Quillbot to translate the manuscript from Bahasa Indonesia to English. While the authors acknowledge the use of AI, the authors maintain that they are the sole authors of this article and take full responsibility for the content therein, as outlined in COPE recommendations and journal policies.

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